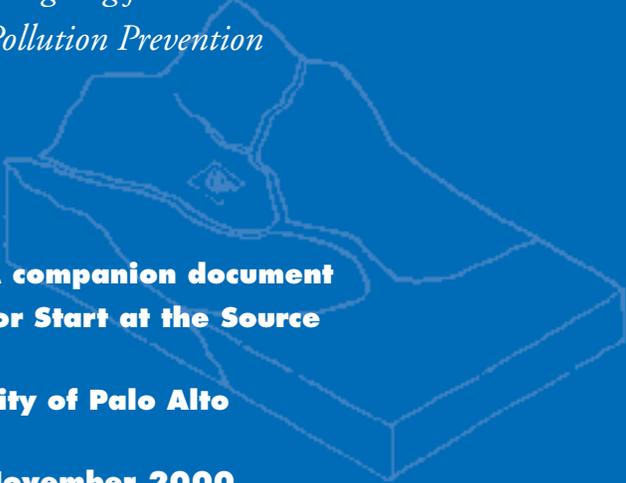




Planning Your Land Development Project

*Designing for Stormwater
Pollution Prevention*



**A companion document
for Start at the Source**

City of Palo Alto

November 2000



This booklet is intended as an companion document to **Start at the Source: Design Guidance Manual for Stormwater Quality Protection**, published by the Bay Area Stormwater Management Agencies Association (BASMAA) in 1999. References to **Start at the Source** throughout the text are intended to guide readers to more detailed information on relevant topics. The City of Palo Alto is grateful to BASMAA for permission to use many of the elements of **Start at the Source**, including text and layout by Tom Richman & Associates with Camp Dresser & McKee and Prof. Bruce Ferguson of the University of Georgia; design by Artefact Design (Sue Cretarolo); and drawings by Patric Dawe. Thanks to Mike Maystead of Cowper Graphics for designing this document.

Land Development Projects in Palo Alto

Both in the design phase and during construction, land development projects hold a key to protecting local creeks and San Francisco Bay.

This booklet has been prepared by the Public Works Department for developers, designers, site planners, property owners, and general contractors planning new construction or remodeling projects in Palo Alto.

The City's primary goals are:

- Compliance with federal, state, and local laws and ordinances prohibiting storm drain pollution
- Preventing storm drain pollution both during and after construction
- Reducing the volume and slowing the flow of stormwater to local creeks

What's the problem?

Development projects can have long-term impacts on water quality as well as the volume of storm runoff from a site. Storm water that runs off of compacted soil or impervious surfaces (such as roofs, paved areas, or parking lots) directly into the storm drain system carries all of the pollutants on the site into local creeks and the Bay.

As the paved or covered area of a site is increased, the volume of runoff increases. Increased runoff leads to

erosion of stream banks, degradation of sensitive creek wildlife habitat, and flooding.

Land development projects create numerous opportunities for storm drain pollution and erosion as they expose loose material and debris to storm runoff, or alter natural drainage patterns. Careful planning in the design phase and attention to pollution prevention techniques during construction are keys to improving water quality and reducing the potential for future flooding.

This guide summarizes the City of Palo Alto's recommendations and requirements for development permit acceptance and approval, as well as pollution prevention techniques during construction, and project design elements that can improve runoff quality after construction. The design section is keyed to a companion document, the 1999 edition of *Start at the Source: Design Guidance Manual for Stormwater Quality Protection*, produced by the Bay Area Stormwater Management Agencies Association. *Start at the Source* elaborates on all of the design elements discussed in this booklet. The City of Palo Alto encourages developers and permit applicants for commercial, industrial, and multi-family residential projects to make use of this valuable resource during project planning and design.

Inside this book

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Permit Applications

Storm drain pollution prevention has become a major focus of local, regional, and state agencies concerned with environmental protection.

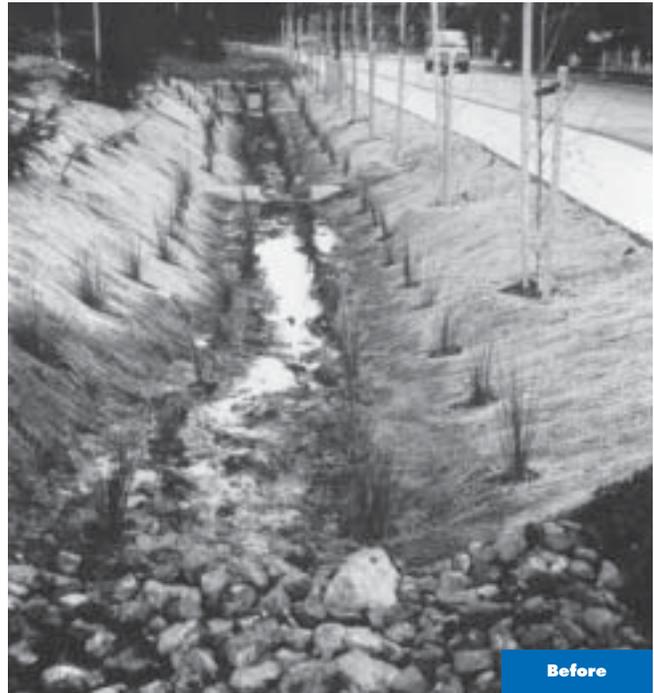
A Stormwater Pollution Prevention Plan (SWPPP) is required for most non-single family residential projects in Palo Alto. Your SWPPP must identify *specific* stormwater pollution prevention measures to reduce pollutants in stormwater discharges from the site both during and after construction, and show where and how controls will be implemented. The complexity of the required SWPPP will vary with the size, location, and nature of the project.

