

## SUSTAINABLE STRATEGIES FOR DEVELOPMENT & CONSTRUCTION

### SUSTAINABLE SITES AND LOCATION STRATEGIES TO BE CONSIDERED:

<b>ADDRESS LOCATION AND LINKAGES</b>	<ul style="list-style-type: none"> <li>○ Choose redevelopment and infill development. Build on previously developed land and brownfield sites.</li> <li>○ Locate near existing infrastructure. Avoid triggering suburban sprawl and unnecessary materials use by consolidating development along existing roads, power lines, and water supplies.</li> <li>○ Protect habitat. Give preference to locations that do not include sensitive site elements and land types.</li> <li>○ Increase density. Create a smaller footprint and maximize the floor-area ratio or square footage per acre.</li> <li>○ Increase diversity. Provide the services that are most needed within communities and support a balance of jobs and housing.</li> <li>○ Encourage multiple modes of transportation. Enable occupants to walk, bicycle, and use public transit.</li> </ul>
<b>SUSTAINABLE NEIGHBORHOOD PATTERN AND DESIGN</b>	<ul style="list-style-type: none"> <li>○ Design walkable streets. Focus on building frontage, ground-level façade, building height-to-street-width ratio, and sidewalks. Limit street speeds. Include street trees, shade, benches, and other amenities for pedestrians.</li> <li>○ Promote alternative transportation. Limit parking, connect the buildings to public transit and bicycle paths, and provide transit centers.</li> </ul>
<b>ADDRESS TRANSPORTATION IN DESIGN &amp; PLANNING</b>	<ul style="list-style-type: none"> <li>○ Locate near public transit. Select a project site in an area served by an existing transportation network.</li> <li>○ Limit parking. The lack of parking spaces on the project site will spark interest in alternative transportation options.</li> <li>○ Encourage bicycling. Install secure bike racks and showers for commuters.</li> </ul>
<b>ADDRESS TRANSPORTATION IN OPERATIONS AND MAINTENANCE</b>	<ul style="list-style-type: none"> <li>○ Encourage carpooling. Designate preferred spaces for carpool vehicles in the parking area.</li> <li>○ Promote alternative-fuel vehicles. Provide a convenient refueling station on the site.</li> <li>○ Support alternative transportation. Promote alternatives to single occupancy car commuting at the building and/or city level.</li> </ul>
<b>DEVELOPMENT SITE DESIGN</b>	<ul style="list-style-type: none"> <li>○ Minimize hardscape. Design driveways and paths intelligently. Substitute pervious surfaces for traditional paving.</li> <li>○ Use native landscaping. Select plants that are native to the area both to reduce water use and to provide habitat for local birds and other species. Incorporate mulch into the landscape to build the soil and naturally suppress weeds.</li> <li>○ Prevent light pollution. Avoid up-lighting, glare, and trespass by using shielded fixtures and smart lighting design.</li> <li>○ Preserve open space and sensitive areas. Consolidate the development footprint and protect and restore natural vegetation, wetland areas, and bodies of water.</li> <li>○ Protect and restore habitat. Designate areas as protected habitat and open space for the life of the project. Develop a conservation management program to make sure that the natural environment is protected. Consider putting protected areas into a land trust.</li> </ul>
<b>SUSTAINABLE SITE OPERATION AND MAINTENANCE</b>	<ul style="list-style-type: none"> <li>○ Develop a sustainable site management plan. The plan should address the application of chemicals and the cleaning of hardscape and building exterior, and it should include an integrated pest management program.</li> <li>○ Implement conservation programs. Work with ecologists and nonprofit organizations to implement conservation programs that protect species and habitat.</li> <li>○ Maintain site lighting to prevent light pollution. Ensure that fixtures are replaced according to the original design. If higher light levels are needed, include timers that shut them off automatically after hours.</li> </ul>

