7 Case Studies

The site planning principles and design concepts described in the previous pages are integrated on the following pages in a series of case studies reflecting the diverse topography and market conditions of the Bay Area.

The case studies are illustrative. They show an approach to site planning and design that integrates stormwater management as an organizing element. Each of the details in Chapter 6 is illustrated at least once to show how the details work in combination with each other. Real sites, and real projects, will require unique combinations to suit unique conditions.

Site planning and design is a complex and demanding process. To be successful, a new development must meet marketing, economic, regulatory, engineering, environmental, construction, and design criteria. The following case studies attempt to show that by treating stormwater as a resource, and using it as a means to generate design, communities can be built that reward investment, enhance the natural environment, and make better places for people to live and work.

Case Studies

Economic benefits of stormwater management

Economic benefits of stormwater management

People have a strong emotional attachment to water, arising from its aesthetic qualities– tranquility, coolness and beauty. As a result, most waterbodies within developments can be used as marketing tools to set the tone for entire projects. A recent study conducted by the National Association of Home Builders indicates that "whether a beach, pond, or stream, the proximity to water raises the value of a home by up to 28 percent."[56]

In California's semi-arid climate, most of the techniques described in this document will not be year-round water features, but instead will hold water only during the rainy months. These ephemeral ponds and streams have a unique character, changing with the seasons and reflecting (literally) daily changes in weather.

Water features command a premium in the marketplace. Homebuyers and renters nation-wide demonstrate a willingness to pay a premium for properties adjacent to urban runoff controls that are designed with aesthetics in mind. According to the US E.P.A., land values for lots fronting runoff controls commanded 5 to 15% premiums over comparable lots at residential projects in Virginia, Colorado, Illinois and Kansas. In Davis, California, properties at Village Homes, a residential subdivision built in the late 1970s with seasonal swales and other environmental features, command significantly higher values than comparable homes in nearby conventionally designed subdivisions.

Stormwater management for water quality presents developers with an opportunity to design more attractive projects that will have an advantage over conventionally designed competitors. Not only do subdivisions sell faster and at a premium, but development costs are generally lower for surface drainage systems compared to conventional underground systems.[57]

Factors that lead to increases in property values. Urban runoff systems that appear to be natural systems are most effective at commanding increases in property values. If recreation is included (e.g. a walking path along a swale or playfield/infiltration basin), an additional premium is realized. These recreational areas and wetlands can become a feature attraction when advertising the property. Amenities such as trails and gazebos may add costs, but these can be compensated for by faster sales and additional profits. Developers can charge premiums for properties with water views, stream frontage, access to greenbelts, or other amenities.

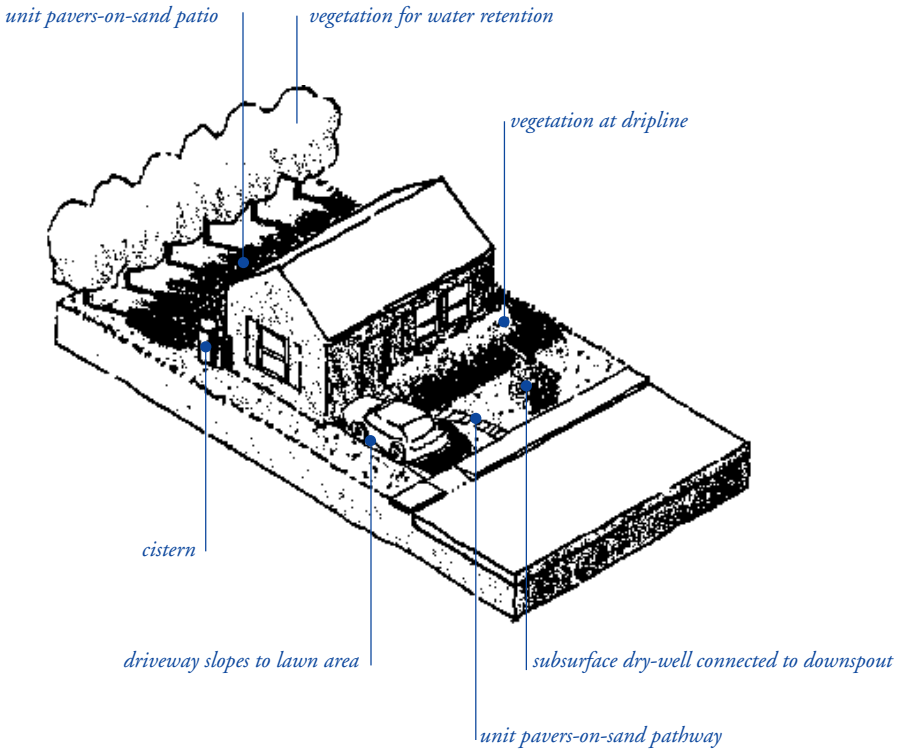
Maintenance. Proper maintenace of the drainage system is essential for homebuyer acceptance and marketing. Runoff controls that are poorly maintained can be a hazard or a nuisance. Maintenance costs need not be significantly higher than conventionally designed projects. For example, a concave lawn requires the same maintenance as a convex one, though the concave lawn can form part of a stormwater management system. In some designs, such as vegetated swales or seasonal ponds, periodic maintenance will be required, but it is less than other amenities routinely included in new development, such as fountains or tennis courts.

Green marketing. Many consumers today demonstrate a preference for products and services that are "environment friendly." Organically grown cotton clothing, natural foods, and recycled papers are a few of the products that sell at a premium to conventional competitors but command increasing market share. Homebuyers, too, respond to products that consciously promote more environmentally responsible designs, as long as these designs are safe, attractive and functional. By promoting a natural drainage system, developers can meet federal mandates for environmental quality while simultaneously differentiating their product through increased habitat, a more diverse landscape, and additional recreational opportunities.

This drainage swale, integrated with a pathway system and landscaping, makes an attractive recreational area that enhances property values.

Case Study

7.1a *Small single lot*



7.1a Small single lot. Even a small, single-family home lot can provide opportunities for stormwater management. Because they occur at the intimate, garden level, these opportunities can add aesthetic richness that will directly benefit residents. Stormwater management techniques can also provide habitat for wildlife, create shade, improve character, provide supplemental irrigation water, and promote growth of landscape planting.

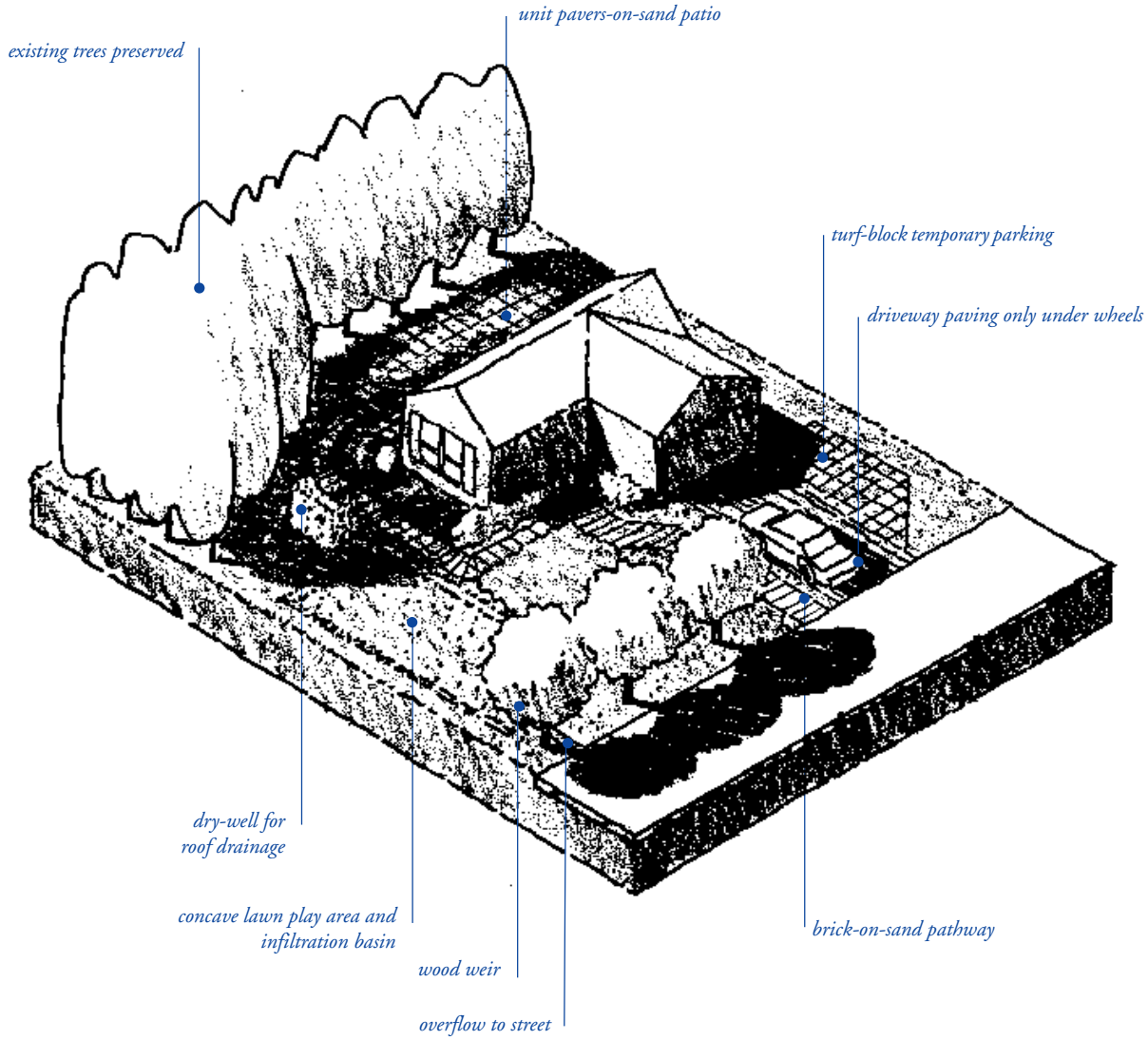
Homeowner education is an important element of stormwater management techniques at all levels, but especially at the single lot scale. Residents need to be educated on the intent of various design elements, and their proper care. They especially need to understand the maintenance needs of more active elements, such as cisterns, which need periodic cleaning or emptying. If dry-wells are included, residents must also understand that they are for rainwater only – never as a place to dump oil, pesticides, paint thinner, solvents, cleaners such as 409, degreasers, or other unwanted wastes.