Please schedule an appointment with Public Works Engineering staff as early as feasible in the conceptual design phase, to discuss site drainage, grading, and pollution prevention. Call (650) 329-2151.



3373 Hillview

Parking lot design incorporates notched curbs and vegetated swales to filter and infiltrate runoff and prevent pollution.



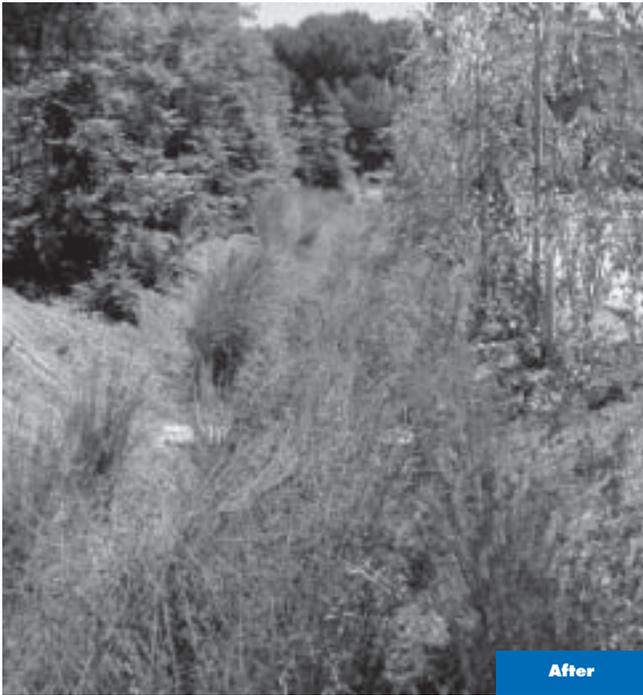
3150 Porter Drive

Newly planted native vegetation will stabilize swale banks. In top third of photo note check dam, which extends retention time for increased infiltration.

Projects in Palo Alto

The development permit application process in Palo Alto includes:

1. Meeting with Public Works staff—call (650) 329-2151 for an appointment.
2. Applying to the Architectural Review Board with a submittal package that includes a conceptual grading and drainage plan/SWPPP that addresses both 1) site design elements that will reduce the flow of runoff and pollution from the site after construction is completed and 2) pollution prevention measures during the construction process. (See *Blueprint for a Clean Bay* for ideas and details.)



3150 Porter Drive

Less than one year later, engineered swale resembles a natural streambed.

3. Applying for a grading or building permit with a detailed grading and drainage plan/SWPPP

Project designs must include strategies for:

- Minimizing impervious surface area and directly connected impervious areas
- Minimizing disturbance of trees or other natural vegetation
- Maximizing infiltration or retention of runoff on the site

Final project construction documents should include the following elements:

- A Storm Water Pollution Prevention Plan (SWPPP) addressing construction and post-construction stormwater impacts (the SWPPP may be incorporated into the grading and drainage plan). For minor projects, inclusion of the City-provided “Pollution Prevention—It’s Part of the Plan” sheet will satisfy the requirement for a construction-phase SWPPP.
- Specification language requiring the construction contractor to use Best Management Practices to protect stormwater quality during construction (model language available from the City).

Projects that disturb five or more acres of land:

In California, these projects have special regulatory requirements, detailed in the State of California’s Construction Activity Storm Water General Permit. These requirements, which exceed those imposed by the City, include:

- Filing a Notice of Intent (NOI) with the State Water Resources Control Board (form available from Public Works Engineering). A copy of the completed NOI must be submitted to the City prior to permit issuance.
- Preparation of a more detailed SWPPP in conformance with the requirements of the General Permit. The SWPPP is subject to review and approval by Public Works Engineering staff.

Strategies for Pollution Prevention

Planning and design

When planning and designing buildings, parking areas, and landscaping, it's important to keep in mind three general goals:

- Minimize the volume and peak flow rate of runoff from the site, and
- Reduce pollution in runoff that does occur.
- Schedule grading and earth-moving activities to avoid the wet season (October 1 through April 15). See City grading ordinance (Palo Alto Municipal Code Chapter 16.28) for special requirements during the wet season.