<b>STORMWATER MANAGEMENT THROUGH DESIGN</b>	<ul style="list-style-type: none"> <li>○ Minimize impervious areas. Increase the area of permeable surfaces, such as vegetated roofs, porous pavement, and grid pavers.</li> <li>○ Control stormwater. Install dry ponds, rain gardens, bioswales, and similar landscape features designed to hold water and slow the rate of runoff.</li> <li>○ Incorporate stormwater management into site design. Use features that serve multiple functions, such as planters that collect stormwater, streets that include bioswales to capture and hold stormwater, and mulch that both builds soil and holds moisture.</li> </ul>
<b>STORMWATER MANAGEMENT IN OPERATIONS AND MAINTENANCE</b>	<ul style="list-style-type: none"> <li>○ Redirect Stormwater. Direct runoff into dry ponds, rain gardens, bioswales, and other landscape features that retain water.</li> <li>○ Harvest rainwater. In many jurisdictions, the water collected can be used in building systems, such as process water, toilets, or irrigation.</li> </ul>
<b>REDUCING HEAT ISLAND EFFECT</b>	<ul style="list-style-type: none"> <li>○ Install reflective roof surfaces. Light-colored or white roofs absorb less heat.</li> <li>○ Reduce the area of paved surfaces exposed to sunlight. Limit the amount of hardscape, design narrow roads, use light-colored paving, shade hardscape with greenery, locate parking underground.</li> <li>○ Plant an urban forest or a green roof. Use street trees, shrubs, and landscaping to reduce heat island effects through evapotranspiration as well as shade.</li> </ul>

**WATER EFFICIENCY STRATEGIES TO BE CONSIDERED:**

<b>REDUCE INDOOR WATER USE</b>	<ul style="list-style-type: none"> <li>○ Install efficient plumbing fixtures. Install new low-flow fixtures, including low-flow lavatories, kitchen sinks and showers, dual-flush toilets, waterless urinals, and composting toilets. Low-flow fixtures use less water than specified by the Energy Policy Act (EPA) of 1992. Select EPA WaterSense and EnergyStar products. In existing buildings, if porcelain replacement proves cost-prohibitive, install new flush valves or flow restrictors (e.g., aerators) to achieve water savings.</li> <li>○ Use nonpotable water. If permitted by the jurisdiction, use captured rainwater, greywater, or municipally provided reclaimed water for flush fixtures. Design and install plumbing systems that can use captured rainwater or greywater in flush fixtures. Greywater use is not an option in all municipalities, so it is important check regulations before planning to utilize this strategy.</li> </ul>
<b>REDUCE OUTDOOR WATER USE</b>	<ul style="list-style-type: none"> <li>○ Choose locally adapted plants. Landscape with native and adapted plants that require less water. These plantings have the added benefit of providing habitat for native wildlife.</li> <li>○ Use xeriscaping. These drought-tolerant plantings have extremely low water needs. Especially in arid regions, employ xeriscape principles when designing the site landscape.</li> <li>○ Select efficient irrigation technologies. Drip and bubbler systems and weather-based controllers can save water.</li> <li>○ Use non-potable water. Captured rainwater, greywater, or municipal reclaimed water is suitable for irrigation.</li> </ul>

