



Flatten Emissions



1.1

Minimize Embodied Carbon

swa

Limit demand for new material

- ☐ by building less
- ☐ by using natural materials rather than ones manufactured and brought to the site
- ☐ by reducing redundancies
- ☐ by using the maximum allowable spacing of welded wire fabric or textile reinforced concrete instead of rebar
- ☒ by reusing on-site materials
- ☐ by siting development in the project site near to existing infrastructure tie ins
- ☐ by using salvaged materials from regional demolition projects or salvage yards
- ☐ by limiting waste using minimal cuts, prefab, or dimensioned materials

Elliniko, Greece



For a decommissioned airport turned into Ellinikon Park, Sasaki reused approximately 300,000 sq ft of concrete from the runways. Because the 30" thick slabs were poured with golf ball sized marble aggregate and no rebar, various treatments were used to reveal the texture for applications in fountains, retaining walls, furnishings, and hardscape.



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Minimize Embodied Carbon

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Choose materials with less energy-intensive manufacturing

- ☐ such as alternative material(s) to concrete for hardscape
- ☐ such as steel with a high percentage of recycled content
- ☐ such as recycled material
- ☐ such as lightweight fill for green roofs instead of foam or cellular concrete
- ☐ such as rammed earth walls or wood fences instead of metal fences or concrete walls
- ☐ such as lower-carbon concrete
- ☒ such as steel from electric arc furnaces and manufacturers powered by renewable electricity
- ☐ such as engineered wood fiber instead of wood chips or rubber surfacing for play areas

San Bernardino, CA

The school district decided to use outdoor furnishings from the manufacturer Vestre. The steel has 30% lower emissions than average, produced with fossil-free hydrogen, and soon by electric arc furnaces. The two Vestre factories are powered by 100% renewable electricity, in part by onsite solar.





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1.1

Minimize Embodied Carbon

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Choose materials with less energy-intensive machining/finishing



such as monolithic wood seating



such as natural stone

Los Angeles, CA



For the Broad Museum's 24,000sq ft public outdoor space, Hood Design Studio created monolithic wood for seating elements. The seats and tables were made with simple cuts to salvaged Barouni olive tree trunks. The gnarled forms match the 100-year-old olive trees planted in the plaza.



Flatten Emissions



1.1

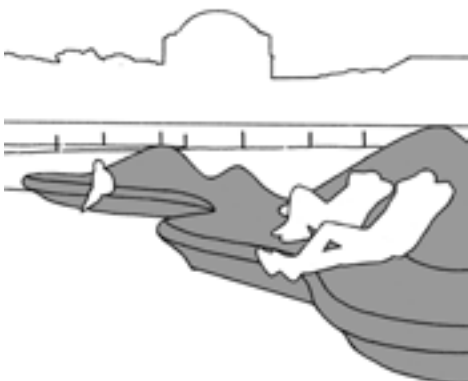
Minimize Embodied Carbon

swa

Source materials and fabricate regionally

(within the state or province)

San Francisco, CA



For site furnishings at the Presidio Tunnel Tops, Field Operations designed sculpted benches made from a 40,000lb, 90ft Monterey Cypress tree that had fallen at the old Army base during a winter storm, but had not been recovered. The logs were milled an hour north and brought back to the city for curing and assembly, then installed at the new park. From tree to bench, total transport was only 100 miles, or less than three hours driving time.



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1.1

Minimize Embodied Carbon

swa

Design for deconstruction and material reuse

- with fasteners (mechanical instead of adhesives, visible, few, or none)
- with simple components, modules, and fewer larger elements
- with materials (high worth, low variety, no composites)

Kansas City, MO



Walking Wall is a 500-yard art piece by Andy Goldsworthy at the Nelson-Atkins Museum of Art. It is composed of stones freshly quarried, dug from fields, and reclaimed from old prairie walls and dry stacked four feet high by skilled wallers. The modularity of the wall is on display as it “walks”—being disassembled on one end, moved piece by piece, and assembled on the other end. A single material and no binders allow the components to be reused over and over.



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1.1

Minimize Embodied Carbon

swa

Keep everything on site

(no off hauling to landfill)

- by retaining fill: cap contaminants, balance cut/fill operations
- by incorporating demolition waste (inorganic)
- by incorporating tree debris (organic)

London, United Kingdom



Cator Park is a new 8-hectare park on the site of a 70s-era suburban public housing complex (council estate). The last of the concrete brutalist buildings were demolished in 2013 as a part of urban renewal (regeneration). HTA Design used 30,000 cubic meters of construction and demolition debris to make landforms. They were thus able to limit emissions involved in off hauling to a C&D landfill. In total 98% of the rubble is being recycled or reused on site.



