



## Sustainable Site Design/ Water Efficiency

### Sustainable Site Issues

The impact of site selection and design is no less important than the sustainable design of a building itself. The three issues that should be considered regarding sustainable sites are:

- Sustainable Site Selection
- Sustainable Site Design
- Water Efficiency and Water Quality

There are many sustainable design solutions for any project. The designer should, in order to integrate the best sustainable solutions, ask at every phase during the design process “will this design decision reduce long-term negative impacts on the natural environment or building occupants while meeting all other project requirements?”

### Sustainable Site Selection

Selecting a site can have long-term impacts on the environment. Consider, for example:

- What are the potential environmental impacts related to the site location?

For example, do not build near wetlands; avoid land close to the flood plain

- How far will building occupants have to travel to get to the site?

Consider distance from site to public transportation

- Are there options for building occupants to take non-polluting forms of transportation to the site?



Select sites with existing infrastructure

- Has the site been developed before, or will construction damage previously undisturbed land?

Consider building on brownfields

- Is the site home to endangered habitat or vegetation?

Avoid endangered species habitats

- Are there local air quality problems that might impact building occupants?

Select a site that avoids nearby sources of potential air quality problems.

As with any good design practices, there are some common sustainable selection and design practices and requirements that may be considered good sustainable site design.

### Good Site Selection Practices

#### [DGS Directive on Location of State Offices](#)

This memo, in response to Executive Order D-46-01, directs DGS staff as well as client agencies to consider factors, including sustainable building programs, when establishing the location of state offices. The policy “should reduce to the extent feasible traffic congestion and air

# Sustainable Site Design/ Water Efficiency



pollution, and it should support sound growth patterns in California's population centers". Specifically, the following smart growth factors should include:

## Notes:

- Locating in a central city... in order to strengthen California's population centers;
- Locating in proximity to public transit corridors;
- Locating in proximity to available and affordable housing;
- Demonstrating sensitivity to building design, scale, and environmental concerns;
- Exploiting objectively viable opportunities for mixed use

## Sacramento Municipal Utilities District (SMUD)



One good example of sustainable site selection is the location of the SMUD Customer Service Center in Sacramento. Primary factors for selecting the current site included:

- The proximity of the site to the existing administrative building to minimize employee travel time and effort. The proximity of the site to the RT Light



## Sustainable Site Design/ Water Efficiency

Rail and bus station to encourage more use of mass transit. The orientation of the site on an east-west axis. This provides an optimal north-south exposure for daylighting and minimizes exposure to east and west sunlight. The proximity of the mature redwood groves that can provide natural cooling and shading to the building.

### Sustainable Site Design

The following recommendations will help reduce impacts of site design.

- Use urban-derived (i.e. organic materials diverted from disposal) compost & mulch to build healthy soils
- Minimize impact to the site during construction
- Reduce quantity of stormwater runoff and improve quality of runoff
- Specify resource-efficient landscape design and installation
- Consider building water reuse or capture of rainwater
- Specify recycled-content products for use in landscape areas

### Site Design Recommendations

1. Use urban-derived (i.e. organic materials diverted from disposal) compost & mulch to build healthy soils.



Organic materials comprise over 40 percent of the disposed waste stream. Diversion of these materials is crucial for conserving landfill capacity, and for reducing the generation of green house gasses (carbon dioxide and methane) from municipal solid waste landfills.

In addition, the urban derived compost and mulch products (i.e. compost and mulch product made from organic materials diverted from disposal) provide a value-added organic product for use in landscape areas.

Use of these urban derived compost and mulch products can reduce the need for chemical fertilizers, herbicides and pesticides.