The techniques illustrated in this example are:

– unit pavers-on-sand patio
– not directly connected impervious driveway
– unit pavers-on-sand pathway
– dry-well connected to roof downspout
– cistern
– vegetation for water retention (deep rooted trees)
– vegetation at dripline of roof.

Case Study

7.1b *Large single lot*



7.1b Large single lot. A large single-family home lot usually provides many opportunities for stormwater management. Because the ratio of impervious cover relative to land area is usually low, adequate landscape area is available to accommodate a variety of subtle infiltration strategies.

As will the small single lot, homeowner education is important so that residents understand the intent of various design elements, and their proper care. They especially need to understand the maintenance needs of more active elements, such as cisterns, which need periodic cleaning or emptying. If dry-wells are included, residents must also understand that they are for rainwater only – never as a place to dump oil, pesticides, paint thinner, solvents, cleaners, degreasers, or other unwanted wastes.

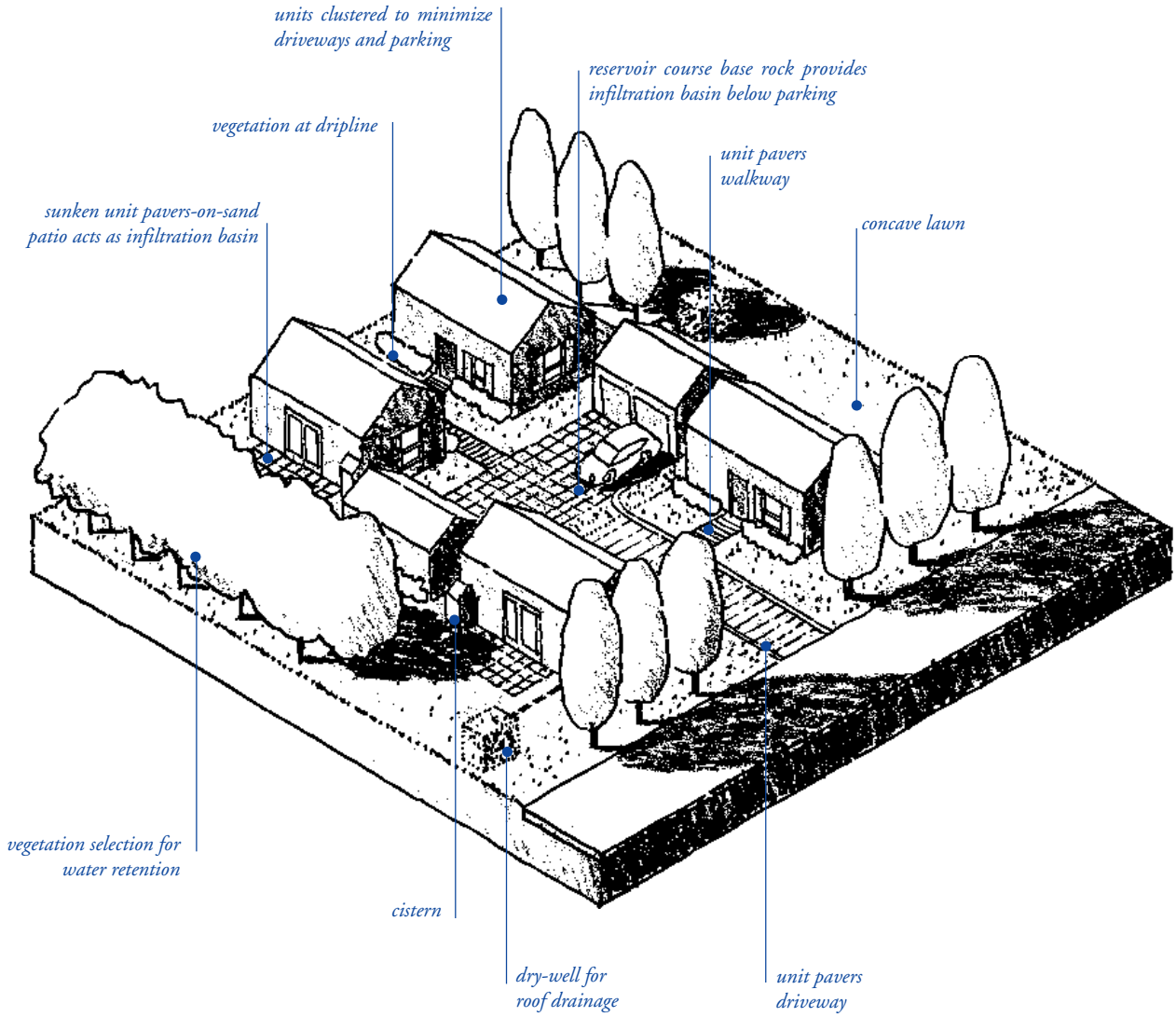
The techniques illustrated in this example are:

– unit pavers-on-sand patio
– concave lawn play area and infiltration basin
– not directly connected impervious driveway
– brick-on-sand pathway
– dry-well connected to roof downspout
– cistern
– vegetation for water retention (deep rooted trees)
– vegetation at dripline of roof.

Case Study

7.1c

High density multi-family site



7.1c High density multi-family site. In the Bay Area, many of the sites for new construction are infill or redevelopment sites. These sites usually have higher densities (typically from 12 to 40 units per acre) which demands a greater proportion of pavement and roof coverage.

Opportunities for on-site stormwater management usually still exist, even in the most densely developed infill site, though they may require greater creativity or multiple use of space.

Continuous homeowner education is needed to prevent dumping. Hazardous waste disposal must be provided for used oil/solvents, cleaners, etc.