**ENERGY AND ATMOSPHERE STRATEGIES TO BE CONSIDERED:**

<p><b>ENERGY DEMAND IN DESIGN &amp; PLANNING</b></p>	<ul style="list-style-type: none"> <li>○ Establish design and energy goals. Set targets and establish performance indicators at the outset of a project and periodically verify their achievement.</li> <li>○ Size the building appropriately. A facility that is larger than necessary to serve its function creates costly and wasteful energy demand.</li> <li>○ Use free energy. Orient the facility to benefit from natural ventilation, solar energy, and daylight.</li> <li>○ Insulate. Design the building envelope to insulate efficiently against heating and cooling losses.</li> </ul>
<p><b>ENERGY DEMAND IN OPERATIONS AND MAINTENANCE</b></p>	<ul style="list-style-type: none"> <li>○ Use free energy. Use the facility’s orientation and appropriate shades, windows, and vents to take advantage of natural ventilation, solar energy, and daylight.</li> <li>○ Monitor consumption. Use energy monitoring and feedback systems to encourage occupants to reduce energy demand.</li> </ul>
<p><b>ACHIEVING ENERGY EFFICIENCY</b></p>	<ul style="list-style-type: none"> <li>○ Address the envelope. Use the regionally appropriate amount of insulation in the walls and roof and install high-performance glazing to minimize unwanted heat gain or loss. Make sure that the building is properly weatherized.</li> <li>○ Install high-performance mechanical systems and appliances. Apply life cycle assessment to the trade-offs between capital and operating costs and evaluate investments in energy efficiency technologies. Appliances that meet or exceed ENERGY STAR requirements will reduce plug load demands.</li> <li>○ Use high-efficiency infrastructure. Efficient street lighting and LED traffic signals will reduce energy demands from neighborhood infrastructure.</li> <li>○ Capture efficiencies of scale. Design district heating and cooling systems, in which multiple buildings are part of a single loop.</li> <li>○ Use energy simulation. Computer modeling can identify and prioritize energy efficiency opportunities.</li> <li>○ Monitor and verify performance. Ensure that the building systems are functioning as designed and support the owner’s project requirements through control systems, a building automation system, and commissioning and retro-commissioning.</li> </ul>
<p><b>MEETING ENERGY DEMAND WITH RENEWABLE ENERGY</b></p>	<ul style="list-style-type: none"> <li>○ Generate on-site renewable energy. Install photovoltaic cells, solar hot water heaters, or building-mounted wind turbines.</li> <li>○ Purchase off-site renewable energy. Buy green power or renewable energy certificates to reduce the environmental impact of purchased electricity and promote renewable energy generation.</li> </ul>
<p><b>INCORPORATING ONGOING PERFORMANCE MEASUREMENT INTO A PROJECT</b></p>	<ul style="list-style-type: none"> <li>○ Adhere to the owner’s project requirements. Prepare detailed owner’s project requirements at the beginning of the design process and conduct commissioning throughout the life cycle of the project to ensure that the building functions as designed.</li> <li>○ Provide staff training. Knowledge and training empower facilities managers to maintain and improve the performance of buildings.</li> <li>○ Conduct preventive maintenance. Develop a robust preventive maintenance program to keep the building in optimal condition.</li> <li>○ Create incentives for occupants and tenants. Involve building occupants in energy efficiency strategies. Promote the use of energy-efficient computers and equipment, bill tenants from submeter readings to encourage energy conservation, educate occupants about shutting down computers and turning out lights before they leave, and give them regular feedback on energy performance.</li> </ul>

