

Start at the Source

*Design Guidance Manual
for Stormwater Quality
Protection*

1999 Edition

**Bay Area Stormwater
Management Agencies
Association**

B A S M A A



TOM RICHMAN & ASSOCIATES
Urban Design and Landscape Architecture

4 Site Design

The fundamental hydrological concepts and stormwater management concepts can be applied to site planning to generate forms that are more integrated with natural topography, that reinforce the hydrologic cycle, that are more aesthetically pleasing and that are often less expensive to build.

A few site planning principles help to locate development on the least sensitive portions of a site, and to create urban and suburban forms that accommodate land use while mitigating its impact on stormwater quality.

The application of these principles in developing a site plan will create opportunities for employment of a wide variety of simple design techniques to infiltrate significant amounts of runoff, improve aesthetics, and reduce development costs.

Site Design

4.1 Define development envelope & protected areas.

Each site possesses unique topographic and hydrological features, some of which are more suitable for development than others. By identifying the development envelope and protected areas, a site plan can be generated that minimizes both environmental impacts and construction costs.

4.2 Minimize directly connected impervious areas.

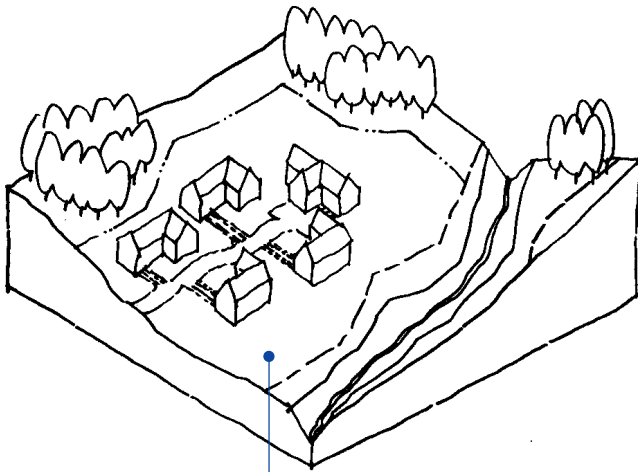
For decades planners, engineers and builders have been trained to get rid of stormwater. This is accomplished by connecting impervious areas to storm drains. Yet these “directly connected impervious areas (DCIAs)” are a principal contributor to nonpoint source pollution and flow impacts.

4.3 Maximize permeability. A parallel strategy to minimizing DCIAs is to maximize the permeability of the site. This is accomplished both by preserving open space and by using permeable pavement surfaces where feasible.

4.4 Maximize choices for mobility. By planning for alternative modes of transportation – bicycles, pedestrians, transit – reliance on automobiles can be reduced.

4.5 Use drainage as a design element. Unlike conveyance storm drain systems that hide water beneath the surface and work independently of surface topography, a drainage system for stormwater quality protection can work with natural land forms and land uses to become a major design element of a site plan.

Define development envelope and protected areas

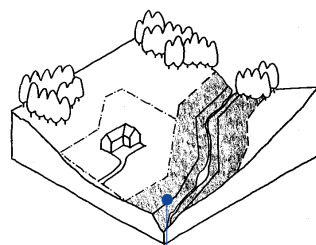


development envelope

The first step in site planning is to define the development envelope. This is done by identifying protected areas, setbacks, easements and other site features, and by consulting applicable local standards and requirements. Site features to be protected may include important existing trees, steep slopes, erosive soils, riparian areas, or wetlands.

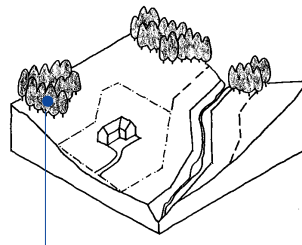
By keeping the development envelope compact, environmental impacts can be minimized, construction costs can be reduced, and many of the site's most attractive landscape features can be retained. In some cases economics or other factors may not allow avoidance of all sensitive areas. In these cases, care can be taken to mitigate the impacts of development through site work and other landscape treatments.

Set back development from creeks, wetlands, and riparian habitats.