Flatten Emissions



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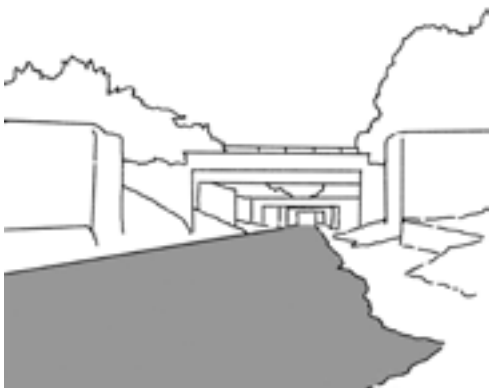
Minimize Embodied Carbon

swa

Design to limit construction vehicle hours

- by limiting grading, earthwork, and/or cut/fill operations
- by limiting trenching, excavation, drainage, and subgrade work
- by limiting paving
- by limiting grubbing and land clearing

Detroit, MI



SmithGroup redesigned an abandoned rail corridor that ran through the center of Detroit into Dequindre Cut Greenway. Built out in two phases, the cut refers to a 25' below grade trench. Repurposed for the greenway, the trench involved comparatively minimal grading, considering the 50' width. Operations mostly focused on clearing trash and brush, revealing the old bones of the retaining walls and old bridge abutments.



Flatten Emissions



1.2

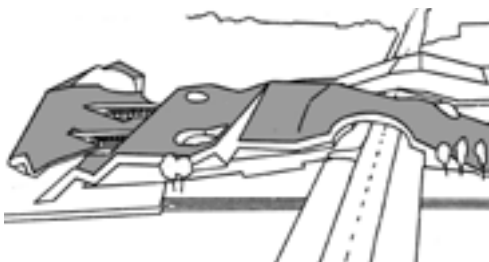
Reduce Operational Energy

swa

Reduce the energy demand of buildings (heating/cooling)

- by insulating the building with green roofs and/or walls
- by preventing heat gain by reducing solar exposure (with trees or canopies)
- by defusing wind force to buildings in the winter (with evergreen windbreaks)
- by designing roof decks and hardscape with high-albedo materials to reduce energy use
- by harnessing radiant heat from sun in winter (with deciduous trees)

Shanghai, China



At Giant Interactive's Headquarters, SWA worked with the architect to incorporate an extensive green roof on the complex folding and dipping surfaces on-structure and on-grade. The 15,222 square meter surface insulates the building with 10 inches of lightweight planting soil and a mix of *liriope*, *carex*, *sedum*, *oenothera*, *spirea*, and other species placed according to exposure. In addition, above the structural slab, a layer of rigid insulation reduces the temperature inside by another 10 degrees.



Flatten Emissions



1.2

Reduce Operational Energy

swa

Eliminate or reduce the need for gas-powered maintenance

- by eliminating lawn areas requiring mowing
- by eliminating hedges requiring trimming
- by eliminating other elements that necessitate powered maintenance tools (blowers, chainsaws, etc.)
- by designing for and specifying the use of electric, rather than gas powered, maintenance equipment
- by designing low maintenance, naturalistic, and/or native-plant landscapes

Abu Dhabi, United Arab Emirates



At Tilal Park, SLA designed a planting palette with only native plant species. In addition to lower water demands, the careful research that went into the 40 plant list, informed by previous work at Al Fay Park, ensures no high maintenance areas, eliminating the need for lawn mowers, leaf blowers, and hedge trimmers.



Flatten Emissions



1.2

Reduce Operational Energy

swa

Reduce the energy demand of irrigation systems

- by using building water (like air conditioning condensate)
- by capturing stormwater or recycling on-site water for later use
- by choosing a gravity-fed drip system rather than a pump-powered system

Tempe, AZ



Reduction of water inputs is key to ration a scarce resource, but creative reuse also limits the energy demand inherent in water delivery. At Orange Mall, at the center of the Arizona State University campus, Colwell Shelor was able to harness air conditioning condensate—a waste product—as a hyper local irrigation source. The student pavilion generates about 1,000 gallons of water between the peak use months of June–September and is delivered via sculptural brass pipes from the roof area.



