STORM DRAINS CONNECT
STREETS TO CREEKS
OURS TO PROTECT



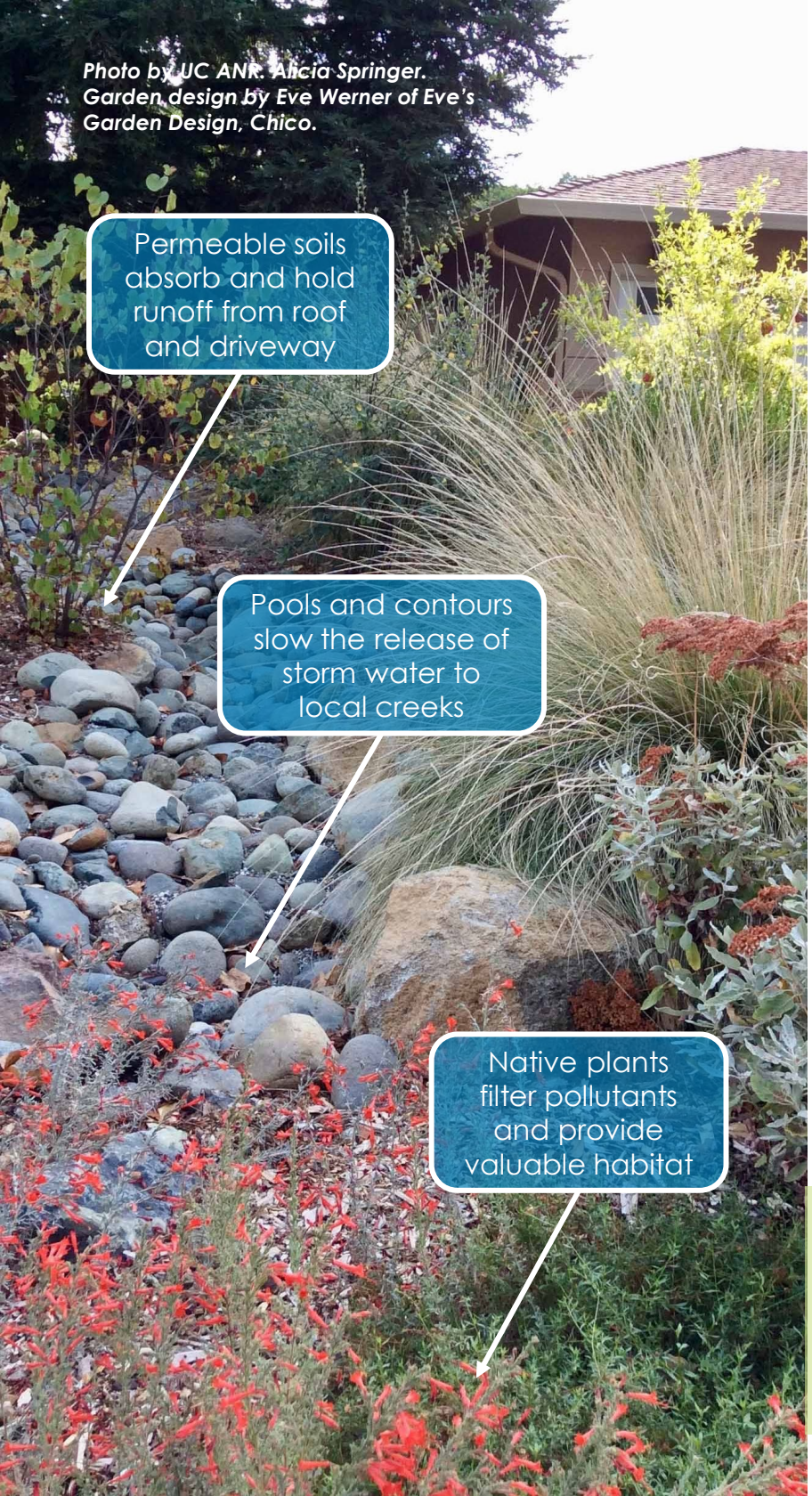
Image provided by the San Mateo Countywide Water Pollution Prevention Program

L.I.D.