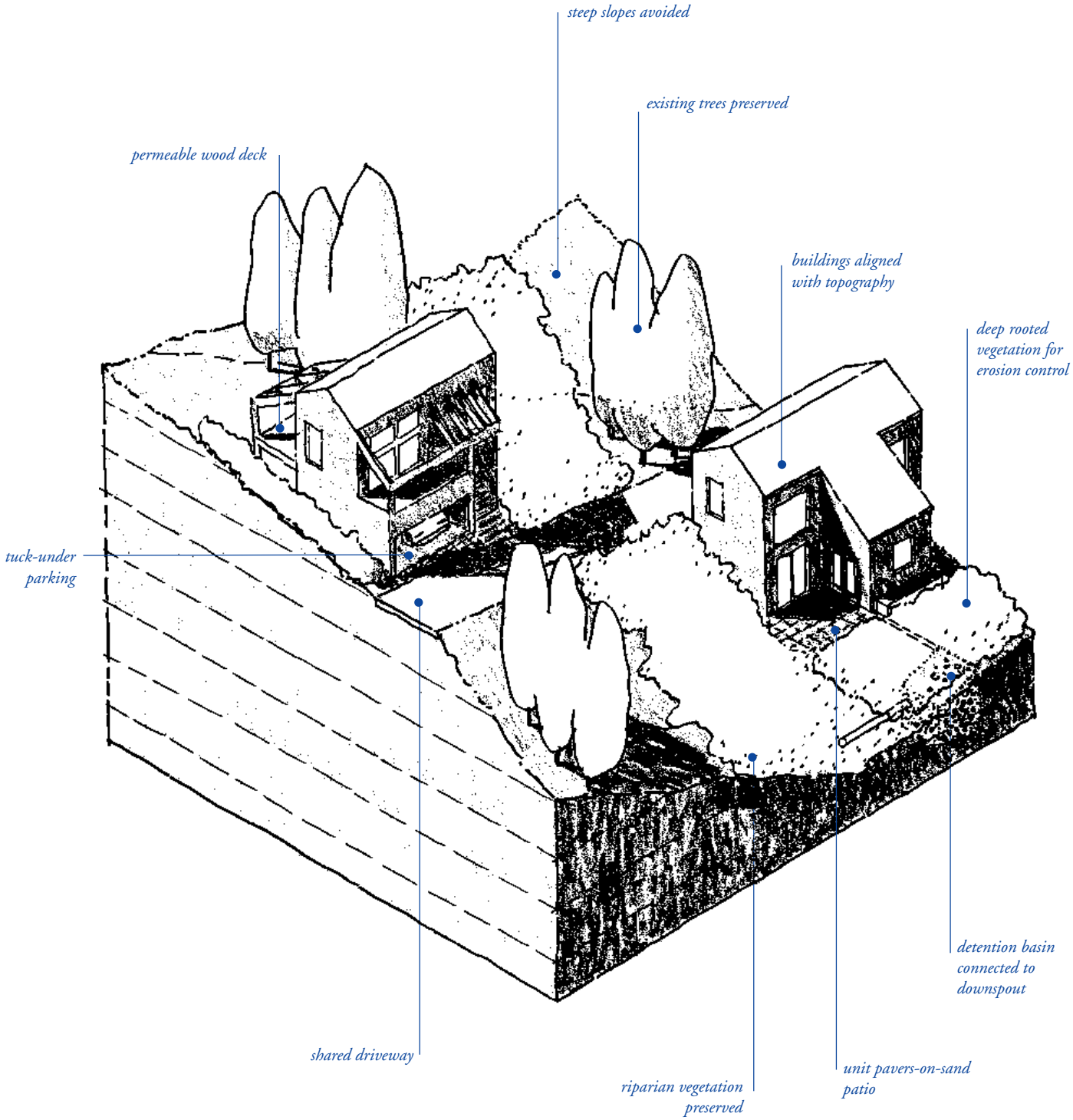
The techniques illustrated in this example are:

- unit pavers-on-sand patio
- concave lawn play area and infiltration basin
- not directly connected impervious driveway
- brick-on-sand pathway
- dry-well connected to roof downspout
- cistern
- vegetation for water retention (deep rooted trees)
- vegetation at dripline of roof.

Case Study

7.1d

Small hillside site



7.1d Small hillside site. Hillside sites present particular challenges for stormwater management. Because slopes are often pronounced, some infiltration strategies that are best suited to more level sites, such as dry wells or infiltration basins, are impractical and can cause landslides or severe damage. Erosion must be prevented through siting with contours to minimize grading and careful stabilization of disturbed slopes. Finally, drainage systems and detention devices must be located so that water does not compromise the integrity of building foundations and other structures.

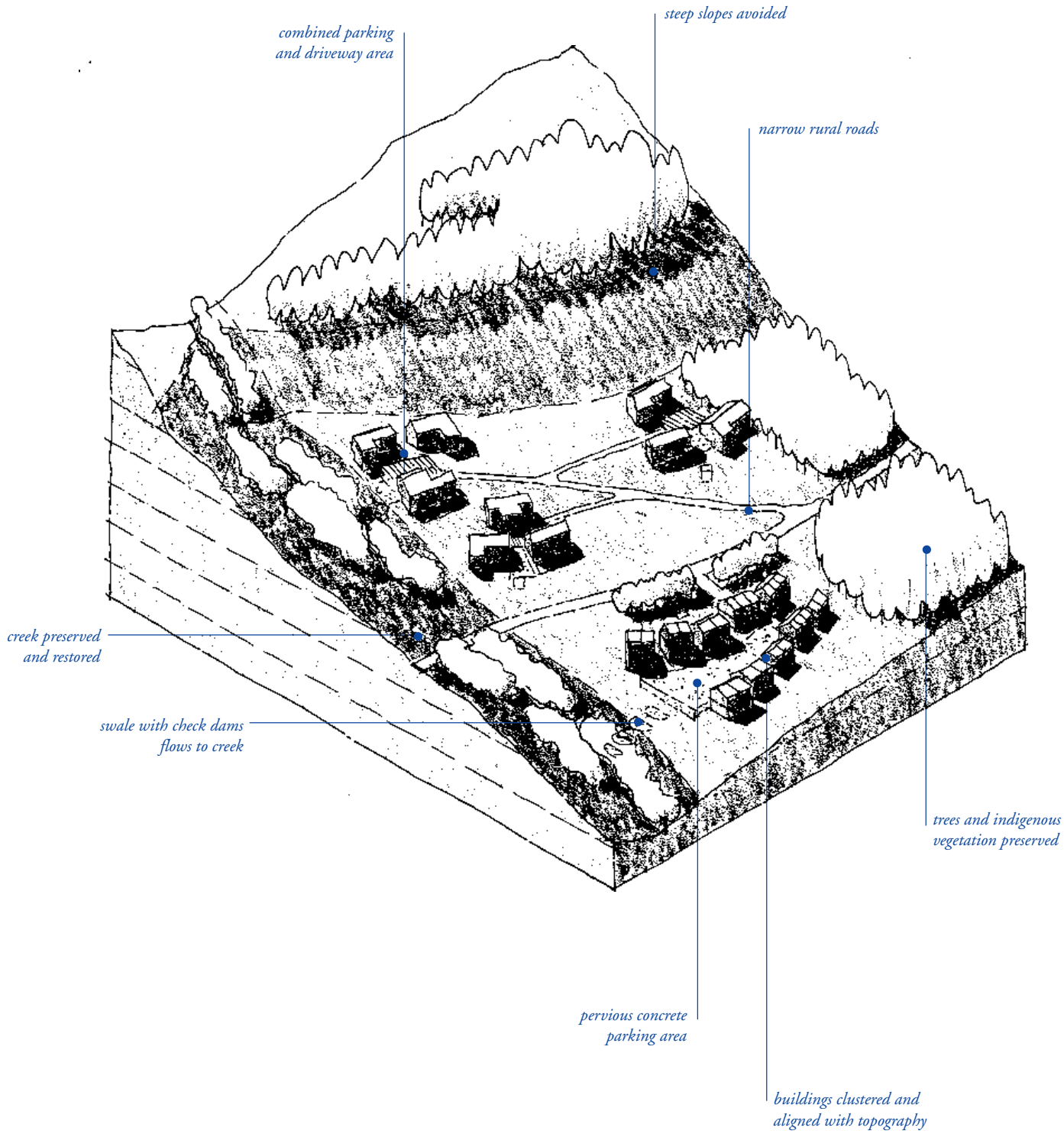
The techniques illustrated in this example are:

– avoidance of steep slopes
– buildings aligned with topography to minimize grading
– preservation of existing trees
– preservation of riparian vegetation
– deep rooted vegetation for erosion control
– shared driveway
– tuck-under parking
– permeable wood deck for outdoor use area
– unit pavers-on-sand patio
– detention basin connected to roof downspout (downslope from building)

Case Study

7.1e

Large hillside site



7.1e Large hillside site. Larger hillside sites present similar challenges as smaller sites, but sometimes offer more opportunities for stormwater management. Because slopes are often pronounced, some infiltration strategies that are best suited to more level sites are impractical and may cause landslides. Erosion must be prevented through siting with contours to minimize grading and careful stabilization of disturbed slopes. Finally, drainage systems, infiltration basins and detention devices must be located so that water does not compromise the integrity of building foundations and other structures.

This example shows a large scale application of the site planning and design principles discussed earlier. Each cluster of buildings could also contain the finer grain elements like those illustrated for the small hillside site (7.1d).