Benefits of runoff-wise planning

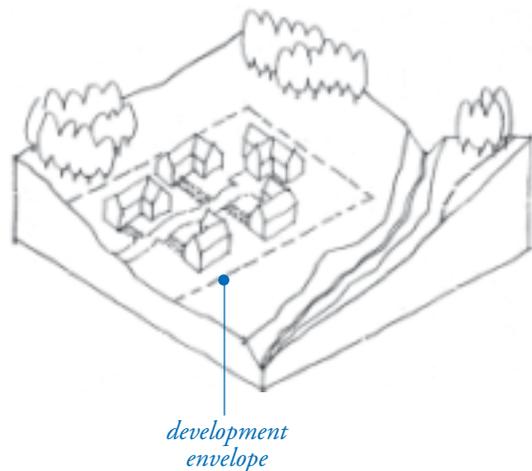
- Compliance with permit restrictions
- Lower storm drainage utility fees (bills are based on impervious surface area)
- Preservation or enhancement of natural features on the site

Runoff reduction/stormwater pollution prevention measures can be incorporated into any design or development. Drainage features incorporated into designs can add aesthetic and economic value to a property. **Start at the Source** includes general discussion (Chapter 6) as well as technical details (Chapter 8) for the different design and construction elements, as well as suggestions for techniques that will ensure essential coordination between project design professionals and construction contractors.

Conceptual considerations

Before beginning the design phase, consider the following principles:

- Define the development “envelope” on the site, noting sensitive areas or natural features that should be protected. (**Start at the Source** page 28)
- Plan to minimize direct connections between impervious surfaces and the storm drain system. (**Start at the Source** page 29)
- Maximize permeability (**Start at the Source** page 30)
- Plan to reduce reliance on automobiles. (**Start at the Source** page 31)
- Consider drainage as a design element. (**Start at the Source** page 32)
- Give preference to pollution prevention techniques with low maintenance requirements.



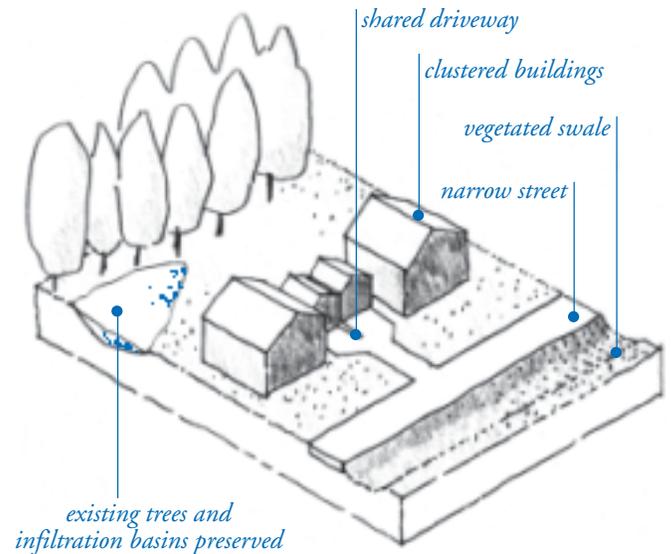
Keep the development envelope compact to minimize environmental impacts and construction costs. Reducing the development footprint preserves natural vegetation and helps prevent both erosion and water pollution.

Design for maximum infiltration

Allowing runoff to infiltrate into the soil on-site has many advantages, including aesthetic benefits, runoff pollution prevention, and reduced cost of irrigation as root systems of trees and shrubs become more robust. Clustering development on the site, building up instead of out, and selection of approved porous paving materials such as open-celled unit pavers can all contribute to infiltration.

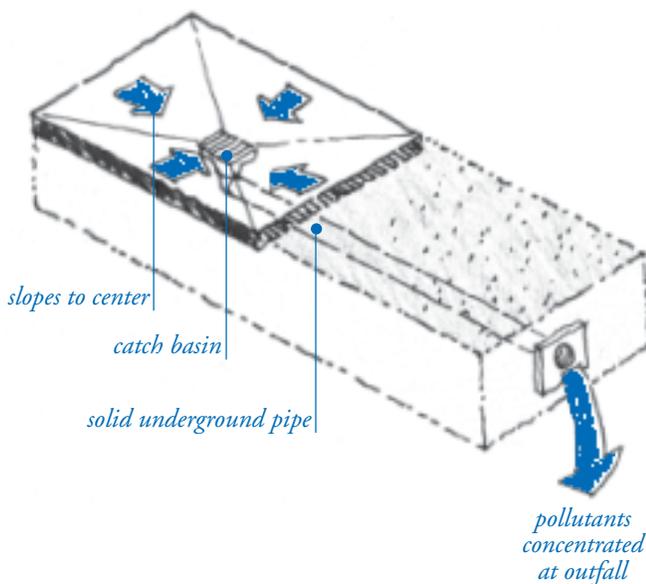
Impervious surfaces that connect directly with the storm drain system cause more storm drain pollution than any other source. Minimizing directly connected impervious areas reduces pollution by allowing for infiltration into the soil and filtration by plant material. It is also an excellent strategy for reducing the volume and velocity of runoff — thus reducing the likelihood of flooding.