LOW-IMPACT DEVELOPMENT

OWNER'S MAINTENANCE GUIDE

Santa Rosa WATER



WHAT ARE LID FEATURES & WHY DO WE NEED THEM?

In healthy natural areas, such as forests and grasslands, soil and vegetation act like a sponge, absorbing rainwater and slowly releasing it into creeks, aquifers, and the atmosphere. However, when natural areas are developed, the land's ability to absorb and store rainwater is greatly reduced. Rain falling on impervious surfaces such as roofs, roads, parking lots, and driveways runs off faster and in greater amounts than it would under natural, pre-development conditions. Large quantities of fast-flowing storm water pick up pollutants such as motor oil, heavy metal dust, feces, fertilizers, and microplastics, and carry them through the storm drain system untreated directly to local creeks and the Russian River. These pollutants and the large quantity of runoff cause major issues for wildlife and public health.

Luckily, there are solutions that allow for necessary development without causing storm water issues. **Low-Impact Development (LID) features are engineered landscape areas designed to capture and treat storm water runoff.** They allow stormwater to slow down, spread out, and soak into the ground while filtering out pollutants. LID features are a requirement of any new development that creates or replaces more than 10,000 square feet of impervious surfaces. Aside from their hydrological benefits, LID features can be beautiful landscape additions that also provide valuable wildlife habitat.

Common examples of LID features include rain gardens, vegetated swales, bioretention planters, and permeable pavement. Let's look at the two most common types of maintenance: vegetated features and permeable hardscaping. Look for factsheets on less common types of LID features at srcity.org/LID.

Correct long-term maintenance of LID features is critical to protect local water quality, groundwater supplies, public health, infrastructure, and wildlife.

LID PREVENTS COSTLY PROBLEMS

Roofs, parking lots, streets, and other impervious surfaces alter natural hydrology, increasing the volume and velocity of stormwater runoff. This has a variety of costly impacts including erosion, flooding, potholes, damage to structures, and wildlife habitat degradation. Well-designed and maintained LID features help prevent these issues and provide many other benefits as well.

Did you know that this:



Can contribute to this?:



Graphic courtesy of Slow it. Spread it. Sink it. Store it! Second Edition June 2015. Sonoma Resource Conservation District and the Resource Conservation District of Santa Cruz County.

BENEFITS of LID

- ✓ Filters out pollutants
- ✓ Replenishes groundwater supply
- ✓ Creates pollinator & bird habitat
- ✓ Beautifies urban areas
- ✓ Reduces flooding
- ✓ Prevents erosion



OWNER'S RESPONSIBILITY

It is the property owner's legal responsibility to maintain LID features so that they function as originally designed and approved. LID features are a condition of approval for qualifying development. Maintenance is required for the life of the development by the local California Regional Water Quality Control Board and the Environmental Protection Agency (EPA) under the Clean Water Act. **This guide will help you stay in compliance.**

Maintenance responsibility is attached to the property and transfers with changes in ownership.

INSPECTIONS & REPORTING

Typically, inspections will be performed annually by City staff. If corrective actions are needed, the property owner will be contacted. Corrective actions must be completed within the timeline specified by the City or prior to the first rain, whichever is sooner.

In some cases, depending on the type, age, and location of the feature, **you may be asked to complete a "self-inspection" or have your feature serviced** by a certified third-party contractor. If needed, City Staff will initiate and approve self-inspections. Self-inspections are typically a simple process that take just a few minutes per feature. City staff will send maps, a short inspection checklist, and instructions. Most homeowners can easily complete inspections themselves.

AN EXAMPLE OF GOOD MAINTENANCE....