Flatten Emissions



1.2

Reduce Operational Energy

swa

Reduce the energy demand of lighting systems

- ☐ with program scheduling
- ☐ with a reduced number of luminaires
- ☒ with low-wattage bulbs (like LEDs)
- ☐ by locating circulation where there is already existing lighting
- ☐ with ambient light sensors or motion detectors

Omaha, NE



At Gene Leahy Mall, Atelier Ten lighting designers helped OJB reduce energy by designing with low wattage LEDs. All light sources are LED and fully dimmable. Iconic existing orange post lights were updated with new lamps, reducing wattage by 85%. During hot summer months, the playground is especially well used at night, even until 11pm, when the park closes.



Flatten Emissions



1.3

Enable No-Engine Mobility

Make safe and convenient person-powered transportation networks

- by adding, improving, or connecting pedestrian pathways, bikeways, trails, or multi-use paths
- by widening sidewalks, improving pedestrian accessibility, and other Vision Zero pedestrian design practices
- by converting a street to a car-free or pedestrian street
- by creating dedicated bike lanes on shared streets
- by maximizing humane density in urban designs and master plans

Dallas, TX



The SWA-designed Katy Trail is a 20-year-old rails-to-trails project that repurposed 3.5 miles of former rail bed running from uptown northward. In car-centric Texas, the trail is well used and well loved with visitation around 2 million per year. The trail offers a car-free link from the American Airlines Center all the way to the Mockingbird Station retail complex near SMU's campus. It has separated paths—one for wheels, and one for walkers and runners. It is being extended into The Loop Dallas.



Flatten Emissions



1.3

Enable No-Engine Mobility

Make safe and convenient no-engine parking/charging

- by providing bike parking near building entrance/exits or adjacent to cycling paths
- by siting shared micromobility programs (such as bikeshare racks, scooter areas, etc)
- by integrating accessible EV charging infrastructure

Memphis, TN



In Tom Lee Park, SCAPE, along with architects Studio Gang, integrated two new 10-bike racks run by the local bikeshare, Explore Bike Share. Both sit just off of the fast path—a 0.6mi shared-use path along the eastern side of the park, grade separated from four lane Riverside Drive. One is near the picnic deck at the southern end, and the other is at the playground area, toward the center.



Flatten Emissions



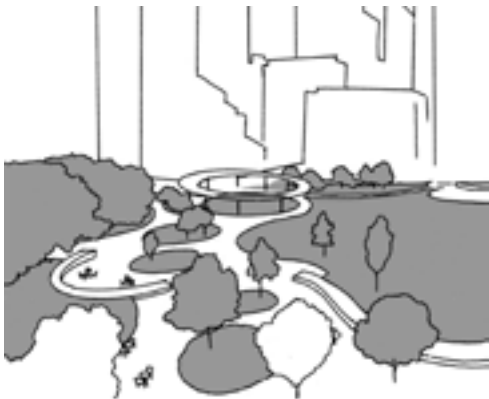
1.3

Enable No-Engine Mobility

Reduce car convenience

- by implementing a road diet or lane reduction to reduce speeds
- by eliminating parking spaces (without replacement)
- by replacing free parking with paid parking

Dallas, TX



Pacific Plaza was one of the five parks in downtown Dallas recently created from surface parking lots. At this site, SWA folded James W. Aston Park, a traffic island with mature trees, into the former private parking lot with the closure of one block of a four-lane street to net 3.5 acres. The park was built on grade, replacing almost 300 parking spaces.



Flatten Emissions



1.3

Enable No-Engine Mobility

Link to shared transportation modes

- such as mass transit (rail, train, electric bus)
- such as internal mobility services (electric campus-wide shuttle or shared mobility service)

Fort Lauderdale, FL



The A1A Streetscape Improvement Project enhances the pedestrian experience in a section of the main road running along much of South Florida's beachfront. Long involved with the beach, EDSA designed the streetscape. Separately, the city contracted with Circuit, a neighborhood electric vehicle company to provide last mile, ad-subsidized free rides to beachgoers. It is called the LauderGo! Micro Mover. The 5-passenger vehicles patrol a fixed route on A1A and are hailed via smartphone app, connecting passengers with the new inland high-speed train, parking, and elsewhere.