Maximize permeability

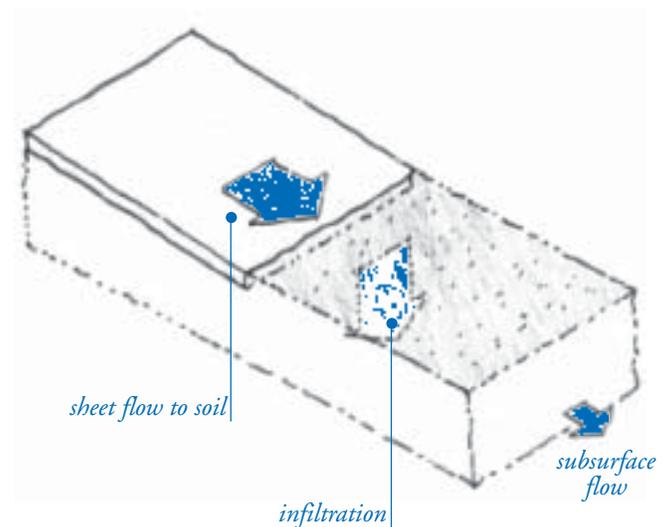


Separate impervious areas with landscaping or vegetation

Traditional Drainage Design Directly connected impervious area



Designing for Pollution Prevention Non-directly connected impervious area

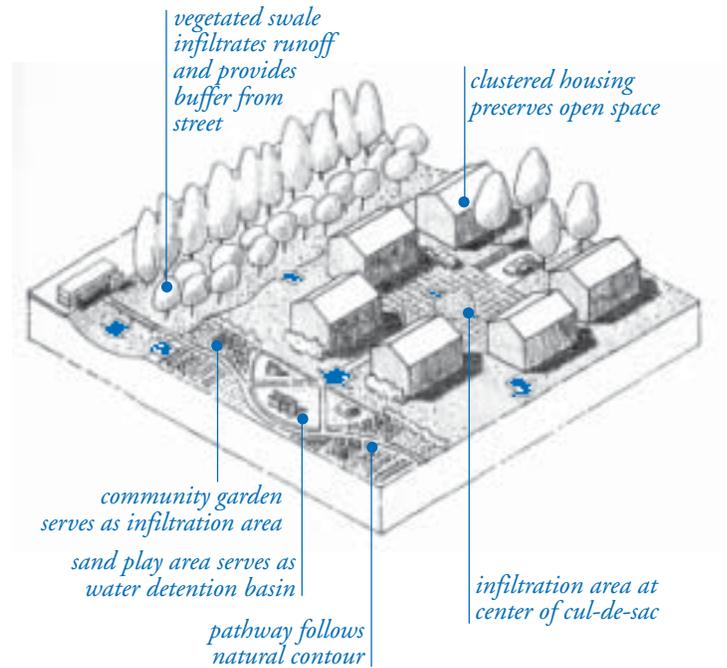


Strategies for Pollution Prevention

Make drainage a design element

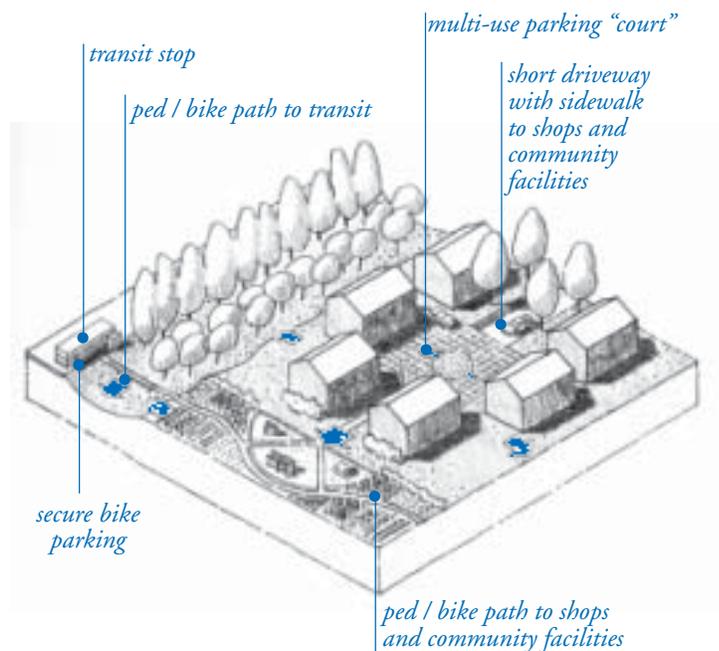
Site planning that takes into account natural contours and drainage patterns can contribute to an aesthetically pleasing design that minimizes both runoff and pollution. In many cases, integrating natural drainage elements also reduces the need for engineered drainage solutions and costly earthwork.