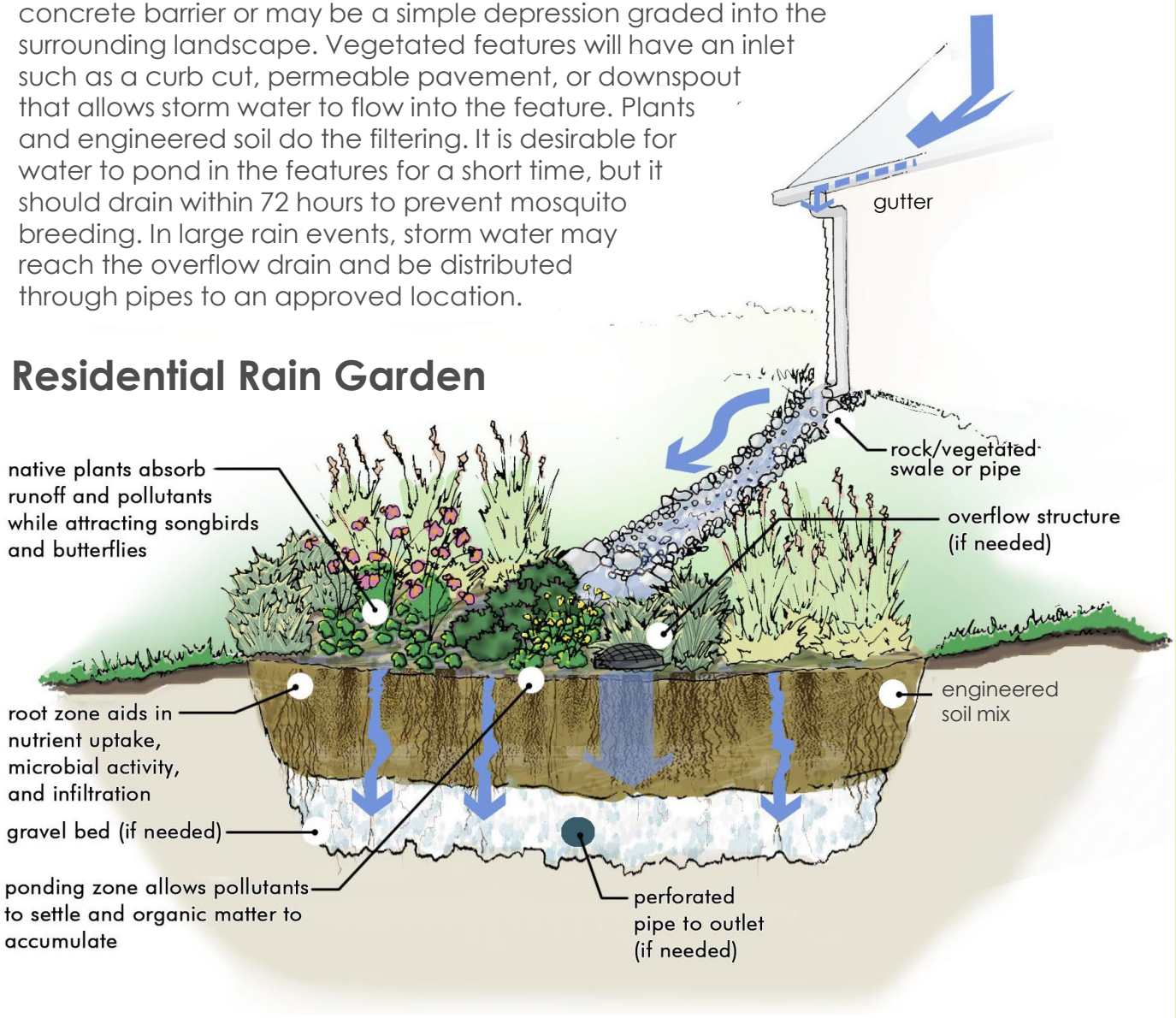


Image Credit: City of Santa Rosa

FACTSHEET: VEGETATED LID FEATURES

Vegetated LID features use **plants and special engineered soil** to absorb and filter storm water. Rain gardens, bioretention basins, and vegetated swales are common examples of vegetated LID features. They may be contained within a concrete barrier or may be a simple depression graded into the surrounding landscape. Vegetated features will have an inlet such as a curb cut, permeable pavement, or downspout that allows storm water to flow into the feature. Plants and engineered soil do the filtering. It is desirable for water to pond in the features for a short time, but it should drain within 72 hours to prevent mosquito breeding. In large rain events, storm water may reach the overflow drain and be distributed through pipes to an approved location.

Residential Rain Garden



THE RIGHT PLANTS ARE ESSENTIAL

The name says it all…**vegetation is key to proper functioning of vegetated LID features!** The LID Technical Design Manual contains a list of approved plants, chosen specifically for their ability to filter out common pollutants and withstand flooding and drought. Most are native plants, and many offer additional habitat benefits too. **Only plants from the LID Manual Approved Plant List are allowed** (unless you get specific approval for alternative plants from your local storm water authority & the Regional Water Quality Control Board).