**MATERIALS AND RESOURCES STRATEGIES TO BE CONSIDERED:**

<p><b>CONSERVING MATERIALS THROUGHOUT A PROJECT'S LIFE CYCLE</b></p>	<ul style="list-style-type: none"> <li>○ Reuse existing buildings and salvaged materials. Selecting resources that have already been harvested and manufactured results in tremendous materials savings.</li> <li>○ Plan for smaller, more compact communities. Reduce the need for new roads and other infrastructure by preventing sprawling land-use patterns.</li> <li>○ Use efficient framing techniques. Two framing approaches that by design use less material than conventional framing without compromising performance are advanced framing, in which studs are spaced 24 instead of 16 inches on center, and structural insulated panels, which combine framing and insulation into one rigid component.</li> <li>○ Promote source reduction in operations. Designate office supply reuse centers or areas that make unused or reusable supplies available for reuse. Encourage paper conservation through double-sided and electronic printing.</li> </ul>
<p><b>PROMOTE SUSTAINABLE PURCHASING DURING DESIGN AND OPERATION</b></p>	<ul style="list-style-type: none"> <li>○ Identify local sources of environmentally preferable products. Using local materials not only reduces the environmental harms associated with transportation, it also supports the local economy.</li> <li>○ Develop a sustainable materials policy. Outline the goals, thresholds, and procedures for procurement of ongoing consumables and durable goods. Incorporate systems thinking. Evaluate materials based on their upstream and downstream consequences. Monitor compliance to ensure that the policy is effective.</li> <li>○ Specify green materials and equipment. Give preference to rapidly renewable materials, regional materials, salvaged materials, and those with recycled content. Choose vendors who promote source reduction through reusable or minimal packaging of products. Look for third-party certifications, such as the Forest Stewardship Council, Green Seal, and ENERGY STAR.</li> <li>○ Specify green custodial products. Choose sustainable cleaning products and materials that meet Green Seal, Environmental Choice, or EPA standards to protect indoor environmental quality and reduce environmental damage.</li> </ul>
<p><b>REDUCE WASTE DURING CONSTRUCTION</b></p>	<ul style="list-style-type: none"> <li>○ Develop a construction waste management policy. Outline procedures and goals for construction waste diversion. This policy should specify a target diversion rate for the general contractor.</li> <li>○ Establish a tracking system. Ensure that the general contractor provides waste hauler reports and captures the full scope of the waste produced. Designate a construction and demolition waste recycling area. Diligent monitoring will ensure that the policy is effective.</li> </ul>
<p><b>REDUCE WASTE DURING OPERATIONS AND MAINTENANCE</b></p>	<ul style="list-style-type: none"> <li>○ Develop a solid waste management policy. Outline procedures and goals for solid waste diversion. This policy should specify a target diversion rate for the facility.</li> <li>○ Conduct a waste stream audit. Establish baseline performance for the facility and identify opportunities for increased recycling, education, and waste diversion.</li> <li>○ Maintain a recycling program. Provide occupants with easily accessible collectors for recyclables. Label all collectors and list allowable materials. Through signage or meetings, educate occupants about the importance of recycling and reducing waste.</li> <li>○ Monitor, track, and report. Use hauler reports or other reliable data to monitor and track the effectiveness of the policy. Track performance goals and provide feedback to the occupants.</li> <li>○ Compost. Institute an on-site composting program to turn landscaping debris into mulch. Work with the waste hauler to allow for collection and composting of food and other organic materials.</li> <li>○ Provide recycling for durable goods. Institute an annual durable goods drive where e-waste and furniture are collected on site and disposed of properly through donation, reuse, or recycling. Allow occupants to bring e-waste and furniture from home.</li> </ul>