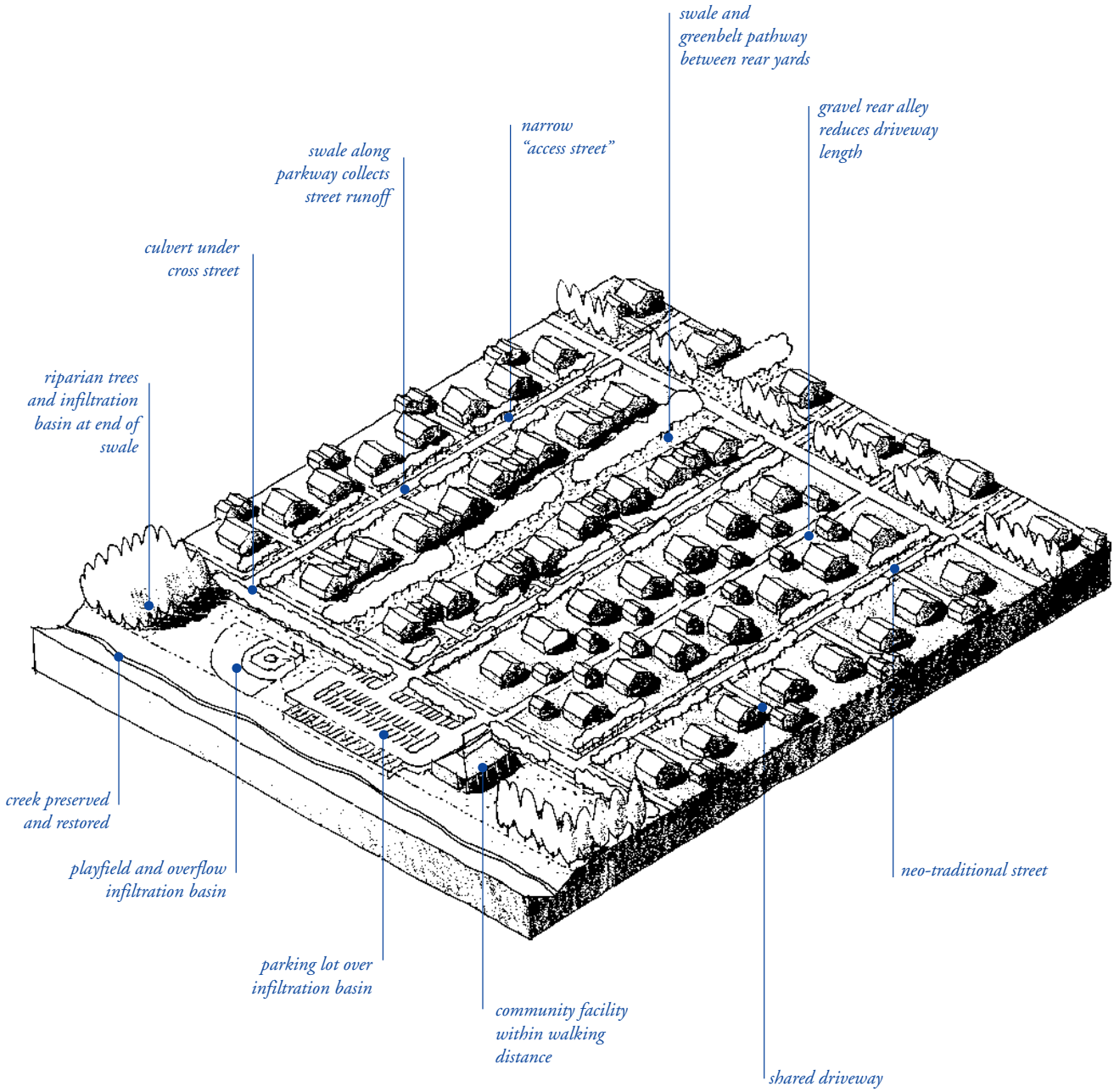
The techniques illustrated in this example are:

– avoidance of steep slopes
– buildings clustered and aligned with topography
– preservation of existing trees and indigenous vegetation
– creek preserved and restored
– narrow rural roads
– combination parking and driveway area
– pervious concrete parking area
– swale with check dams flows to creek

Case Study

7.1f

Large flat site



7.1f Large flat site. Larger flat sites present some of the greatest opportunities for stormwater management. If soils have adequate percolation rates, infiltration swales and basins are easily incorporated. In more poorly drained soils, flat sites allow for detention and retention systems to slow the speed of runoff and hold it for later release. This allows sediments to settle and minimzes stream bank erosion from high velocity flows.

This example applies the site planning and design principles discussed earlier at the neighborhood scale. For the purposes of illustration, two different street access systems are shown: driveways from the street or rear alley access. Each has different planning implications, but both can be integrated with appropriate stormwater management.

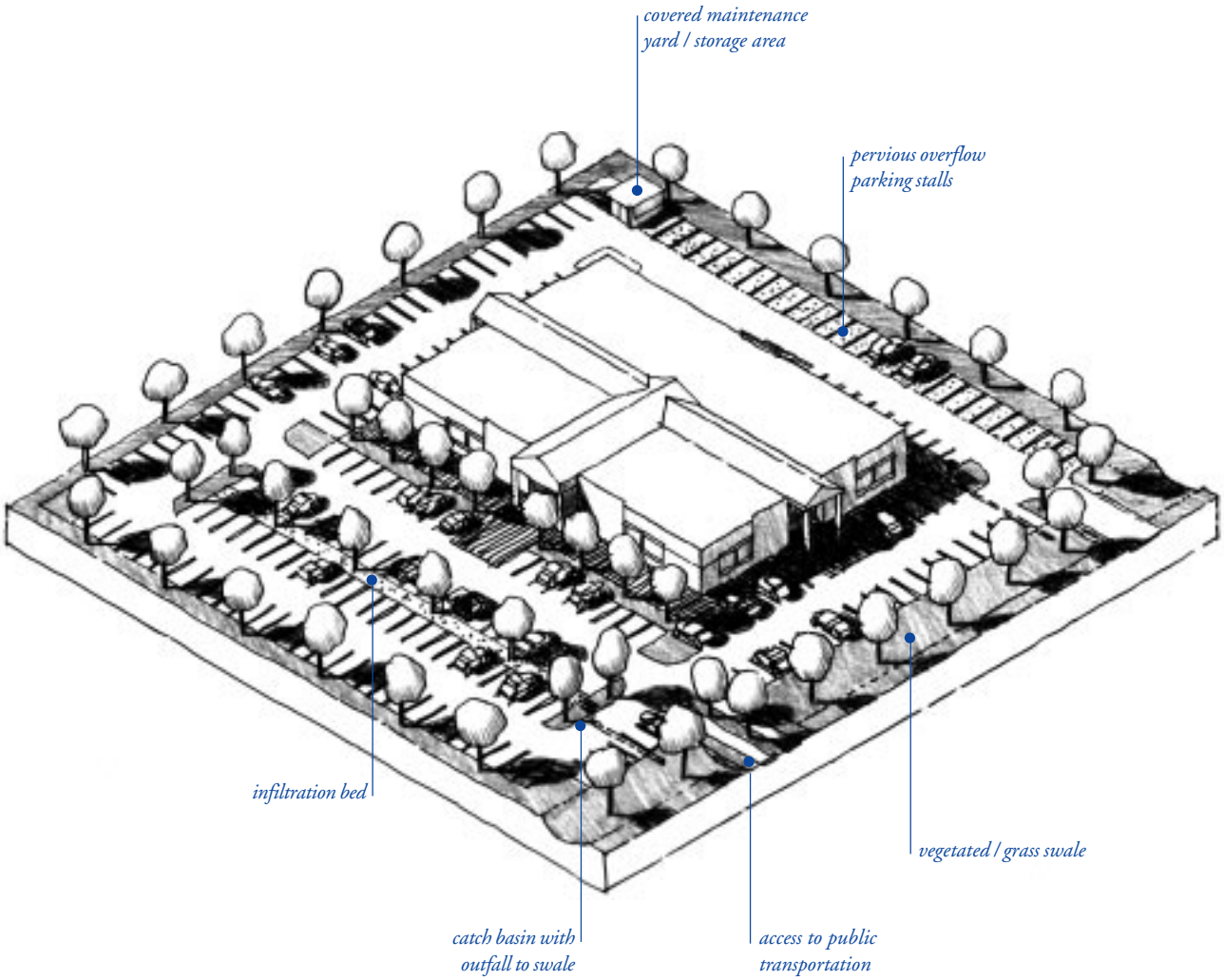
Each cluster of buildings could also contain the finer grain elements like those illustrated for the small single lot, large single lot and infill site.

The techniques illustrated in this example are:

– neo-traditional street design
– gravel rear alley reduces driveway length
– shared driveways to minimze pavement
– community facility within walking distance
– parking lot over infiltration basin
– depressed playfield with multiple use as infiltration basin
– swale along parkway collects street runoff
– culvert to carry parkway swale under cross street
– riparian trees and infiltration basin at end of swale
– swale and greenbelt pathway between rear yards

Case Study

7.2a *Shopping center*



7.2a Shopping center. Shopping centers present many opportunities for stormwater management, especially in the parking areas. Infiltration swales and extended detention (dry) basins can be incorporated into space between parking aisles. Recognizing that much of the parking is only necessary during peak times, such as the holiday season, a proportion of outlying stalls may be paved with a more permeable pavement such as crushed aggregate or turfblock .