It's a common misconception that LID plants don't need irrigation because they are native. Actually, most need regular water at least during the first few summers, and once mature, may still need weekly to monthly dry-season irrigation. For recommendations on how much to water your plants, visit srcity.org/WateringRecommendations.

AN OUNCE OF PREVENTION

Regular maintenance of your LID feature will save money and time in the long run by helping prevent the need to do major restoration or replace the feature later. The maintenance recommendations in this guide will help you keep your LID feature in compliance & thriving.


Image provided by the
San Mateo Countywide Water Pollution Prevention Program
YES
Vegetative cover is greater than 50%
Approved plants are diverse and healthy, providing habitat & filtration
No sediment buildup
No weeds
Mulch is non-floatable
GOOD MAINTENANCE


NON-COMPLIANT FEATURE
NO
Trash stored where it could spill into feature
Permeability modified without approval
Sediment being washed into overflow drain
Abundant micro-trash
Planted vegetation has largely failed, leaving less than 50% live vegetative cover
Image Credit: Kellen Johnston, City of Santa Rosa

VEGETATED LID FEATURES

DO…

- ✓ **Choose approved plants** from the current LID Manual Approved Plant List, found at: srcity.org/Low-Impact-Development
- ✓ **Maintain at least 50% vegetative cover** (weeds and trees don't count!)
- ✓ Use interlocking, rough-cut mulch such as **arbor or vineyard mulch** that is less likely to float
- ✓ **Irrigate** plants as needed in dry season
- ✓ **Hand-pull weeds**
- ✓ **Clear inlets** of sediment, overgrown plants, and debris before the wet season to allow water to flow in
- ✓ **Clean out overflow drain**

Image Credit: Knoll Gardens

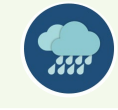
DON'T…

- ✗ Change grade of LID feature or surrounding landscape
- ✗ Install plants not on the Approved List
- ✗ Let vegetative cover fall below 50%
- ✗ Allow regular foot traffic that may compress engineered soils
- ✗ Add large quantities of rock
- ✗ Use floatable mulch such as evenly cut wood chips or bark nuggets
- ✗ Allow sediment to build up
- ✗ Use herbicides
- ✗ Cut back desired vegetation too short or too often

HEALTH & SAFETY TIP
If you see standing water in your feature 72 hours after a rain event, check out msmosquito.org/services for mosquito abatement options.