**INDOOR ENVIRONMENTAL QUALITY STRATEGIES TO BE CONSIDERED:**

<p><b>IMPROVE AIR QUALITY DURING CONSTRUCTION</b></p>	<ul style="list-style-type: none"> <li>○ Prohibit smoking. Institute a no-smoking policy in the building and around building entrances, operable windows, and air intakes.</li> <li>○ Protect air that comes into the building. Locate air intakes away from likely exhaust sources, such as idling vehicles or smoking areas. Locate smoking areas away from building entrances.</li> <li>○ Specify low-emitting materials. Use green materials for both new construction and renovations. Select low-VOC paints, adhesives, sealants, and furniture.</li> <li>○ Develop and follow a construction indoor air quality management plan. The plan should include dust control and good housekeeping, protection of pervious materials from moisture, and protection and capping of ducts and mechanical systems.</li> <li>○ Test for radon or other on-site contaminants. If present, include a ventilation system to address possible emissions.</li> <li>○ Design for proper ventilation. Consider the number of occupants in each space and the activities they will be engaged in. Make sure that the ventilation system, whether natural or mechanical, can provide enough air exchanges. Size the systems appropriately.</li> <li>○ Use air filters with high MERV ratings. Minimum efficiency reporting value (MERV) Rating is a measurement scale designed by ASHRAE to rate the effectiveness of air filters. The higher the MERV rating the greater particulates captured by a filter.</li> <li>○ Protect air quality during construction. Prevent mold by protecting all materials from moisture exposure. Prevent dust and particulate buildup.</li> <li>○ Conduct a flush-out. Before occupancy, flush out indoor airborne contaminants by thoroughly exhausting old air and replacing it with fresh, outdoor air.</li> <li>○ Install entryway grates. Use permanently installed, cleanable grates or mats to remove pollutants carried by people’s shoes.</li> </ul>
<p><b>IMPROVE INDOOR AIR QUALITY DURING OPERATIONS &amp; MAINTENANCE</b></p>	<ul style="list-style-type: none"> <li>○ Ensure adequate ventilation. Operate ventilation systems to supply ample outside air to the occupants. Follow the most recent industry standards, such as ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality.</li> <li>○ Monitor outdoor airflow. Use an outdoor airflow measurement device that can measure and control the minimum outdoor airflow rate.</li> <li>○ Monitor carbon dioxide. Use monitors and integrate them with a ventilation system that regulates the supply of air based on occupants’ demand. With demand-controlled ventilation, air flow is automatically increased if concentrations exceed a setpoint.</li> <li>○ Prohibit smoking. Enforce a no-smoking policy in the building and around building entrances, operable windows, and air intakes. Communicate the policy to building occupants through building signage and tenant meetings.</li> <li>○ Calibrate sensors. Perform routine preventive maintenance, such as calibrating sensors and monitors, to ensure that accurate data are used to modulate systems.</li> <li>○ Develop and implement a green cleaning policy. To minimize the introduction of contaminants, outline procedures and goals for the custodial program at the facility. This policy should specify standards for selecting cleaning products and technologies, such as Green Seal standards, California Code of Regulations, and certification of cleaning equipment from the Carpet and Rug Institute.</li> <li>○ Conduct custodial effectiveness assessment. Identify opportunities for improving building cleanliness and reducing occupants’ exposure of potentially harmful biological and particulate contaminants.</li> <li>○ Employ permanent entryway systems. Place grilles, grates, or mats at least 10 feet long at all major entrances help to reduce the dust, dirt, and contaminants brought into the facility. Develop cleaning procedures to properly maintain entryway systems.</li> <li>○ Use integrated pest management. A coordinated program of nonchemical strategies, such as monitoring and baiting, will reduce the need for pesticides and other potentially toxic contaminants.</li> </ul>
<p><b>IMPROVE OCCUPANTS</b></p>	<ul style="list-style-type: none"> <li>○ Use daylighting. Design the building to provide ample access to natural daylight and views for the occupants. Optimize access to views by using low partitions</li> </ul>

<b>COMFORT AND CONTROL</b>	<p>and vision panels.</p> <ul style="list-style-type: none"> <li>○ Install operable windows. If possible, provide windows that can be opened to the outside. To save energy, sensors may be included to inform the HVAC system to shut down if a window is open.</li> <li>○ Give occupants temperature and ventilation control. In mechanically ventilated buildings, provide thermostats that allow occupants to control the temperature in their immediate environment. Provide adjustable air diffusers that allow occupants to adjust the air flow as well.</li> <li>○ Give occupants lighting control. Provide adjustable lighting controls so that occupants can match lighting levels to their tasks. These may be designed in combination with daylight and occupancy sensors to conserve energy.</li> <li>○ Conduct occupant surveys. Use valid survey protocols to assess occupants' satisfaction with the indoor environment. Evaluate results to identify areas of dissatisfaction and prepare a corrective action plan to make the necessary operational changes.</li> <li>○ Provide ergonomic furniture. Include furniture that is adjustable to prevent repetitive stress injuries.</li> <li>○ Include appropriate acoustic design. Use soft surfaces and other strategies to ensure that sound levels remain comfortable for the activity level of the space.</li> </ul>
----------------------------	--

**INNOVATION STRATEGIES TO BE CONSIDERED:**

<p>OFFSET FROM RENEWABLE ENERGY</p>
<p>CREATE OR IMPLEMENT A PROGRAM FOR OCCUPANTS OR OTHER STAKEHOLDER TO DIVERT A SIGNIFICANT AMOUNT OF WASTE GENERATED FROM OUTSIDE SOURCES TO APPROPRIATE RECYCLING LOCATIONS</p>
<p>EVALUATE A LARGE QUANTITY OF PRODUCTS BEING USED IN THE PROJECT AND DEMONSTRATE THAT THEY PRODUCE SIGNIFICANT PERFORMANCE ADVANTAGES OR ENVIRONMENT BENEFITS</p>