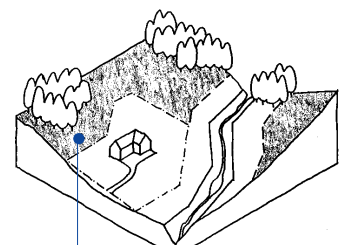
creek setback

Preserve significant trees. Trees protect soil structure, aid in soil permeability, and provide aesthetics.



existing significant trees

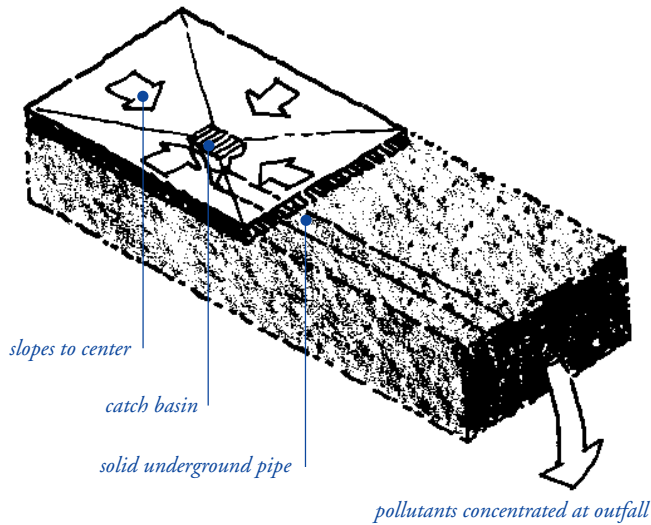
Avoid erosive soils and slopes. These include steep or long continuous slopes, soils high in silt or fine sand, or soils lacking vegetative cover.



erosive soils

Minimize “directly connected impervious areas”

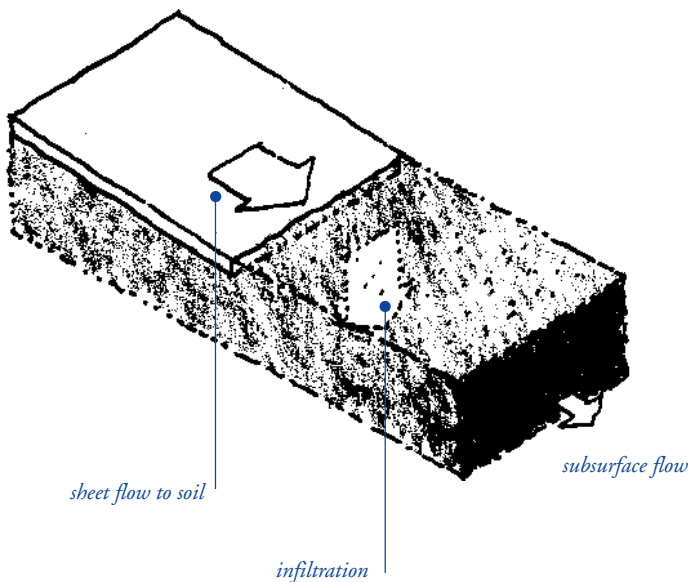
Directly connected impervious area (DCIA)

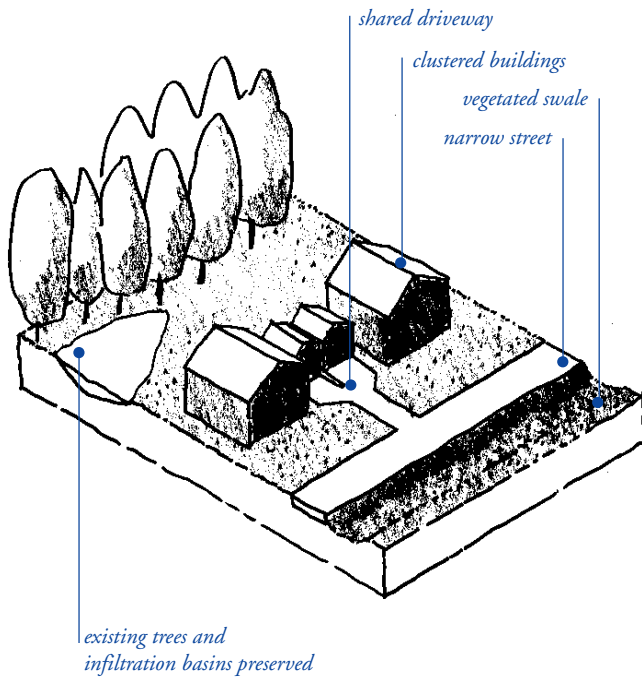


Impervious areas directly connected to the storm drain system are the greatest contributor to nonpoint source pollution. Any impervious surface which drains into a catch basin, area drain, or other conveyance structure is a “directly connected impervious area (DCIA).” As stormwater runoff flows across parking lots, roadways, and paved areas, the oils, sediments, metals, and other pollutants are collected and concentrated. If this runoff is collected by a drainage structure and carried directly along impervious gutters or in sealed underground pipes, it has no opportunity for filtering by plant material or infiltration into the soil. It also increases in speed and volume, which may cause higher peak flows downstream, and may require larger capacity storm drain systems, increasing flood and erosion potential.