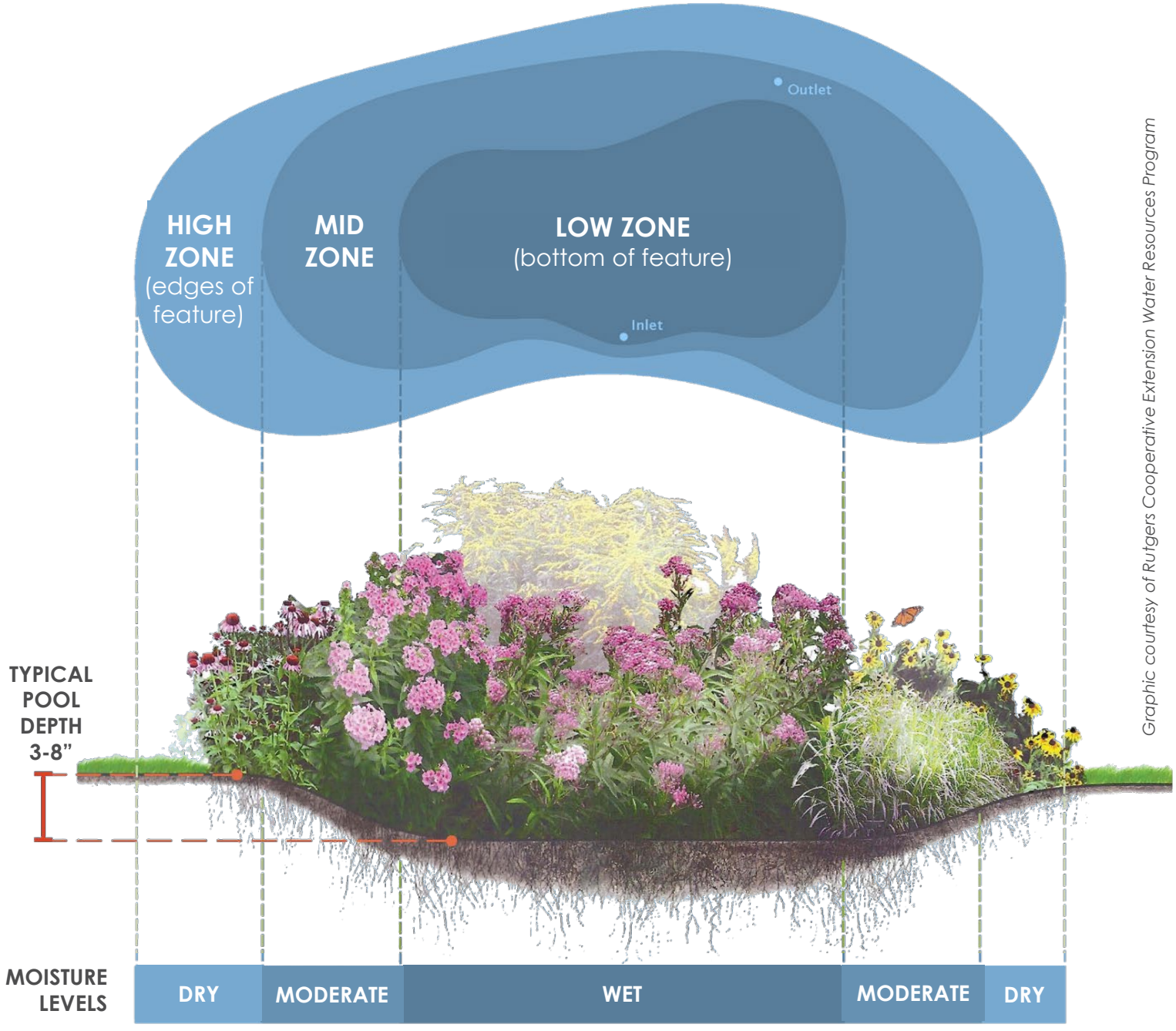
MONTHLY MAINTENANCE RECOMMENDATIONS

VEGETATED LID FEATURES

Activity	Notes	How Often?	Ideal Season(s)			
			Spring	Summer	Fall	Winter
Remove **trash** and debris	Wear gloves to clean out any trash that may have accumulated. Put trash in garbage and any leaves or dead plant material Into the compost.	monthly and after every major storm				
Remove accumulated **sediment**	Use a shovel or wet/dry vac to remove any accumulated sediment at the inlets or bottom of feature. If sedimentation is severe, coordinate with City to help identify potential sources. If clogged with sediment, top layer of engineered soil may need to be replaced to maintain drainage.	when sediment reaches 2" in depth, or once a year				
Water plants	Ensure irrigation timer is working and properly programmed for weather conditions. Run system to check for leaks or breaks and repair. Hand water regularly if there is no irrigation system. Visit srcity.org/WateringRecommendations for watering details.	dry season, especially when plants are young				
Remove **weeds**	Hand pull weeds, making sure to remove the root. Avoid using herbicides. It is easiest to pull weeds while young. See LID Plant Identification guide to help identify common weeds.	monthly in growing season, ideally before weeds make seeds				
Replace **plants** that have not done well	If survival falls below 50%, replace plants that have died with plants from the original approved planting plan or equivalents from the City LID Manual Approved Plant List.	as needed, inspect 1x/year				
Inspect and maintain **structures** such as inlets and overflow drain	Clear any plants that have grown over the inlets or drain. Remove any leaves, sediment, or other debris that may be clogging inlets/drains/splash pads. Make sure drainage grates are in place and in good repair.	as needed, inspect 1x/year				
Check plastic **liner** (if applicable)	If there is a plastic liner, check that it is still attached to the sidewalls of the planters. If it is not attached, it will need repair because water can flow underneath the liner and cause problems.	as needed, inspect 1x/year				
Clean up **grasses** and grass-like plants	Rake out dead material from grasses/sedges/rushes, and if needed, cut back to 6-8" tall. Do not cut too short or often.	as needed, inspect 1x/year				
Prune trees and shrubs	Prune up lower branches of trees to maintain sidewalk clearance. Deadhead or lightly trim shrubs, thinning if needed to maintain sunlight to understory plants.	as needed, inspect 1x/year				
Add non-floatable **mulch**	If soil looks bare, add 2-3" of non-floatable mulch such as arbor mulch. Avoid evenly cut wood chip mulch, which floats & can cause clogging. Make sure mulch is pulled away from plant stems.	as needed, inspect 1x/year				