Typically, when new development takes place, existing vegetation and native soil are removed. After construction, a thin layer of topsoil is spread on very compacted subsoil. The new landscape acts much like an impervious surface. Rainwater, unable to infiltrate into the soil, quickly runs off into streams carrying sediments, pesticides, fertilizers, and other chemicals. Soil amended with compost and other organic amendments can transform poor soils into a fertile growth medium that supports healthy plant growth while reducing water, fertilizer, and pesticide requirements. The soil can also act as a biofilter, capturing and holding potential pollutants in place so soil microbes can decompose them. The end result is fewer chemicals, less irrigation, fewer stream problems, cleaner water, thriving landscapes, and lower maintenance costs.

# Sustainable Site Design/ Water Efficiency



The California Integrated Waste Management Board maintains an [Index to Compost and Mulch Source List](#).

Information includes a list of counties that have businesses that market organic materials products. Information includes primary distribution points for compost and mulch, feedstock used, annual production, and products available.

## Notes:

### 2. Minimize impact to the site during construction

- Use a site sedimentation and erosion control plan
- Limit access of heavy equipment
- Consider relocating disturbed vegetation
- Minimize disturbance to existing vegetation

### 3. Reduce quantity of stormwater runoff and improve quality of runoff

Problems associated with stormwater runoff include the quantity of runoff and the quality of stormwater runoff. The management of stormwater runoff requires supporting infrastructure and associated maintenance. Stormwater is also polluted from contaminants and sediment collected from pavement and non-pervious surfaces.

First reduce stormwater volumes. For example:

- Reduce impervious surfaces
- Design a smaller building footprint
- Use roof gardens or green roofs
- Capture stormwater for reuse (such as for fire sprinklers or sewage conveyance)



## Sustainable Site Design/ Water Efficiency

Next, filter stormwater. For example:

- Design detention ponds
- Design natural features to filter runoff, such as constructed wetlands, vegetated filter strips, or bioswales
- Use other technologies or systems to filter runoff, such as oil and grit separators
  - Use roof gardens or vegetated roofs



Chicago City Hall Roof Garden

The picture is of the Chicago City hall green roof. The roof was installed for the Chicago City Hall Urban Heat Island Initiative project. This is a sophisticated design that includes a range of roof landscape environments, ranging from a 3.5-inch deep 'extensive' system to 24-inch deep 'intensive' landscape islands. Approximately 14,000 cf of polystyrene was used to create the illusion of a rolling terrain. The project included a drip irrigation system fed partially by water collected from the adjacent penthouse roof. Construction at one of the city's busiest intersections also added to the challenges associated with this project. The project was intended to demonstrate the benefit of green roofs in moderating summer temperatures within ultra-urban environments. The roof is monitored to demonstrate these benefits.

The Austin, Texas Greenbuilder Program publishes the [Sustainable Building Sourcebook](#). The content regarding pervious paving includes specifications, implementation issues, guidelines, and resources.

#### 4. Design and Install Landscape for Resource-Efficiency

- Design and plant for proper plant spacing (avoid overplanting which results in excess pruning, possible plant removal, and generation of green waste)
- Limit turf areas (avoid narrow strips, severe slopes, etc.) These turf areas are hard to maintain, encourage water/chemical runoff, and can cause hardscape damage. Turf areas should be functional and designed for easy maintenance.
- Consider other ground covers, native grasses and wildflowers instead of turf.
- Aim for diversity. Monocultures are prone to disease and insect infestation.
- Group plants that have similar watering needs to prevent over-watering and excessive plant growth.
- Select appropriate plants for local microclimates.
- Plant water-efficient species (including native species if appropriate). This type of plant material requires less water, fertilizers, pesticides, and pruning; generates less green waste, & supports wildlife.
- Select plants that will not grow too large for their space or over walkways, driveways, etc., as they will require constant pruning & generate excessive green waste.
- Avoid using invasive plant species.

# Sustainable Site Design/ Water Efficiency



- Use water efficient irrigation systems and energy efficient lighting in landscape areas.
- Provide for the onsite composting and/or chipping and grinding of landscape trimmings, prunings and grass clippings for reuse onsite; or ensure that these materials are diverted to a local compost facility.
- If a cafeteria is included in the building, then incorporate a food scrap collection program as part of the organic materials composting program. The resulting compost product should be reused in landscape areas.