On the other hand, designed drainage elements that incorporate infiltration, filtration, or stormwater detention can become the functional and visual hallmarks of a project, adding value for the occupants of a development and the entire community.



Reduce reliance on automobiles

Vehicles are the largest source of water pollution in the Bay Area. With the current state of traffic in our region, an integrated plan that minimizes residents' or workers' need to drive to or from the site has obvious benefits. Developing links to public transportation and promoting walking and bicycling by constructing convenient paths and bicycle storage facilities enhance the value of any project.



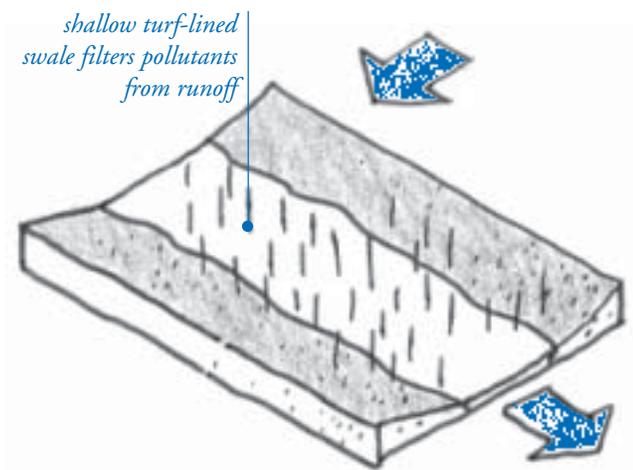
Reduce polluted runoff from the site

General Strategies:

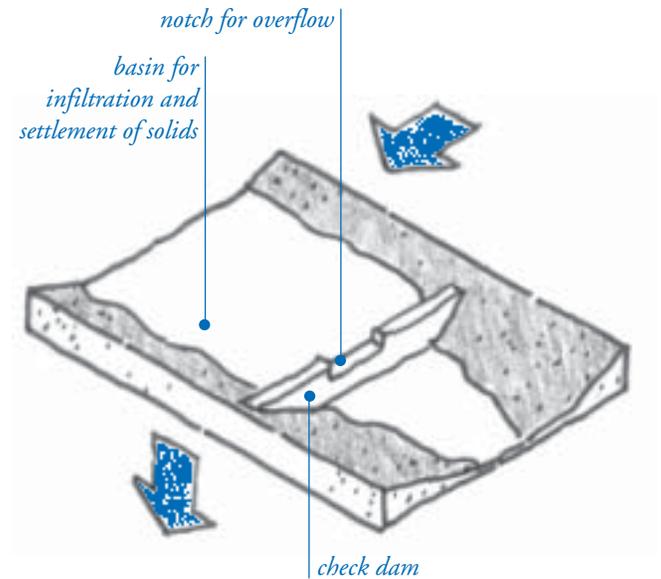
Broadly speaking, there are three approaches to reducing polluted runoff:

- Infiltration: Using the natural properties of soil and vegetation to absorb runoff on the site
(**Start at the Source** page 39)
- Filtration: “Treating” runoff by directing it through soil and vegetation before it leaves the site
(**Start at the Source** page 41)
- Storage: Holding runoff on the site before discharging it gradually into the storm drain system
(**Start at the Source** page. 40)

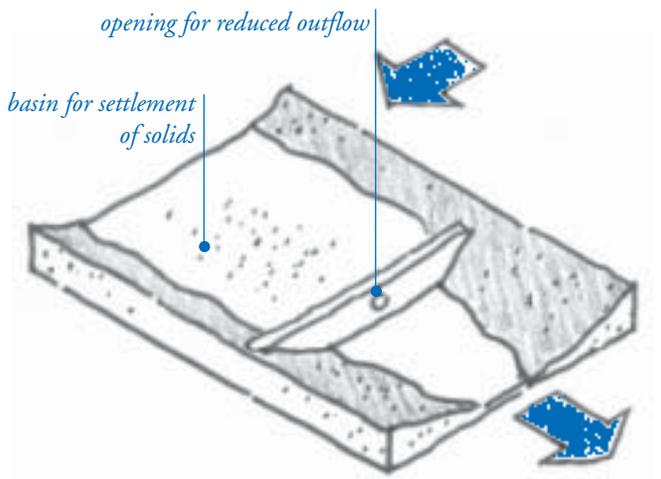
Filtration/biofilter



Infiltration area



Detention basin



Integrated Site Planning

An integrated site plan includes a combination of pollution prevention strategies, selected for the specific characteristics of a particular site and planned to achieve both stormwater quality and runoff minimization objectives.