A basic site planning principle for stormwater management is to minimize these directly connected impervious areas. This can be done by limiting overall impervious land coverage or directing runoff from these impervious areas to pervious areas and/or small depressions, especially the first 1/3 to 1/2 inch of rain. This means that if the site is 50% impervious, then the pervious areas must have capacity to infiltrate two times the treatment depth. In this example, that is 2/3” to 1” of rain, because both surfaces are subject to rain. Larger storms may require an underground storm drain system, but even these systems can mitigate stormwater quality impacts if runoff from impervious surfaces passes through pervious areas and depressions before being collected in conveyance devices.

Not-directly connected impervious area



Maximize permeability

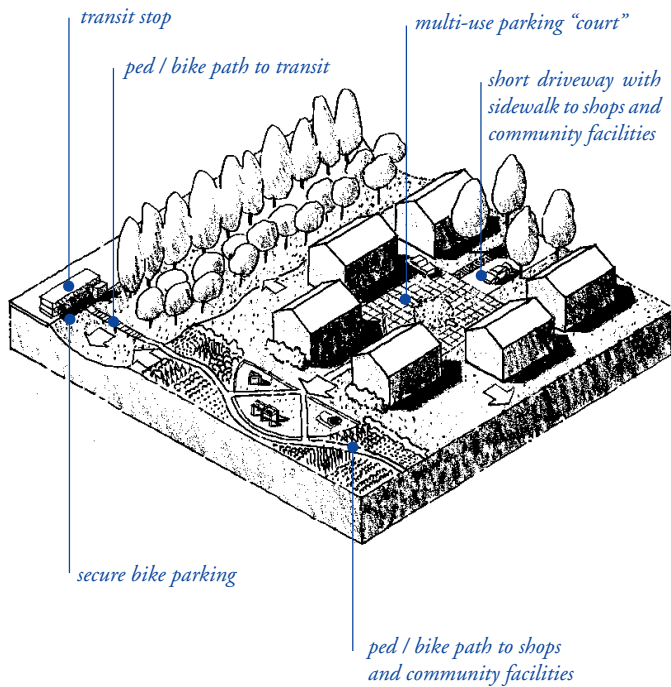
Within the development envelope, many opportunities are available to maximize the permeability of new construction. These include minimizing impervious areas, paving with permeable pavement materials, clustering buildings, and reducing the land coverage of buildings by building taller and narrower footprints. All of these strategies make more land available for infiltration and open space.

Clustered driveways, small visitor parking bays, and other strategies can also minimize the impact of transportation-related surfaces while still providing adequate access.

Once site coverage is minimized through clustering and careful planning, pavement surfaces can be selected for permeability. A patio of brick-on-sand, for example, is more permeable than a large concrete slab. Gravel, mulch, and lawns are permeable ground covers suitable for a wide variety of uses. Pervious concrete and porous asphalt, used in the eastern United States, are alternative materials that can preserve permeability where a larger, more intensely used paved area is needed.

Maximizing permeability at every possible opportunity requires the integration of many small strategies. These strategies will be reflected at all levels of a project, from site planning to materials selection. In addition to the environmental and aesthetic benefits, a high-permeability site plan may allow the reduction or elimination of expensive underground conveyance storm drain systems, yielding significant savings in development costs.