## Notes:

[The State of California Department of Water Resources](#) provides a number of related resources including an Efficient Landscape Ordinance, and a publication titled Irrigation Water Needs of Landscape Plants in California

5. Consider building water reuse or capture of rainwater



### Rainwater Catchment at a Ft. Worth, TX Post Office

The rainwater collection storage tanks at the Ft. Worth Post Office was installed to provide drinking water, but was first tested on irrigation while the water quality was tested. As a semi-private federal agency, the Postal Service was not under the jurisdiction of local building and health



## Sustainable Site Design/ Water Efficiency

codes, which have made this installation more difficult.

It is estimated that the combination of water conservation strategies and water collection in this facility will save over one million gallons per year, resulting in cost savings to the USPS of about \$2,800.

[The State of California Department of Water Resources](#) offers a Graywater Standard and a Graywater Guide. The [Department of Health Services](#) also has numerous resources on recycling water.

6. Specify recycled-content products for use in landscape areas:

- Outdoor furniture, such as benches, tables, and chairs, etc., should be purchased from suppliers making a recycled content product
- Bender board - purchase a plastic lumber product for use in planter bed areas.
- Tree stakes and ties - Use recovered lumber, or other recycled content product, for tree stakes and ties made from waste tires.
- Irrigation equipment - specify the use of recycled content plastic pipes, joints, and fittings.



Recycled Content Park Bench

The [California Integrated Waste Management Board's Recycled-Content Product Database](#) includes site products.

### Other Site Issues

- Properly site building to take advantage of microclimate (Refer to Energy section of the training manual)
- Use vegetation to provide shade
- Design site lighting that minimizes light pollution in the night sky
- Create positive connections between the new/renovated facility and it's community.
- Encourage development of urban infill sites or rehabilitation of an existing building.

### Benefits of Sustainable Site Design

- Reduce water usage on site
- Associated labor and resource cost
- Reduce long-term energy consumption
- Reduce operating cost
- Reduce negative impacts of energy production
- Reduce chemical usage on site
- Environmental benefits
- Improve local water quality
- Reduce disturbance to habitat and ecosystems
- Reduce emissions

### Sample Projects in California

[Solar Living Center](#), Hopland

Sustainable site features

- On-site water sources:

# Sustainable Site Design/ Water Efficiency



- Agricultural well
- Storm-water runoff
- Gray water
- Potable water
- Water flow controlled by a solar-powered pump
- Constructed wetlands and ponds

## Project benefits:

- Reduces irrigation needs
- Reduces energy use
- Restores water resources
- Connects visitors with landscape and seasonal cycles
- Provides associated cost savings

The final project cost was \$1.86 million, including all site and building development costs. Annual savings related to water efficiency and reuse measures is approximately \$7,800.00 annually.

[GAP Headquarters](#), San Bruno

## Sustainable site features:

- roof covered with a mixture of native grasses and wildflowers (solution is low-maintenance, provides thermal and acoustic insulation, and contributes to increased energy savings; roof also absorbs rain, slowing run-off to local storm drains)
- a grove of mature oaks existing on the site was preserved.
- natural ventilation
- form of building is designed to integrate into surrounding terrain

## Notes:

State departments, as well as local government and private sector partners. This manual was developed by DGS, the Sustainable building task force, and CIWMB as one component of the sustainable building training program for state departments. This document will be undergoing constant revision as other deliverables outlined in the Blueprint are completed and technological and process breakthroughs advance the rapidly emerging field of sustainable design.

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<sup>i</sup> This manual is being developed as part of a ten-point plan to implement the Governor's sustainable building goal as outlined in Executive Order D-16-00 and the report Building Better Buildings: A Blueprint for Sustainable State Facilities (Blueprint). Task 7 of the Blueprint calls for developing sustainable building technical assistance and outreach tools, including a training program for