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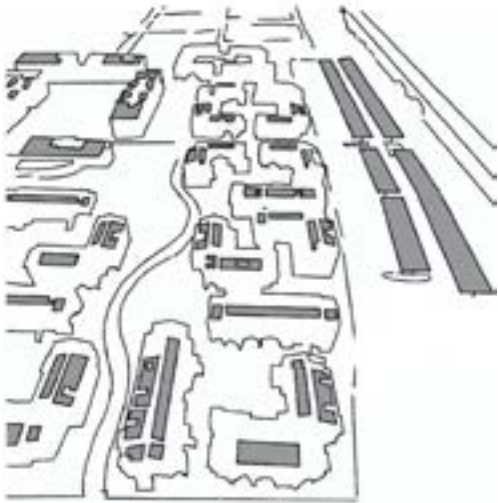
1.4

Power With Renewables

swa

Add photovoltaic panels

Davis, CA



West Village is an on-campus neighborhood housing over 3,000 students, faculty, and staff at the University of California, Davis. SWA, as the master planner, contributed to the goal of making this 200-acre site the largest community in the US to plan for achieving zero-net-energy. Using on-site fixed solar panels installed on rooftops and above parking lots, 4 MW of electricity is produced and consumed directly by residents, meeting more than 80% of total demand.



Flatten Emissions



1.4

Power With Renewables

swa

Site and/or integrate larger renewables

- ☐ such as wind turbines
- ☐ such as geothermal energy production
- ☒ such as hydropower or tidal power
- ☐ such as biogas production
- ☐ such as hydrogen fuel cell systems

Ithaca, NY



The Cornell University campus has a history of using renewable energy. Famous for its gorges, the university has harnessed Fall Creek for hydropower since 1868. More recently in 2008, Urban Strategies completed a campus master plan, followed closely by the university's Climate Action Plan. The two paved the way for the campus to run on 100% renewable electricity, 10 years ahead of its goal. The hydroelectric plant, lake source cooling, solar thermal, and roof-top solar are all part of on-site renewable energy production. Cornell is the only university with a hydro plant on campus.



Flatten Emissions



1.5

Repurpose Urban Land

swa

Design only on previously developed land to minimize infrastructure build out

(no greenfield land, no fill)

Toronto, Canada



In order to meet the rising demand for jobs and housing in Toronto, Woodbine Racetrack, a 1956 horse racing site, has been reimagined as a transit-oriented mixed-use development by master planners SWA. The 684-acre site integrates new uses for 60,000 new residents and a new public transit station without the need for carbon-intensive greenfield development and new infrastructure build out. The site is the single largest contiguously owned parcel of development land remaining in the City of Toronto.



Flatten Emissions



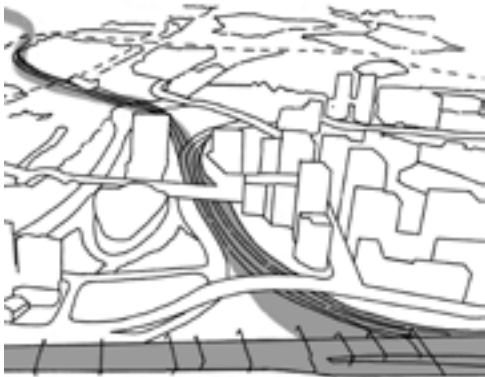
1.5

Repurpose Urban Land

swa

Reuse previously undevelopable urban land to minimize infrastructure build out

London, United Kingdom



EDAW led a consortium of firms to complete the London Olympic Park Master Plan, siting the 2012 Summer Games and planning its afterlife. The land selected, in a Victorian industrial area in east London centered around the Lower Lea Valley, was previously undevelopable due to severe soil and groundwater contamination. The brownfield site had been used by the chemical and fertilizer industries as well as for landfills and warehouses. The project involved the remediation of over 500 acres of land, already tied into various passenger rail lines via two stations on either side of the site.