(**Start at the Source** page 13)

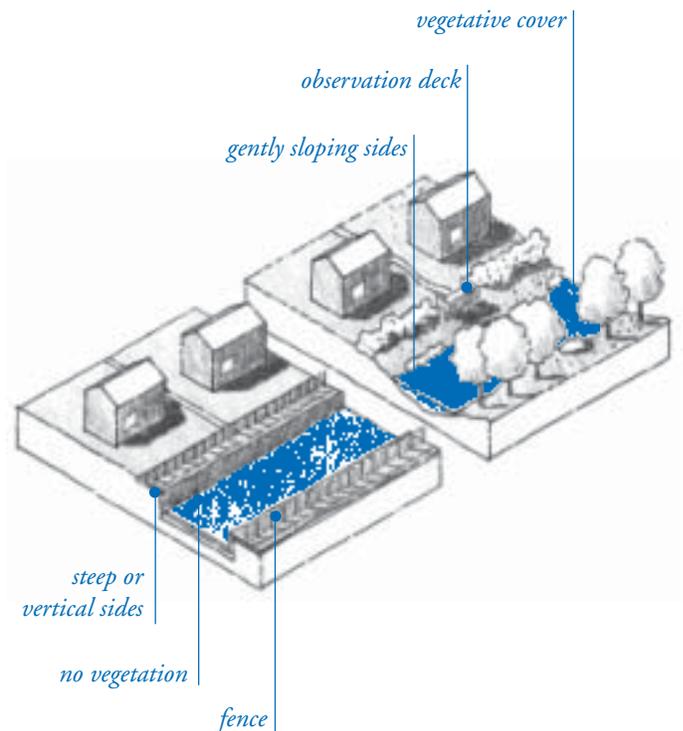
It's important to remember that over time, it's the small storms—of a size that occurs every two years or more frequently—that produce 80 percent of the Bay Area's overall rainfall and runoff. Designing pollution control measures that will handle these frequent small storms can reduce 80 percent of stormwater pollution! Integrated pollution prevention solutions are designed to take all of the runoff from small storms and the first part of runoff from larger storms.

Considerations for parking lot and facility design

Key long-term sources of pollution from land development projects should be given special consideration when preparing development permit applications:

- Dumpster/recycling areas
- Loading docks
- Roof drains
- Parking lots

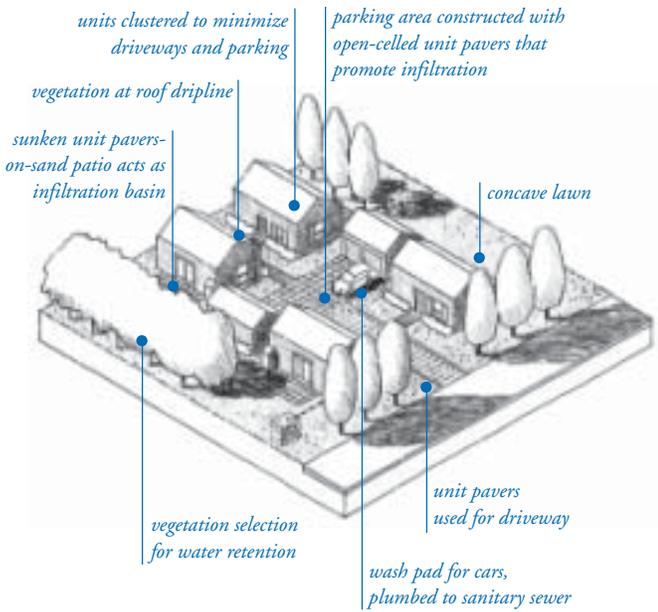
Integrated Approach Water as an amenity



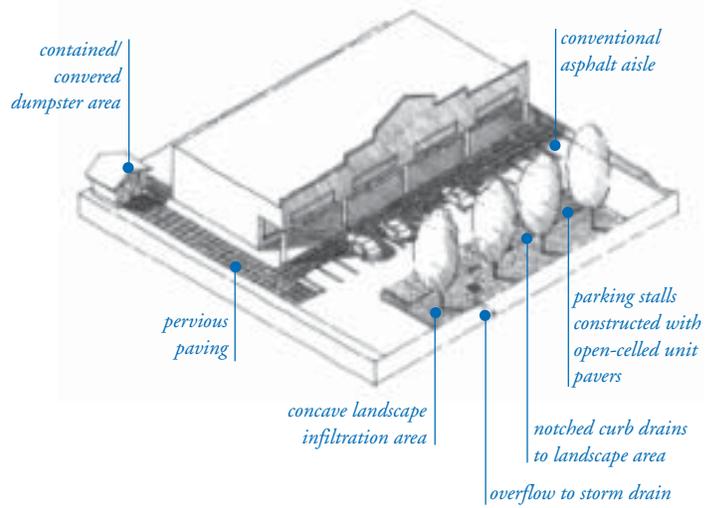
Traditional Approach Water as a hazard

Read more about the following examples of integrated site plans in **Start at the Source**.