THE RIGHT PLANTS IN THE RIGHT PLACES

Here are a few favorite species from the Approved Plant List. To increase habitat value and curb appeal in your LID feature, try using a variety of species including flowering plants. Plants in the low zone do most of the filtering, so you'll want to make sure plantings are densest there. Find the Approved Plant List at srcity.org/LID.



Graphic courtesy of Rutgers Cooperative Extension Water Resources Program

LOW ZONE



Carex barbarae
Santa Barbara sedge



Carex pansa
CA meadow sedge



Juncus patens
grey rush

MID ZONE



Iris douglasiana
Douglas iris



Mimulus aurantiacus
sticky monkey flower



Aster spp.
native aster species

HIGH ZONE



Fragraria chiloensis
dune strawberry



Eschscholzia californica
CA poppy



Muhlenbergia rigens
deer grass



Achillea millefolium
CA native yarrow



Achillea millefolium
non-native yarrow cultivars



Festuca californica
CA fescue



Arctostaphylos spp.
manzanita



Epilobium canum
CA fuschia



Festuca idahoensis
blue bunchgrass

FACTSHEET: PERMEABLE HARDSCAPING

Permeable hardscaping contains **pores or separation joints that allow water to flow through into an infiltration bed** of gravel or drain rock. Types of permeable pavement include porous asphalt and concrete, open joint or interlocking pavers, and plastic or concrete grid systems with gravel-filled or plant-filled voids. Permeable hardscaping can be found in parking lots, driveways, sidewalks, patios, or sometimes in street gutters as part of a vegetated roadside bioretention basin.