Maximize choices for mobility

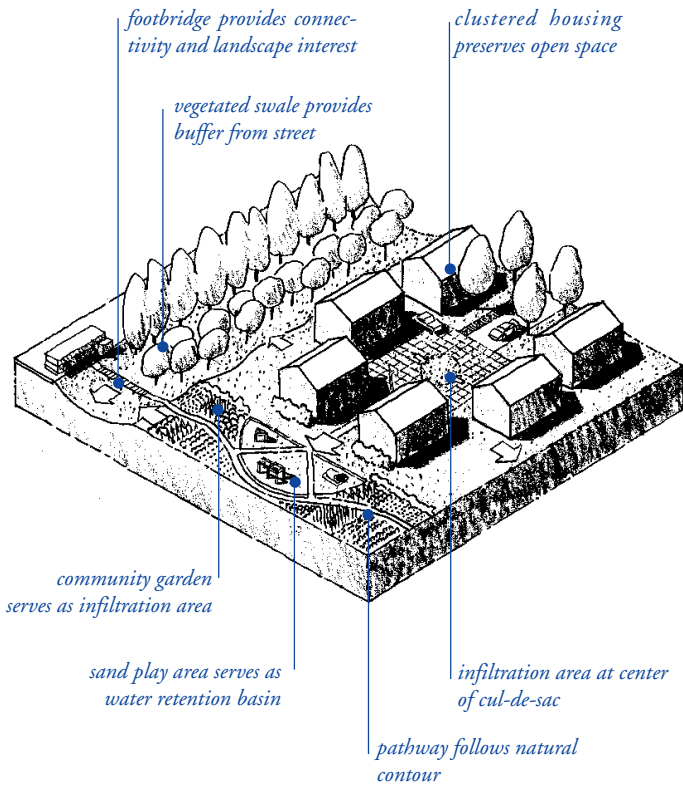


Given the costs of automobile use, both in land area consumed and pollutants generated, maximizing choices for mobility is a basic principle for environmentally responsible site planning. By designing developments to promote alternatives to automobile use, a primary source of stormwater pollution can be mitigated.

Bicycle lanes and paths, secure bicycle parking at community centers and shops, direct, safe pedestrian connections, and transit facilities are all site planning elements that maximize choices for mobility.

The automobile is a valuable, essential element of our current transportation system, and its use must be accommodated. But by giving comparable accommodation to other transportation modes, less environmentally costly choices for mobility become more viable.

Use drainage as a design element



Unlike conveyance storm drain systems that hide water beneath the surface and work independently of surface topography, a drainage system for stormwater infiltration can work with natural land forms and land uses to become a major design element of a site plan.

By applying stormwater management techniques early in the site plan development, the drainage system can suggest pathway alignment, optimum locations for parks and play areas, and potential building sites. In this way, the drainage system helps to generate urban form, giving the development an integral, more aesthetically pleasing relationship to the natural features of the site. Not only does the integrated site plan complement the land, it can also save on development costs by minimizing earthwork and expensive drainage structures.



Attractive? Yes. Nuisance? Not necessarily. Because of concerns about safety and liability, many developers and municipal agencies are reluctant to combine stormwater facilities with recreational uses. Yet, a well-designed stormwater facility can be safe and attractive.

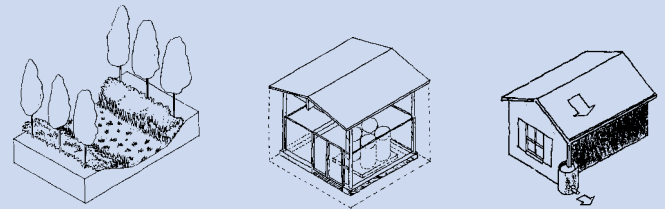
This sand play area at Village Homes in Davis, California, doubles as a stormwater detention basin. Designed to hold about six inches of rainwater, this playground has been in use for over twenty years without any reported water-related accidents, lawsuits, or injuries.¹⁹ It shows that multi-use stormwater management facilities can be both attractive and safe.

Finding that the way we design and build communities has a direct effect on water quality, the Bay Area Stormwater Management Agencies Association (BASMAA) has prepared **Start at the Source**, a manual that aims to help designers, developers, and municipal agencies create communities that achieve water quality goals.

The *Site Planning & Design Guidance Manual* contains introductory information on hydrology, watersheds, the importance of minimizing impervious land coverage, zoning and planning strategies for stream protection, and conceptual examples of dozens of methods for integrating stormwater management into all kinds of projects, including new development, infill, and redevelopment.

A **new technical section** presents detailed information on a wide variety of designs that can be adapted to residential, commercial, industrial and institutional projects.

This document recognizes that the one of the best opportunities to reduce the generation of urban runoff or nonpoint source pollution is through planning and design.



“The more we study stormwater runoff, the more we realize the critical role site planning and design play in our ability to reduce the impacts of development on the quality of our nation’s waters. This manual is a significant step in teaching planners and developers to plan for water quality.”

Thomas E. Mumley

California Regional Water Quality Control Board

San Francisco Bay Region

Urban Runoff Program Manager

“BASMAA’s *Start at the Source* guidance manual is a pioneering effort which focuses on the importance of considering storm water quality in the early stages of planning new residential development in the San Francisco Bay area.”

Community Planning & Environmental Committee

**Consulting Engineers and Land Surveyors
of California (CELSOC)**

“Through its integrative approach and illustrative method, *Start at the Source* shows how new development can be designed and built to meet functional and market demands while protecting water resources.”

Jim Dalton, Executive Vice President

American Society of Landscape Architects