The utility functions inherent in any shopping center also need attention, such as restaurant wash-down areas, trash collection areas, and service yards. These outdoor work areas require specific techniques to prevent polluted runoff from entering the storm drain system or local water bodies. Similarly, potential hazardous materials use within the shopping center, i.e. dry cleaning establishments, requires special attention and treatment.

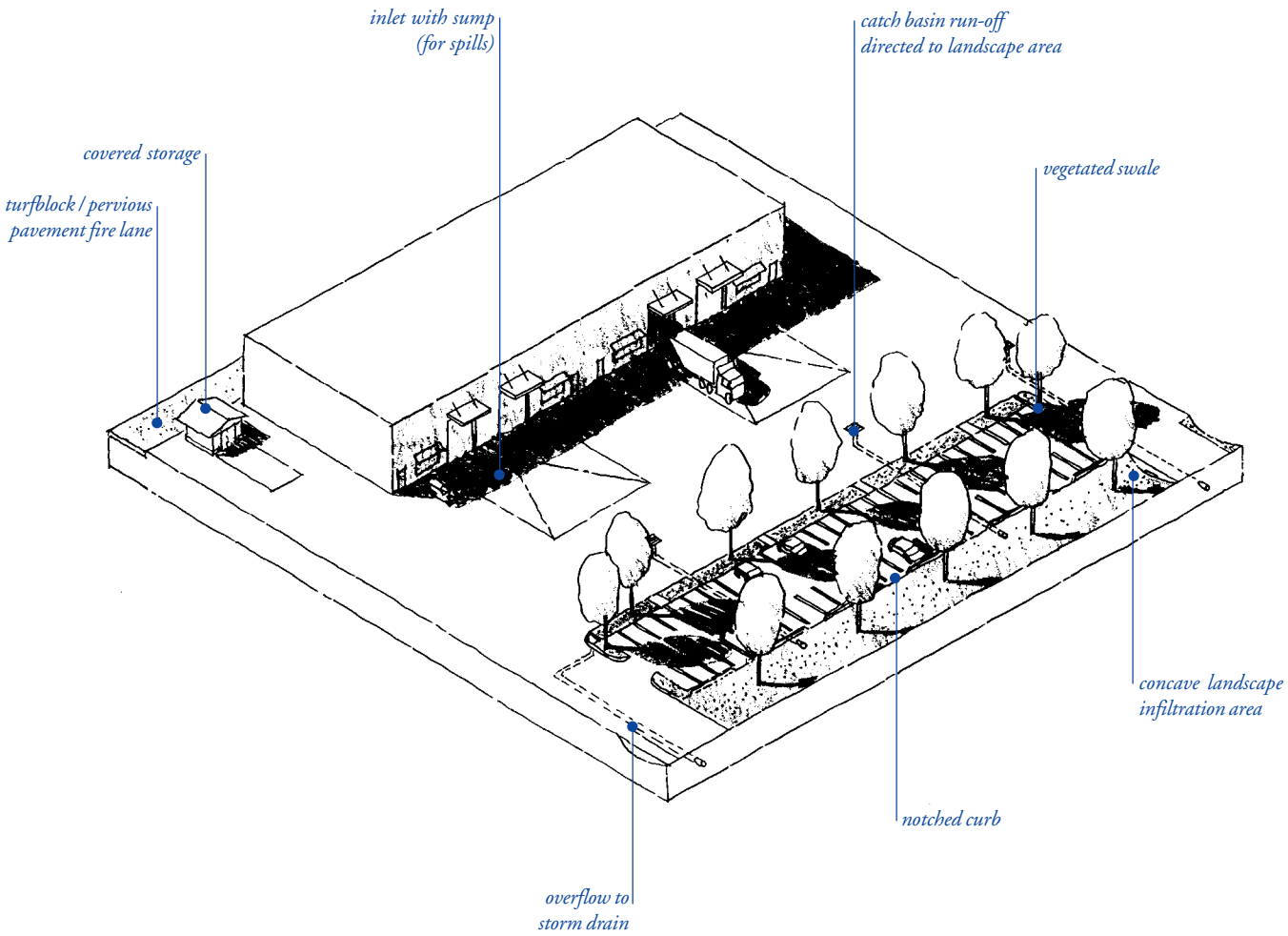
If well designed, correctly installed, and properly maintained, stormwater management techniques can enhance the aesthetic character of a shopping center and improve its marketability.

The techniques illustrated in this example are:

– vegetated/grass swale along perimeter
– infiltration bed to divide parking aisles
– pervious overflow parking stalls
– public transportation service
– covered maintenance yard/service areas

Case Study

7.2b *Industrial park*



7.2b Industrial park. Industrial parks present special challenges when designing for stormwater management. They usually require large paved areas for truck access and employee parking, and space is usually limited. They also often have chemical storage and other special activity areas that require that infiltration techniques are avoided.

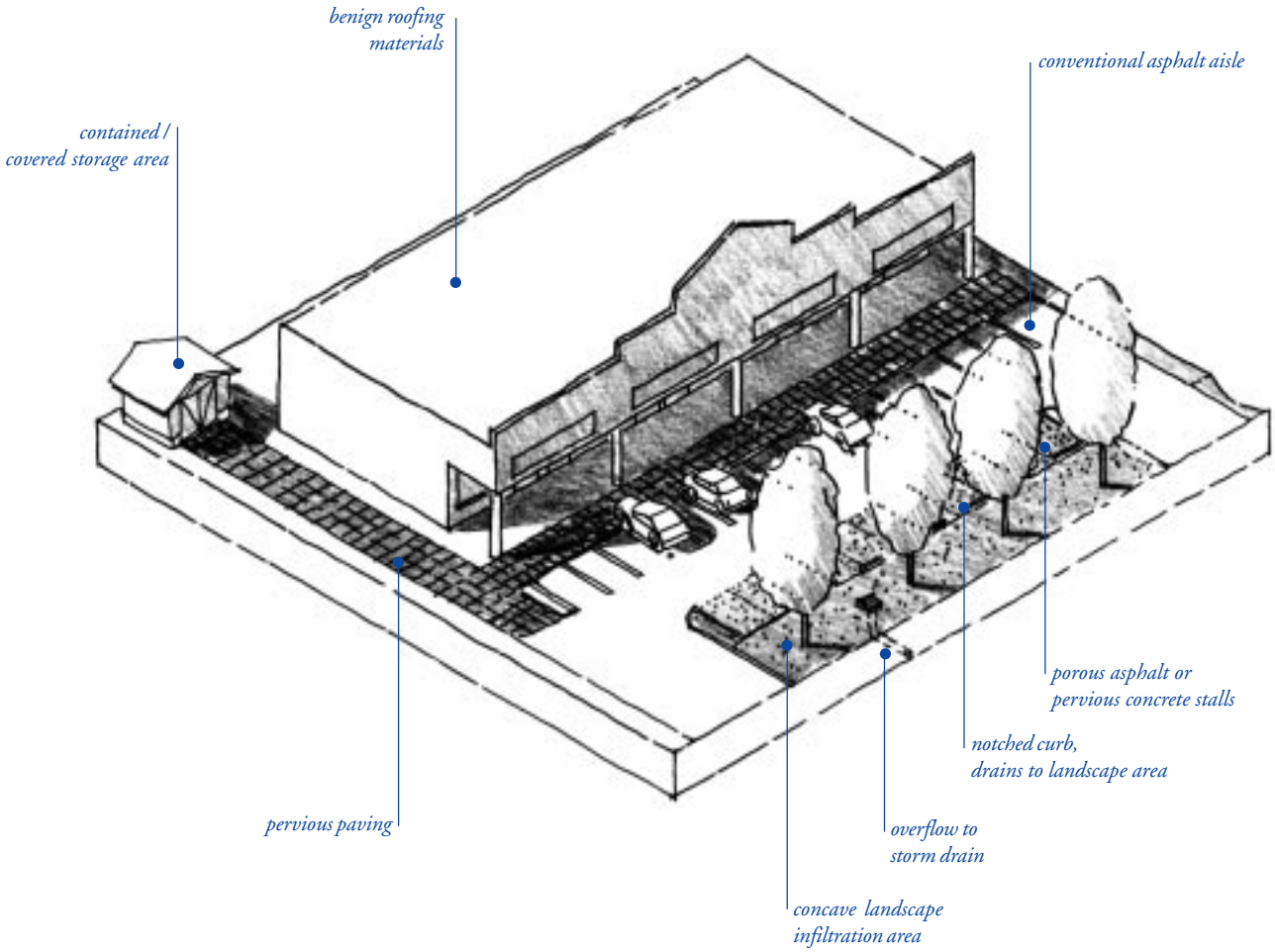
Still, there are opportunities to incorporate design details to protect stormwater quality. These include minimizing impervious surface area through the use of permeable pavements, infiltration areas to collect runoff, and proper treatment of special activity areas.