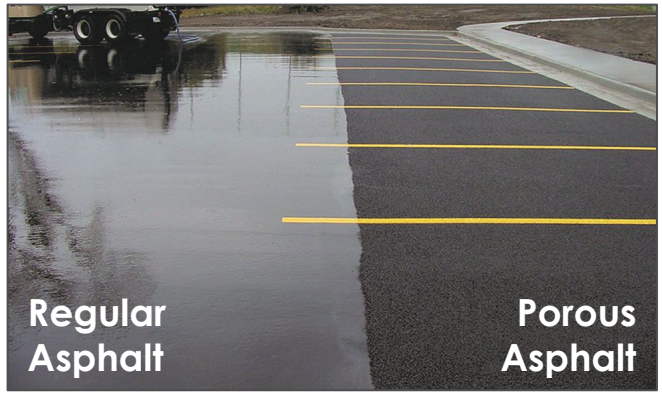
PREVENT CLOGGING

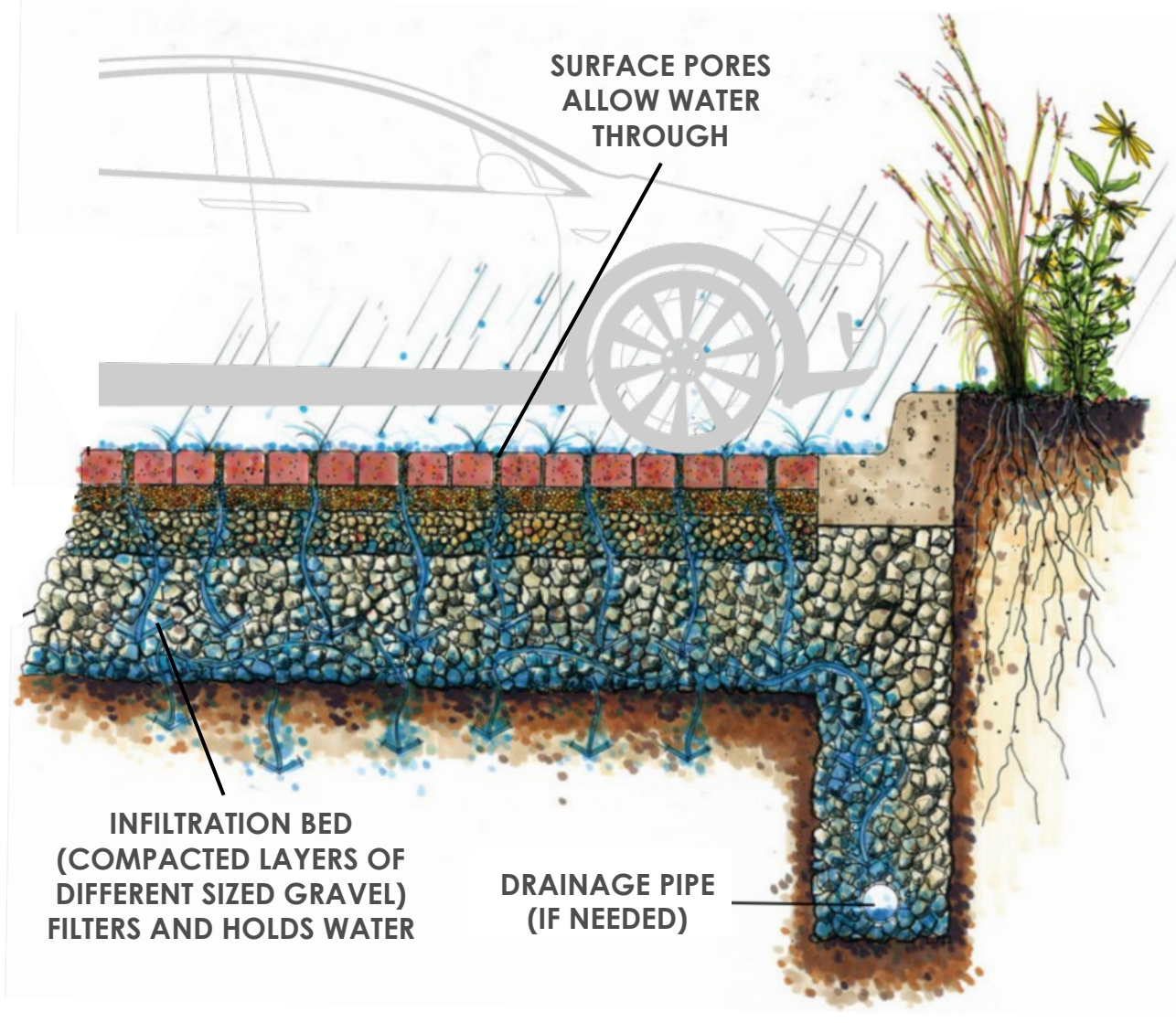
The most important maintenance for permeable hardscaping is keeping excess sediment out of the pore spaces. Keeping sediment from washing onto permeable hardscaping is the easiest form of preventative maintenance. Using a vacuum sweeper, which can either be a commercial truck or a smaller rented walk-behind unit, 1-2 times per year will clean out sediment before it causes major problems. **If sediment is allowed to build up in the surface pores or below in the gravel bed to the point that it cannot be cleaned out, the feature may need to be replaced.**

EXAMPLES









PERMEABLE HARDSCAPING MAINTENANCE

YES

Pore space is clear of sediment and pavement has no runoff during low-intensity storms.

Roadside Bioretention features often have a strip of permeable pavement too.



NO

Lots of sediment clogging pore spaces

PERMEABLE HARDSCAPING

DO...

- ✓ **Prevent soil washout onto the pavement** by maintaining landscaping areas adjacent to permeable hardscaping
- ✓ **Clean up small amounts of sediment and leaves ASAP** using a wet/dry vac
- ✓ **Use a tarp** under any landscaping materials that must be stored on permeable hardscaping, or store materials elsewhere
- ✓ **Remove deeper sediment** at least semi-annually using a rented walk-behind vacuum sweeper or a hired vacuum sweeper truck
- ✓ **Clean inlets** draining to the subsurface bed twice per year
- ✓ **Prevent** oil & automotive fluid drips

DON'T...