Flatten Emissions



1.6

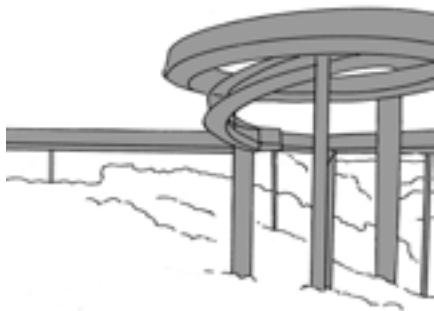
Prevent GHG Discharge

swa

Limit gas release from soils

- by protecting natural soils from compaction-elevating structures, limiting stockpiling, reducing impervious surface footprints, and/or restricting the movement of heavy machinery
- by limiting soil disturbance with perennials instead of annuals and/or limiting grading
- by preserving soil biology with the elimination of synthetic fertilizers and pesticides and/or using mulch on exposed soil
- by eliminating the drainage of organic soils and/or specifying trees and plants grown in nurseries without peat substrates

Shenzhen, China



Floating Bridge is one of three bridges that are a part of Guangming OCT Trail, a 15-mile greenway a 10-minute train ride from the city. Except for construction activities around footings, the elevated bridges leave the soil below undisturbed. Additionally, the trail partially follows an existing brick path, reducing new areas of compaction.



Sequester Carbon



2.1

Preserve Undeveloped Land and Vegetation

swa

Consolidate and reduce the development footprint

- by siting buildings and impervious surfaces on previously developed areas of the site
- by developing on edges near existing infrastructure to reduce the need for excavation and new infrastructure

Bozeman, MT



For the design of Story Mill Community Park, Design Workshop consolidated much of the impervious surface to areas that had been developed previously when the site was a wheat mill and farm. In addition, 45% of park construction activities occurred within previously developed areas with 53% of the 60-acre site untouched by construction. The design limited disturbance, preserving greater sequestration capacity.



Sequester Carbon



2.1

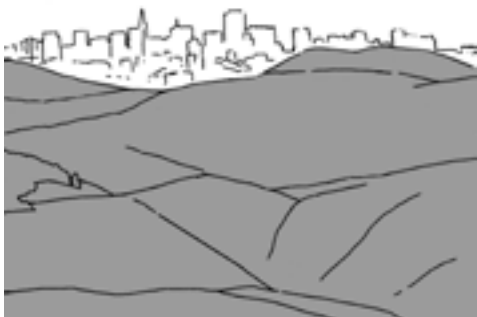
Preserve Undeveloped Land and Vegetation

swa

Put land into long-term conservation

- ☐ with a conservation easement
- ☒ with a land trust
- ☐ with a land donation
- ☐ with a private reserve

Marin County, CA



Today, the Golden Gate National Recreation Area is a 90,000-acre park straddling the inlet to San Francisco Bay. In the 60s, as development pressures were increasing on private lands, several nonprofits and land trusts acquired land for conservation. These were consolidated with military surplus lands in a proposal to make an urban national park. SWA completed a comprehensive inventory and analysis of natural, social, and cultural resources in the Northern Unit, and made recommendations for strategic land conservation and management. Today, the GGNRA sequesters more than 75,000 metric tons of CO₂ annually.



Sequester Carbon



2.1

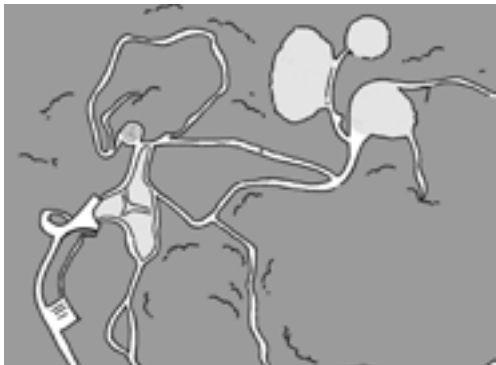
Preserve Undeveloped Land and Vegetation

swa

Preserve or conserve existing biomes

- such as mature tree stands or forests
- such as native grasslands
- such as wetlands (coastal, marsh, mangroves, seagrasses, freshwater, peat bogs, swamps)

Point Arena, CA



Fletcher Studio helped design a cemetery alternative within a mature forest in Northern California. Better Place Forests' novel model buys land, puts it into long term conservation, and tags trees with memorial markers where families can place ashes. At this 40-acre site, the design is minimally invasive, allowing families to orient, reflect, and commemorate without significantly impacting the large Coast Redwoods. A forest conservation team works to maintain the forest ecosystem.