The techniques illustrated in this example are:

- vegetated/grass swale along perimeter
- catch basin runoff directed to infiltration area
- permeable pavement fire lane
- notched curb to direct runoff from parking area into swale
- proper loading dock design
- covered maintenance yard/service areas

Case Study

7.2c *Strip Mall*



7.2c Strip Mall. Though strip malls are usually very densely developed, they present opportunites for stormwater management techniques. These can be implemented without changing the normal aesthetics or function.

Parking areas can be paved in porous asphalt or other permeable pavements. Buildings can be constructed from benign materials, and the landscape buffers, usually required by local jurisdictions, can be designed as infiltration areas with appropriate overflow into the storm drain system.

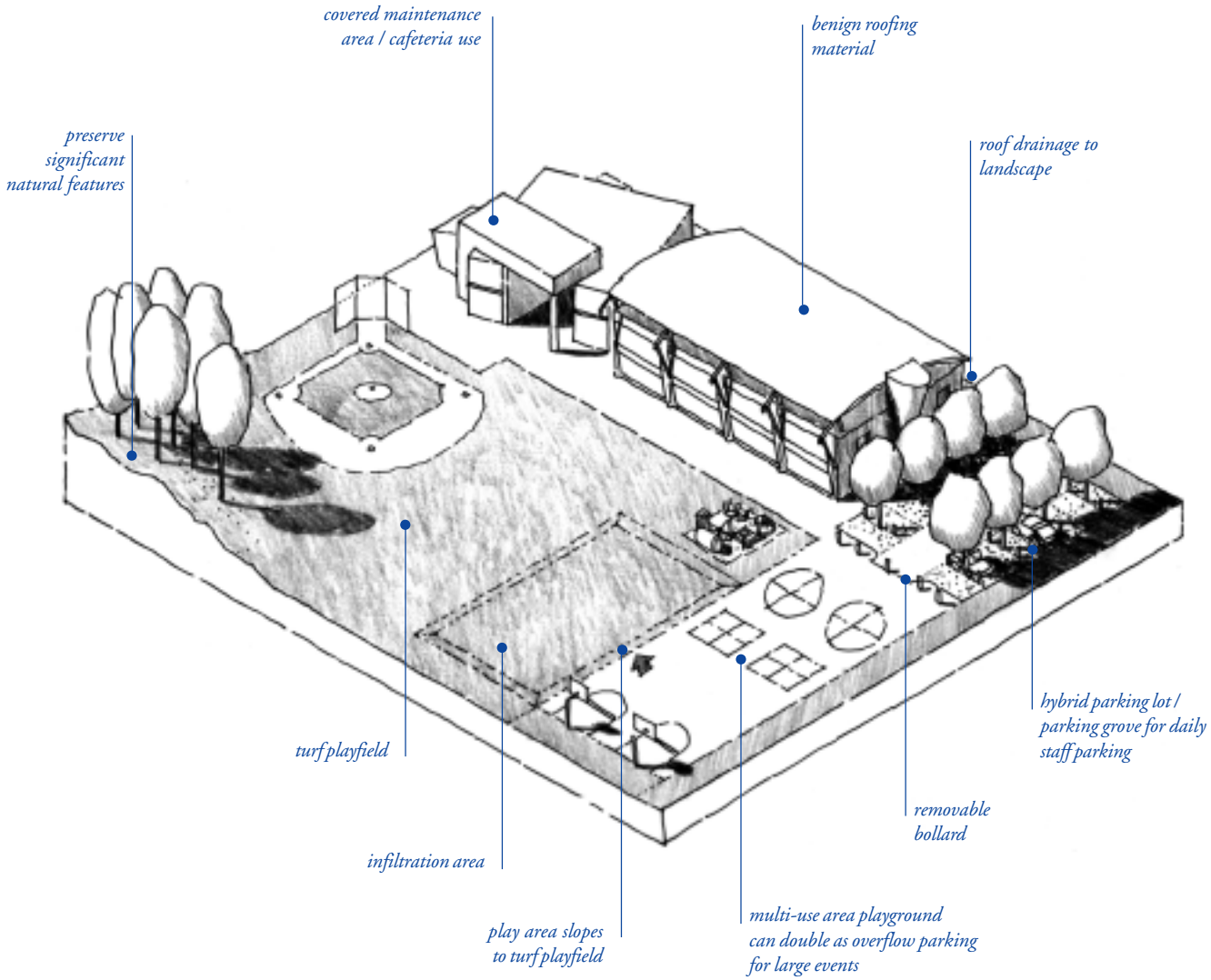
Finally, trash and other storage areas can be properly designed and constructed to prevent pollutants from running off these areas into the storm drain system.

The techniques illustrated in this example are:

- benign roofings materials
- catch basin runoff directed to infiltration area
- permeable pavement parking stalls
- concave landscape areas to infiltrate runoff
- notched curb to direct runoff from parking area into swale
- covered maintenance yard/service areas

Case Study

7.2d *Schools and parks*



7.2d Schools and parks. Schools and parks present a wide range of opportunities for stormwater management techniques. Large landscape areas for passive and active recreation can be designed as extended detention (dry) ponds to infiltrate and detain runoff, while drying up shortly after rains.

At schools, staff parking can be located in parking groves, since the teaching staff generally parks for long periods. Paved areas, such as basketball courts, can be designed as parking or other multi-use space for special events, thus reducing the need for additional impervious land coverage. Buildings can be designed from benign building materials with appropriately designed outdoor work areas for service, cafeteria, and utility needs.

In large subdivisions, land is often reserved for future schools and parks. Land can be reserved in the lower portion of the site for these uses and designed to receive stormwater from the entire subdivision watershed. This approach illustrates how stormwater management can influence overall site planning and design.

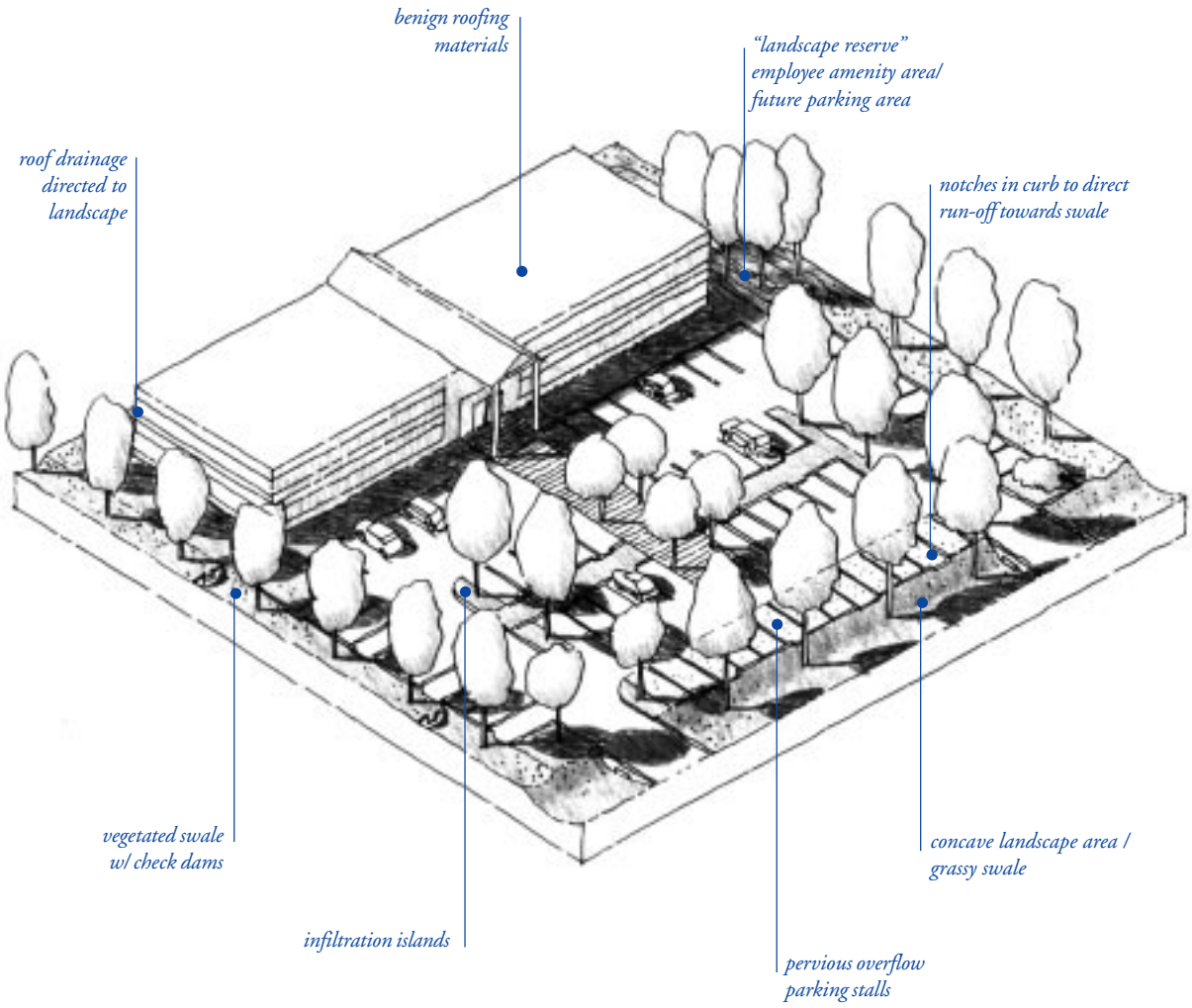
The techniques illustrated in this example are:

– benign roofings materials
– catch basin runoff directed to infiltration area
– parking grove for staff use
– multi-use paved areas
– concave landscape areas to infiltrate runoff
– preservation of significant natural areas
– covered maintenance yard/service areas

Case Study

7.2e

Office building



7.2e Office buildings. Office buildings can integrate stormwater management techniques in many ways.

Buildings can be designed from benign materials with appropriately designed outdoor work areas for service, cafeteria, and utility needs.

Landscape areas for employee use and perimeter screening can be designed as extended detention (dry) basins or biofilters (grassy swales) to infiltrate and detain runoff, while drying up shortly after rains. These areas can also be designed as fountains or entry statements to add aesthetic enhancement .

Parking can be treated in a variety of ways, with overflow parking accommodated on permeable pavement. Impervious parking stalls can be designed to drain onto landscape infiltration areas. Alternative transportation can be promoted by providing bicycle lockers, showers and clothes lockers for bicycle commuters, and company sponsored van- and carpool programs.

Finally, many jurisdictions allow a portion of the required parking to be held in "landscape reserve," until a need for the full parking supply is established. This means that the original construction only builds parking to meet anticipated staff needs. If the parking demand increases, the area held in landscape reserve can be modified to accommodate parking. In this way, parking is held to a minimum based on actual use, rather than by a zoning formula that may not apply to the office building's actual parking need.

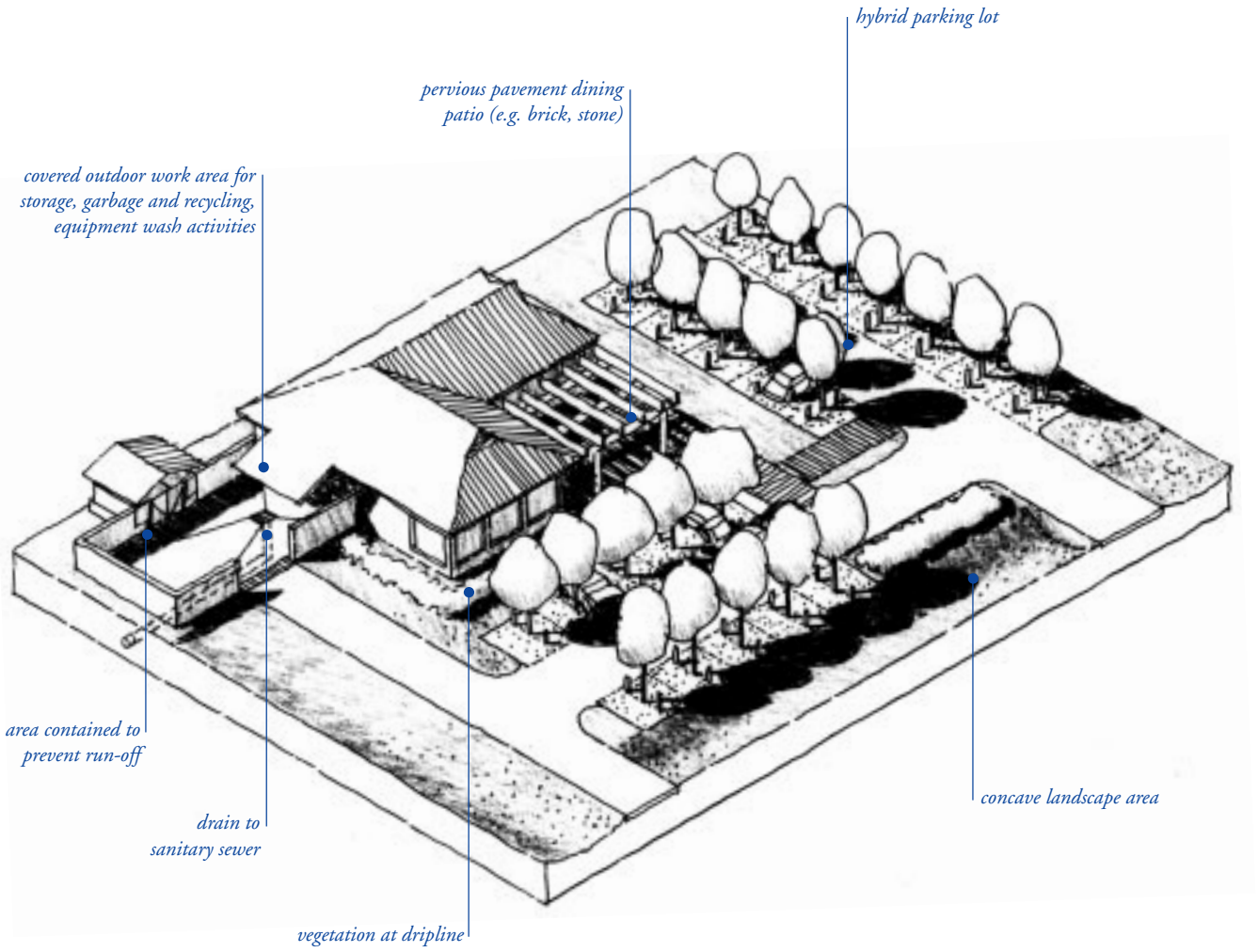
The techniques illustrated in this example are:

- benign building materials
- catch basin runoff directed to infiltration area
- vegetated swale with check dams
- landscaped "parking reserve"
- concave landscape areas to infiltrate runoff
- pervious overflow parking stalls
- roof drainage directed to landscape

Case Study

7.2f

Restaurant



7.2f Restaurant. Restaurants offer a strong contrast between infiltration opportunities and special activity areas. Careful selection of materials such as brick or stone paving for outdoor patios can enhance the restaurant's aesthetic while allowing for infiltration. Landscape plantings can also be selected for stormwater infiltration.

Parking can be provided in a variety of ways, with hybrid parking lots for staff, who stay for long shifts, or with landscaped infiltration islands in lots with conventional paving for patrons, who stay for shorter periods.