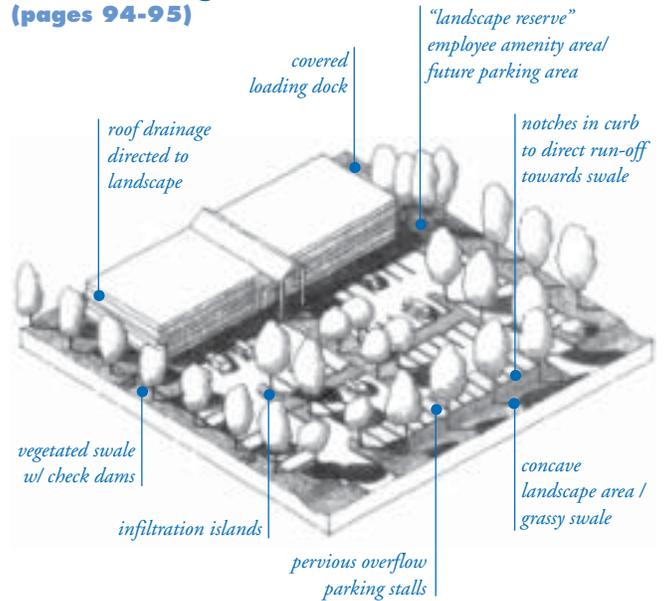
High density multi-family site (page 83)



Strip mall (page 92)



Office buildings (pages 94-95)



Facility Design

In many facilities, dumpster areas and loading docks are ongoing sources of storm drain pollution—and continuing challenges for both City inspectors and building managers. Planning for pollution prevention in the design stage is an economical solution to a significant problem.

Dumpster/recycling areas

- For food service facilities, dumpster areas must be bermed and covered. (Municipal Code Section 16.09.032(b)(16))



Loading Dock

Loading dock includes 1) roof covering loading/unloading area, 2) trench drain at roofline (plumbed to storm drain) to capture parking lot runoff, and 3) drain (plumbed to sanitary sewer and fitted with normally closed fail-safe valve) at base of loading dock.

- Dumpster areas at all facilities should be covered whenever feasible. Alternatively, designers will be asked to grade the area so that runoff will flow onto landscaping or a pervious area away from driveways, parking lots, gutters, or streets.

Loading docks

- Runoff from loading docks where chemicals or hazardous materials may be handled shall not drain to a street, gutter, or storm drain. (Municipal Code Section 16.09.032(b)(4)(D))

- It is recommended that all loading docks be covered, in order to preclude the need for a drain.
- If drains are needed at loading docks, they must be connected to the sanitary sewer and the area must be covered and bermed or graded to prevent rainwater run-on. Sanitary sewer drains in loading dock areas must be equipped with spring-loaded fail-safe valves which will be kept closed during hours of operation. (Municipal Code Section 16.09.032(b)(2))

Roof drains

- Roof drains should flow to splash blocks or cobbles, or onto landscaping—not to driveways or impervious surfaces. Direct connection to the storm drain system is discouraged. Secondary containment is required for roof equipment containing cooling system water or heating system hot water. (Municipal Code Section 16.09.032(b)(6))



Roof Drainage

Avoid direct connections between rain water leaders and storm drains. Here, downspout discharges rainwater to a cobbled swale that can overflow to landscaping.

Parking Lot Design

Parking lot design

In a commercial or industrial development, parking is frequently the largest single land use.

In Palo Alto, design standards for parking lot and associated landscaping are generally focused on vehicle safety and aesthetics. However, the City strongly encourages inclusion of stormwater treatment amenities such as those described below and in **Start at the Source**.

You will be required to stencil catch basins with the important “No Dumping!” message. Contact the Regional Water Quality Control Plant at (650) 329-2598 to obtain watershed-specific stencils.

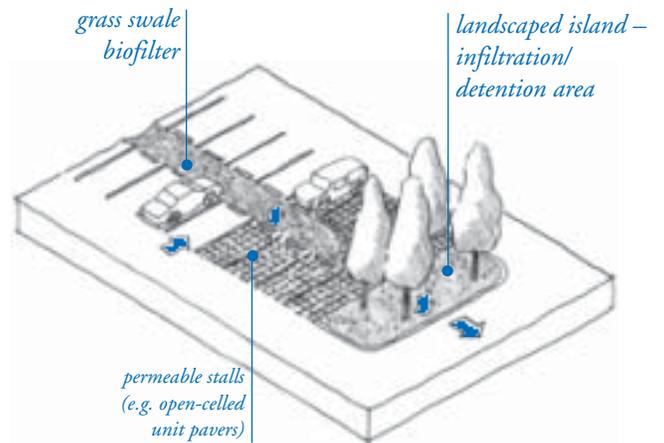
Covered parking is recommended because it prevents vehicle-related pollutants from contaminating stormwater runoff. Underground or covered parking must be constructed with floor drains connected to interceptors plumbed to the sanitary sewer. (Municipal Code Section 16.09.032(b)(17))

There are numerous other options for both reducing the volume of toxic parking lot runoff by using permeable paving materials to absorb it (infiltration), and treating the runoff by directing it through vegetated swales before it enters the storm drain system (filtration).