Sequester Carbon



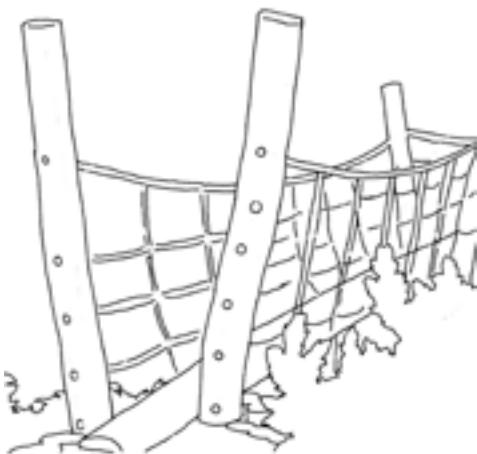
2.1

Preserve Undeveloped Land and Vegetation

swa

Specify sustainably harvested wood

London, United Kingdom



Specifying materials has effects on forest sequestration offsite. At Children's Garden at the Royal Botanical Gardens, Kew, Ground Control worked with play manufacturer Duncan and Grove to build four play areas using only hardwood from FSC certified mills or that was reclaimed. *Robinia*, from commercial nurseries in Europe, was stripped of bark and sapwood to reveal the naturally durable heartwood and used in many ways in the playground equipment.



Sequester Carbon



2.2

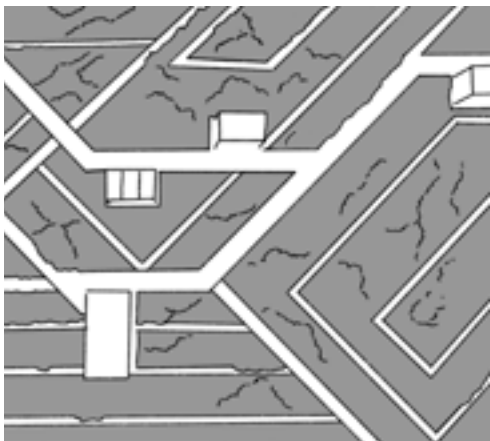
**Maximize Carbon Uptake
With Plant Material**

swa

Maximize planting area

- by reducing the ratio of hardscape to softscape
- by designing open, non shading, or temporary structures that allow growth underneath

Chicago, IL



Hoerr Schaudt designed this green roof as an amenity space for an office conversion of the Old Chicago Post Office. Totalling four acres, the roof deck includes four recreation spaces and an event pavilion. The remaining area is a garden, designed with narrow paths that maximize both planting area and immersion in the meadow-like planting. The ratio of softscape to hardscape in these areas is high. The main path is 6' wide, secondary paths are 3.5', and maintenance paths are 2'.



Sequester Carbon



2.2

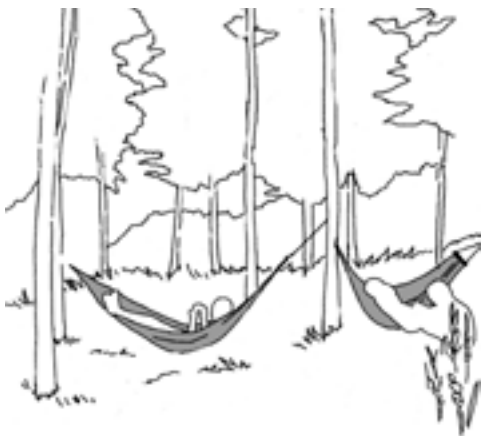
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With Plant Material**

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- by designing open, non shading, or temporary structures that allow growth underneath

Chongqing, China



At Jin Hai Wan Riverfront Park, SWA maximized planting with evergreen trees in a regular pattern and a low groundcover. People string up hammocks that co-opt living tree trunks as the structural element, provide seating, and allow growth underneath. The steep topography opens up views to the Jialing River, making it popular place to camp out for the day.



Sequester Carbon



2.2

**Maximize Carbon Uptake
With Plant Material**

swa

Grow new trees

- such as a forest with multiple layers (vertical diversity, multi-staged forest, forest garden)
- such as a forest with high-density (as in a Miyawaki Forest or tiny forest)
- by specifying tall trees, 35' and over
- by selecting deciduous rather than evergreen trees for 50% more carbon absorption

Tokyo, Japan



The consolidation of a printing company's urban production facility exposed more than 13 acres of landscape area. SWA's Ichigaya Forest project transformed more than half the site into new a multi-layered forest. It is modeled on a natural forest with vertical diversity, multiple stages, and a character between an open secondary forest and a dense shrine forest. Almost 300 plant species were used and the project is expected to sequester 30 tons of CO₂ annually.