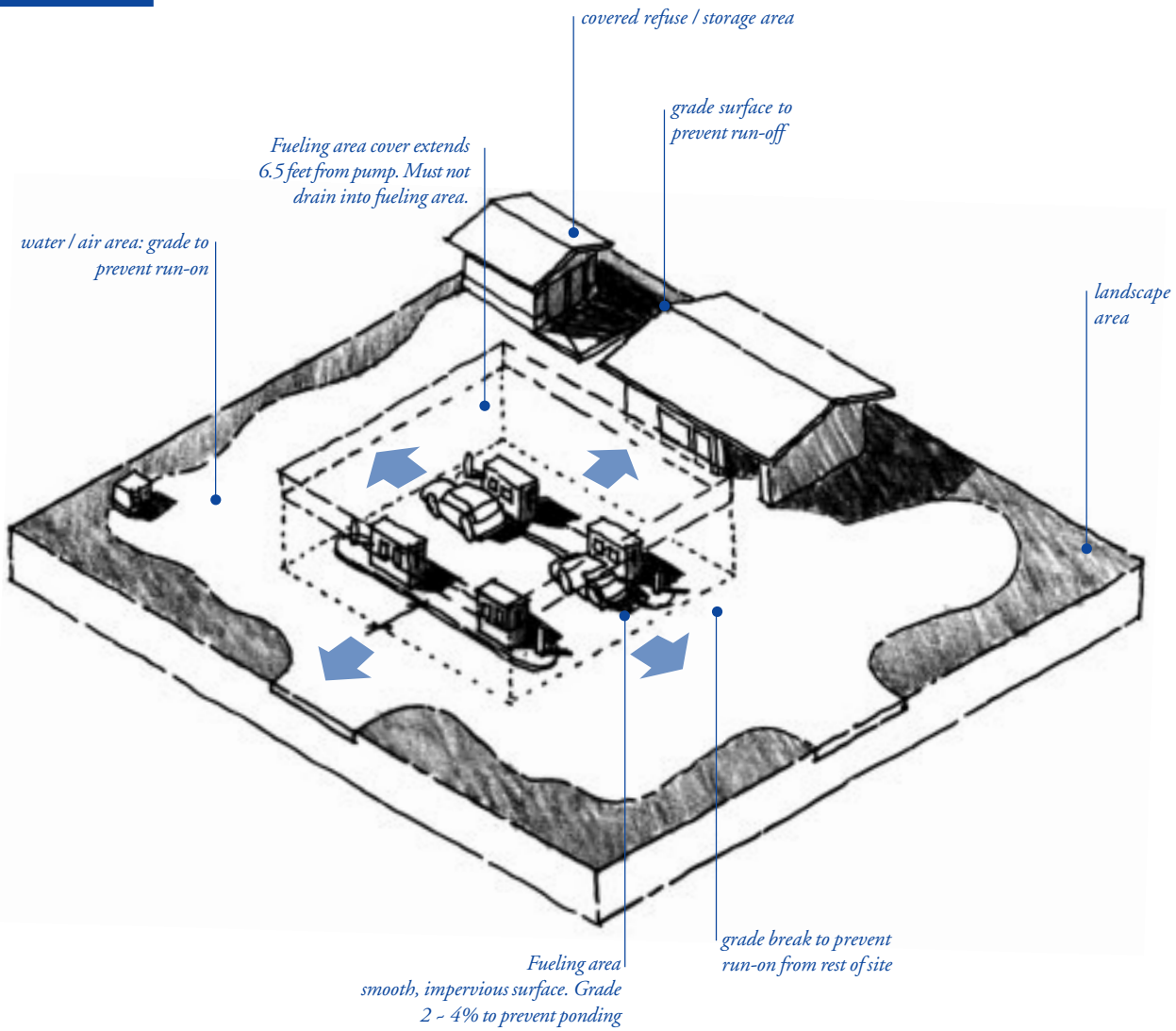
In contrast to these infiltration opportunities, restaurants have special activity areas that need to be isolated from the storm drain system. Grease, stored items, trash, and other food waste must be kept in properly designed and maintained special activity areas. Local ordinances may have design guidelines for allowable square footage of covered and uncovered areas.

The techniques illustrated in this example are:

– permeable pavement patio
– benign building materials
– catch basin runoff directed to infiltration area
– hybrid parking lot
– vegetation at dripline
– concave landscape areas to infiltrate runoff
– covered outdoor work area (trash, food waste, storage, equipment wash)

Case Study

7.2g *Gas station*



7.2g Gas station. Gas stations and vehicle fueling areas have specific design guidelines. These are described in a Best Management Practice Guide for retail gasoline outlets developed by the California Stormwater Quality Task Force, in cooperation with major gasoline corporations. Designing for prevention is the first step. Plans must be developed for cleaning near fuel dispensers, emergency spill cleanup, and routine inspections to prevent leaks and ensure properly functioning equipment. [1]

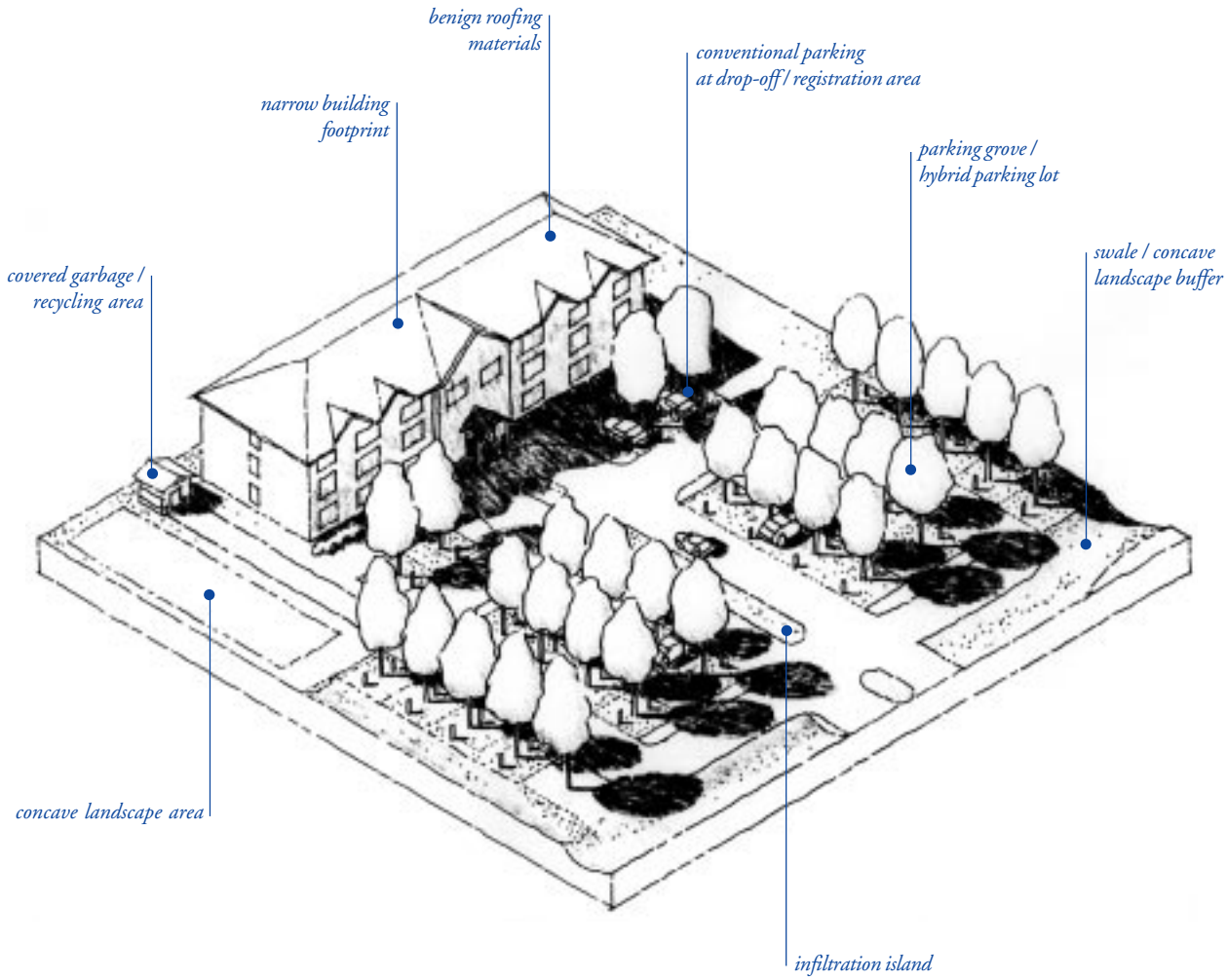
The practice guide addresses standards for existing, new, or substantially remodeled facilities, and is available from www.blymyer.com/swqtf.

Some of these features are illustrated in the case study above:

– fueling area cover
– flat impervious surface fueling area (2%-4% slope to prevent ponding,
– grade break (e.g., curb, berm) that prevents run-on of stormwater
– separate water / air area graded to prevent run-on
– covered refuse / storage area

Case Study

7.2h *Hotel/motel*



7.2h Hotel/motel. Hotels and motels present many opportunities for stormwater management designs. Because guests park for long periods of time, such as overnight, parking areas can be designed as parking groves or hybrid lots. This increases the aesthetic appeal of the hotel, reduces heat island effect, and minimizes the impact of parking when the hotel is not highly occupied. However, it is important to retain some conventional parking for more heavily used drop-off and loading areas.

Landscape areas for guest use can be designed as infiltration/detention areas to hold water briefly after rains. Perimeter areas also can provide opportunities for stormwater management.

The building can be designed from benign materials with a narrow multistory footprint, rather than a sprawling single floor. Rainwater can be directed in gutters and downspouts into landscape areas.

The techniques illustrated in this example are:

– permeable pavement patio
– benign building materials, narrow building footprint
– catch basin runoff directed to infiltration area
– parking grove
– vegetation at dripline
– concave landscape areas to infiltrate runoff
– covered special activity area (trash, food waste, storage)