(**Start at the Source** pages 61-63; 120-125)

- Acceptable permeable paving materials include pervious concrete, porous asphalt, and open-celled concrete unit pavers set over a permeable base.
- Vegetated swales can be designed to promote infiltration and detain and filter runoff.

Grass/vegetated swale and pervious pavement



- “Manufactured treatment systems” are small pre-fabricated units designed to fit into a catch basin. A variety of catch basin filters and inserts are available. These devices are less desirable than infiltration/filtration solutions, because they require extensive and carefully scheduled maintenance, and none reduce overall runoff volumes or mitigate peak flows. Owners are required to commit in writing to future maintenance of manufactured treatment devices.
- Providing only the minimum number of parking stalls helps to reduce impervious area, storm runoff, and water pollution.

Landscaping

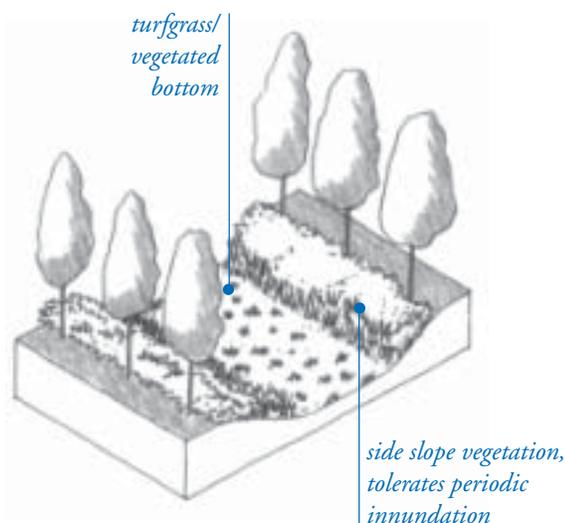
Coordinate landscaping with site engineering

Landscaping offers many opportunities to integrate site drainage and pollution prevention features into a project—while improving aesthetics.

(**Start at the Source** pages 70-73; 138-147)

- Vegetated swales can be included in parking lots design to provide treatment (filtration), storage (infiltration), or both. (**Start at the Source** page 70)
- Plant species selection can also be instrumental in site runoff reduction, erosion control, and stormwater pollution prevention. Deep-rooted plants increase the infiltration capacity of the soil. Leaf-surface area collects and holds rainwater in small storms. If you are planning major detention/retention features, be sure to choose plants that can tolerate periodic inundation. (**Start at the Source** pages 146-147)
- It's important to coordinate with the project landscape architect early in the design process.

Grass/vegetated swales



395 Page Mill Road

In a redevelopment project, the landscape architect and design engineer collaborated on the creation of a “creek” that filters and infiltrates runoff from a large parking lot before discharging to the storm drain system. The banks are planted with native vegetation, and the watercourse meanders to slow the flow and increase detention/infiltration time. The “creek” has become a major site amenity.



These materials are available from Palo Alto Public Works Engineering at the Development Center, 285 Hamilton Ave., Palo Alto. Call (650) 329-2151 for more information.

- *Start at the Source: Design Guidance Manual for Stormwater Quality Protection*, 1999 Edition. Bay Area Stormwater Management Agencies Association
- *Blueprint for a Clean Bay: Best Management Practices to Prevent Stormwater Pollution from Construction-Related Activities*. Bay Area Stormwater Management Agencies Association, 1999.

Specialized brochures about specific types of construction activities:

- General Construction and Site Supervision
- Earth-Moving Activities
- Fresh Concrete and Mortar Application
- Heavy Equipment Operation
- Home Repair and Remodeling
- Landscaping, Gardening, and Pool Maintenance
- Painting and Application of Solvents and Adhesive
- Roadwork and Paving
- State of California Stormwater BMP Handbooks (set of 3)

BMP Fact Sheets from Bay Area Stormwater Management Agencies Association:

- Inlet Filters
- Grassy Swales
- Porous Pavement
- City of Palo Alto Municipal Code Sewer Use Ordinance (Chapter 16.09)
- City of Palo Alto Municipal Code Grading Ordinance (Chapter 16.28)
- Watershed-specific “No Dumping!” catch basin stencils (available from the Regional Water Quality Control Plant, (650) 329-2598)
- National Pollution Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activity
- “Pollution Prevention—It’s Part of the Plan” (BMP Plan Sheet)
- “It’s in the Contract! (but not in the Bay): Pollution prevention specifications for City construction contractors and maintenance crew supervisors”
- *Preventing Pollution During Construction: Guidelines for Contractors and Maintenance Crews* (video)