- ✗ Use leaf blowers on permeable pavement, which can force dirt and debris into pavement void spaces
- ✗ Power wash permeable hardscaping unless it has just been vacuumed. Power washing can drive sediment deeper into voids
- ✗ Allow construction staging, soil/mulch storage, etc. on unprotected permeable hardscaping
- ✗ Allow sediment to build up
- ✗ Use herbicides to remove weeds
- ✗ Wash mud from your vehicle, tools, or other surfaces onto permeable hardscaping
- ✗ Repair vehicles on top of permeable hardscaping

ANNUAL MAINTENANCE RECOMMENDATIONS
PERMEABLE HARDSCAPING

Activity	Notes	How Often?	Ideal Season(s)			
			Spring	Summer	Fall	Winter
Check adjacent landscaping for washout potential	If any bare spots or eroded areas are observed within nearby planted areas, they should be replanted/mulched/stabilized ASAP. If any washout does occur it should be cleaned off the pavement immediately to prevent further clogging of the pores.	as needed	✓	✓	✓	✓
Use a wet/dry vac (such as a shop vac) for **quick cleanups**	If you notice small amounts of sediment or leaves have been deposited on your permeable pavement, a quick cleanup using a household wet/dry vac can prevent bigger cleanups later.	as needed	✓	✓	✓	✓
Remove **weeds**	It is easiest to remove any weeds growing in the joints or pore spaces of your permeable hardscaping while they are still small.	2x/year	✓			✓
Remove **deeper sediment** with a commercial vacuum sweeper	For large areas, hire a commercial vacuum sweeper truck. For small areas, walk-behind vacuum sweepers are available for rent at some local equipment rental companies. Ensure that your machine uses vacuum action, not high-pressure air or water as this can drive sediment deeper. Grid pavers with large open spaces do not require vac sweeping.	1x /year in fall for low traffic areas 2+x/year for high traffic areas	✓		✓	
Inspect/clean **inlet** structures draining to the infiltration beds	If there are curb cuts or pipes that bring water to your permeable hardscaping, check that they are clean. This will help prevent sediment buildup and save on cleaning later.	2x/year	✓		✓	
Inspect/clean subdrain **outlets** (if applicable)	If your structure has subdrains, find the outlets and make sure they are not blocked.	1x/year			✓	
Test for permeability	If water is flowing across permeable pavement during low intensity storms or standing on the porous pavement 30 minutes after a rain event, it's time for a deep clean.	1x/year				✓

RESOURCES FOR MAINTENANCE OF PERMEABLE HARDSCAPING

For small installations, rented "walk-behind" vacuum units may prove most effective. Though these units can be loud and lack dust suppression, they are relatively easy to operate and inexpensive. Examples of effective walk-behind units include the Billy Goat models, the 5700 industrial-strength Scrubber by Tennant, and the sidewalk class vacuum sweepers made by Nilfisk, Advance and Hako. If walk-behind units are used, it is recommended that the scrub pressure be kept relatively low. The dirtiest areas may need to be power washed (<500 psi) after vacuuming.

For large areas, look for companies that provide parking lot cleaning services and use vacuum sweeper trucks such as the Elgin Whirlwind and the Allianz Model 650. Though much less effective than "pure" vacuum sweepers, regenerative air sweepers, such as the Tymco Model 210, Schwarze 348, Victory, and others, may be used. (Note: simple broom sweepers are not recommended for porous pavement maintenance.)



Image Credit: Kellen Johnston, City of Santa Rosa

L.I.D.

ADDITIONAL RESOURCES

REQUEST AN INFORMATIONAL SITE VISIT

(707) 838-5385
stormwater@townofwindsor.com
Inside Windsor Town limits only please.

LID MANUAL & APPROVED PLANT LIST

https://tinyurl.com/LID-Plant-List-with-Photos

STREETS TO CREEKS LID FEATURE FACTSHEETS

www.streetstocreeks.org/commercial/low-impact-dev/

E.P.A. GENERAL LID INFORMATION

www.epa.gov/nps/urban-runoff-low-impact-development

TOWN OF WINDSOR

STORM DRAINS CONNECT STREETS TO CREEKS OURS TO PROTECT

Writer Credit: Kellen Johnston, City of Santa Rosa
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