accordingly. Vegetation can be established during the dry season, but this requires irrigation. Once saturated, swales function as conveyance structures carrying runoff to a rain garden, wetland, infiltration area, or other safe location. Swales are not recommended for areas that receive large amounts of sediment that can prematurely fill the swale and impede its functionality. Steeper swales (generally 7% slope or greater) may require lining with rock and/or geotextile fabric. Consult the RCD for help estimating flows and velocities.

MAINTENANCE: Routine maintenance is required. Before a planted swale is densely vegetated, it is extremely vulnerable to erosion and must be protected with straw matting and other erosion control materials. Maintenance of a dense, healthy vegetated cover consists of periodic mowing (keep grass 2-4 inches high), weed control, reseeding of bare areas, and clearing of debris and accumulated sediment. The swales should be regularly inspected for pools of water, formation of gullies, and for uniformity in cross section width and longitudinal slope. When the uniformity is compromised it should be re-established quickly.

Rock-Lined Swales (Dry Creek Beds)

A rock-lined swale (or dry creek bed) uses rock instead of grass or other vegetation to safely infiltrate and convey runoff. Most are designed with rounded rock for an aesthetically pleasing landscape feature that mimics a creek bed.

When installing a swale use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. Non-woven geotextile fabric can be used underneath the rock.

MAINTENANCE: Periodically remove leaves and replace rocks moved by surface flow.

Swale Installation Tips:

- Excavate a narrow linear depression that slopes down to provide a flow path for runoff. The path length
- (10-15 feet or more) should meander to slow water flow and prevent erosion.
- Use plants from creek and river ecosystems (see list on previous page) to help reduce erosion and increase evaporation of runoff.
- The end of the swale requires an outlet for high flows (another landscaped area or a yard drain.)

Installation tips courtesy of the Bay Area Stormwater Management Agencies Association.

Local Resources

Napa County Resource Conservation District, 707-252-4188, www.naparcd.org

Napa Countywide Stormwater Pollution Prevention Program, 707-253-4823, www.countyofnapa.org/stormwater

City of Napa Water Division, 707-257-9521, www.cityofnapa.org/water

Napa County Public Works Water Conservation Program, 707-259-5969, www.countyofnapa.org/waterconservation

Napa County Department of Planning, Building and Environmental Services, 707-253-4417, www.countyofnapa.org/PBES

Napa County Mosquito Abatement District, 707-553-9610, www.napamosquito.org

This fact sheet was prepared by the Napa County Resource Conservation District with funding from the California Department of Fish and Wildlife.

Slow It, Spread It, Sink It!

Rain Gardens and Swales

DID YOU KNOW? Something as simple as water from a downspout can contribute to a number of unwanted consequences. Roofs and other impervious surfaces alter natural hydrology, increasing the volume and velocity of stormwater runoff. Fast-moving stormwater runoff can cause streambank erosion, degraded wildlife habitat, potholes, damage to structures, and deliver harmful pollutants to our waterways. Fortunately there are simple low-cost things that we all can do to help decrease the volume of, and minimize the pollutants in, the runoff leaving our properties. Many of these suggestions also have the added benefit of beautifying our local landscapes while following the simple mantra: Slow it. Spread it. Sink it!

Rain Gardens

A rain garden is a specialized landscape design that captures stormwater runoff from roofs, driveways, or other impervious surfaces and allows water to SINK back into the ground. It uses plants to remove pollutants and improve infiltration allowing water to soak back into the landscape. In soils with low permeability this system may be used to temporarily store water (not completely infiltrate) and remove pollutants before they enter a waterway.

A rain garden design can be as simple as a shallow depression filled with plants that can flourish in both moist and dry conditions. The required size, shape, and depth of the garden depend on how much water you are trying to capture. For large amounts of runoff or areas with insufficient infiltration, there are a full spectrum of engineered features, such as specialized soil mixtures, an aggregate base, and subsurface drains that can be added. These more complex designs are often referred to as bioretention cells.

Plant the center of the garden with species that tolerate wet conditions, such as native sedges and rushes. Around these, put plants suited to occasional standing water, like yellow monkeyflower (*Mimulus guttatus*) or California aster (*Aster chilensis*). Use plants that prefer drier soil at the futhermost edges of the garden, such as native evergreens and deciduous shrubs. Contact your local RCD or a local plant nursery knowledgeable in native and drought tolerant species for more suggestions.

Rain gardens should be located at least 10 feet from your house and at least 40 feet from a septic system or steep slope. They should also be designed

Rain garden plant suggestions:

Heteromeles arbutifolia

Festuca rubra
red fescue

Juncus patens
gray rush

Leymus triticoides
creeping wildrye

Mahonia pinnata
California holly grape

Heteromeles arbutifolia
toyon

Rhamnus californica
California coffeeberry

Ribes speciosum
fuchsia-flowered gooseberry

Mimulus guttatus
yellow monkeyflower

Mimulus aurantiacus
common monkeyflower

Rudebeckia californica
California coneflower

Cistus skanbergii
hybrid rockrose

to drain within 48-72 hours to reduce the risk of standing water and mosquito breeding. Rain gardens are a beautiful way to protect your property from erosion and protect the water quality of local creeks. They can enhance the aesthetic value of a site; be used on small parcels of land, easements, and right-of-ways; and are easily incorporated into existing landscapes or open space.