Sequester Carbon



2.2

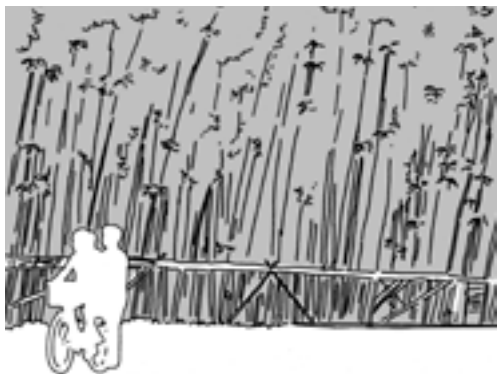
**Maximize Carbon Uptake
With Plant Material**

swa

Grow new plants that...

- ☐ are fast growing
- ☐ are long lived (including high tolerance or widely adapted species)
- ☐ have a longer growing season in the region
- ☒ are high density like bamboo (where appropriate and not invasive)

Suzhou, China



At Suzhou International Expo Center Plaza, SWA chose to use a fast-growing plant—native bamboo—planted in dense stands to create rooms in contrast to the large plaza. As the 20' tall plants are not held up in a natural forest context, they are braced with a 2'x2' grid of bamboo stalks 5' high.



Sequester Carbon



2.2

Maximize Carbon Uptake With Plant Material

swa

Retain existing vegetation

- by specifying trees that minimize the need for pruning
- by not removing mature trees in good health

Santa Cruz, CA



UC Santa Cruz sought to expand Kresge College as the campus accommodates a significant increase in student population. In designing the 8-acre master plan, Studio Gang nestled the new buildings into the coast redwood forest and curved the buildings around significant groves. The project preserves as many healthy trees as possible, only requiring the removal of existing trees in the footprints of proposed new buildings.



Sequester Carbon



2.2

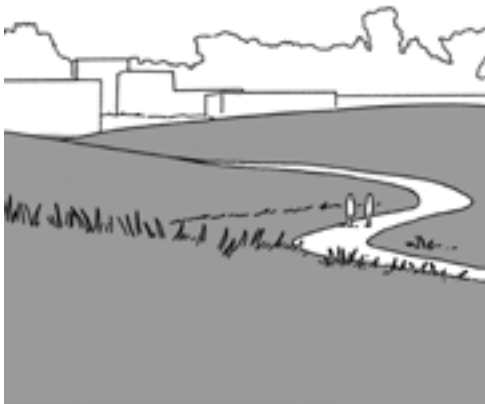
Maximize Carbon Uptake With Plant Material

swa

Limit lawn to critical programmatic areas

(to maximize higher sequestration planting types)

Potomac, MD



For Glenstone, an art museum, PWP with Larry Weaner Landscape Associates designed a 230-acre landscape largely comprised of open meadow and forest with a few lawn areas for outdoor sculpture. The 40 acres of meadow, which is on grade and on structure, need considerably less inputs than manicured lawn, using organic methods (no herbicide) before and after seeding, annual mowing, and no irrigation for the native species. Previously the site had been graded for a single-family subdivision with 91 acres of conventionally managed turf.



Sequester Carbon



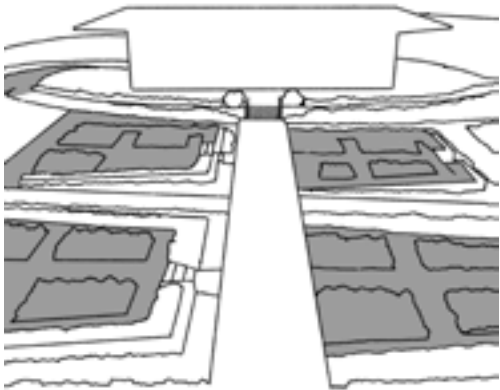
2.3

Increase Soil Organic Carbon

swa

Apply organic mulch or cover crops plowed under as green manure

Dallas, TX



SWA's Edible Landscape Garden at the Dallas Arboretum is modeled after a potager, or kitchen garden, to educate visitors about growing food. Pecan shell mulch is used across the arboretum to moderate soil temperature, retain moisture, and suppress weeds. It is also used in the edible beds which has the extra benefit of increasing soil organic carbon (SOM), important in frequently disturbed agricultural soils.