MAINTENANCE: Routine maintenance is required and can be performed as part of the regular site landscaping program. Weeding and irrigation are essential in the first couple of months while plants become established. Annual pruning and mulching are recommended. Additional irrigation may be necessary during drought years. The use of native, site-appropriate vegetation reduces the need for fertilizers, pesticides, excessive water, and overall maintenance.

DO

- Use California native or drought tolerant plants as appropriate.
- Minimize use of fertilizers to prevent water contamination and try organic options whenever possible.

DON'T

- Site in soils with high water tables or clay soils without an overflow device.
- Place too close to your home's foundation.

Benefits of a Rain Garden

- Water conservation: Installing plants with low water needs and directing runoff water to areas where it can be stored in the soil for later use by plants saves water.
- Groundwater recharge: Allowing more water to sink into the soil helps to protect our aquifers by enhancing groundwater recharge.
- Enhance and create wildlife habitat: Choosing appropriate plants can create habitat for local wildlife and act as natural pest control.
- Improve landscape aesthetics: Rain gardens can beautify your landscape.
- Reduce peak runoff flow: Peak flows occur when runoff reaches its highest point. By slowing runoff, we can reduce peak flows and mitigate flooding and erosion potential.

Rain garden with overflow drain at New Technology High School.

- Reduce erosion: Installing a rain garden limits the loss of top soil from a property and reduces the volume of sediments entering local streams.
- Protect infrastructure: Rain gardens can help reduce runoff that could damage structures, foundations, or public infrastructure, such as roads.

Rain garden planning and installation tips:

- Rain gardens are generally dug to a 6-inch depth and should be equal to roughly 4% of the size of the contributing impervious surfaces (roof, driveway) on the property. For example, if the impervious surfaces on a property are 500-700 ft^2, the rain garden should be roughly 24 ft^2.
- Site the garden at least 10 feet away from any structures and 5 feet from property lines.
- Once you have figured out the size and location for the rain garden, lay out the shape using a string or tape to define the outline of where you will dig.
- If the yard is level, dig to a depth of 6 inches and slope the sides. If the site is sloped, you may need to dig out soil on the uphill side of the area and use the soil to construct a small berm (a compacted wall of soil) along the down slope side of the garden.
- Once the garden is excavated, loosen the soil on the bottom of the area so you have about 12 inches of soft soil for plants to root in. Mix in about 3 inches of compost to help the plants get established and improve the water-holding capacity of the soil.
- If water enters the garden quickly, place gravel or river rock at the entry points to prevent erosion.

Installation tips courtesy of the Bay Area Stormwater Management Agencies Association.

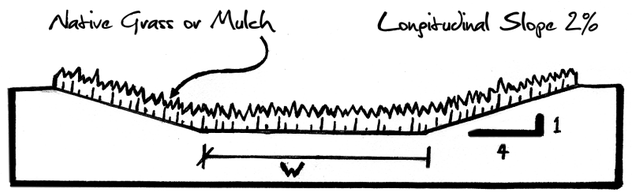
Swales

Swales are shallow channels designed to SLOW water down, SPREAD it out and allow it to SINK into the soil during low flows. Once saturated, they convey water to a safe outlet such as a rain garden or other infiltration areas. They can be formed to fit almost all site conditions and landowner objectives. Depending on the existing landscape and available space, swales can have a meandering or nearly straight alignment. An advantage to a meandering swale is that its geometry maximizes the time water spends in the swale thus aiding the trapping of pollutants and sediments while promoting infiltration. There are two types of swale systems: vegetated or rock-lined (sometimes called dry creek beds).

Vegetated Swales

Grassed swales are vegetated with native perennial grass, sedge, or rush species along the bottom and sides of the channel. The vegetation in the channel slows runoff, allows sediments to filter out, and can help remove nutrients. Bioswales are vegetated swales that use engineered media (usually a designed soil mix consisting of sand, loam soil and hardwood mulch) beneath the swale to improve water quality, reduce runoff volume, and control peak runoff rates. Although their functions are similar to grassed swales, bioswales have a greater capacity for water retention, nutrient removal, and pollutant removal. Adding gravel or other permeable material below the soil mixture further enhances infiltration.

When installing a swale, use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. Vegetation in the swale should be established before the first winter storms, so plant



Swale plant suggestions:

Festuca mairei
atlas fescue

Festuca rubra 'Molate'
Molate fescue

Carex buchananii
curly top sedge

Seslaria autumnalis
autumn moor grass

Carex barbarae
Santa Barbara sedge

Juncus effusus
common rush

Epilobium canum
California fuschia

Juncus patens
grey rush

Carex barbarae

Epilobium canum

Grey rush photo by El Nativo Growers, Inc.

DO

- Use California native plants or drought tolerant plants.
- Use fertilizer and pesticides only when necessary.

DON'T

- Walk or drive machinery directly in the swale as this will cause soil compaction.
- Place too close to your home's foundation.
- Allow water to stand or stagnate.