Sequester Carbon



2.4

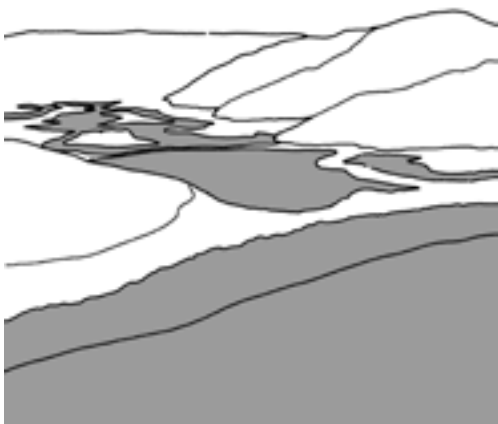
Regenerate Natural Carbon Sinks

swa

Create new grasslands, forests, and/or wetlands

(coastal, marsh, mangrove, seagrass, freshwater, peat bog, swamp)

Muriwai, Gisborne, New Zealand



The Orongo Station Conservation Master Plan by Nelson Byrd Woltz created wetlands on a large sheep ranch where 200 acres had been previously drained. 58 acres of freshwater wetland with chain ponds and 17 acres of tidal saltwater wetland were constructed or restored. The freshwater Orongo and Te Mamaku wetlands were planted with three mixes according to submersion frequency.



Sequester Carbon



2.4

Regenerate Natural Carbon Sinks

swa

Restore degraded grasslands, forests, and/or wetlands

(coastal, marsh, mangrove, seagrass, freshwater, peat bog, swamp)

St. Petersburg, FL



Ken Smith Workshop and Rogers Partners were tasked with rebuilding the 1970s-era St. Pete Pier. The old pier was largely a road with parking, whereas the new pier is open at the center and sheltered by a new breakwater. The light and reduced wave action likely resulted in increased seagrass bed growth. From before project completion to after, there has been a 43% increase in continuous seagrass area. The new pier design, along with the restoration efforts of the Tampa Bay Estuary Program, has resulted in a carbon sink over two acres.



Sequester Carbon



2.4

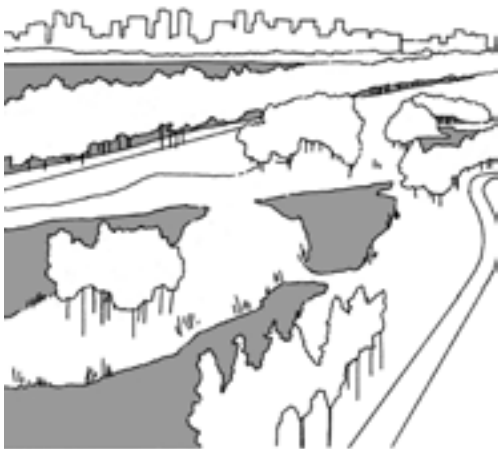
Regenerate Natural Carbon Sinks

swa

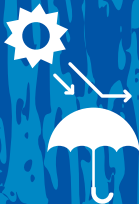
Create new grasslands, forests, and/or wetlands

(coastal, marsh, mangrove, seagrass, freshwater, peat bog, swamp)

Wuhan, China



The East Lake Greenway is a 3.5 mi greenway through the middle of the largest urban lake in China (*Dong Hu*). SWA designed the linear park along an existing spine of causeways linking fish ponds. The plan enhanced people-oriented slow mobility by residents of the megacity and also expanded the wetlands and deep marshes. The Greenway was so well used after opening, a second phase was added.



Modulate Excess



3.1

Limit Exposure to Coastal Storms

swa

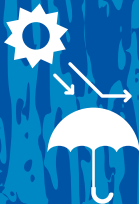
Move activities away from high-risk areas

- by planning the removal or reduction of structures and people in flood zones (managed retreat)
- by locating structures in the site above the current 100- or 200- year flood level
- by raising a portion of the site higher than the current 100- or 200-year flood level
- by eliminating essential infrastructure or elements from low lying areas

New York City, NY



As part of a city-wide initiative aimed at reducing flood risk due to coastal storms and sea level rise, recreation areas along Lower Manhattan's riverfront are being raised eight to nine feet above their historical elevations. A part of the East Side Coastal Resiliency project, Mathews Nielsen Landscape Architects designed these elevated park spaces to work in tandem with a series of floodgates in order to protect neighborhoods and critical transportation infrastructure from catastrophic flooding.



Modulate Excess



3.1

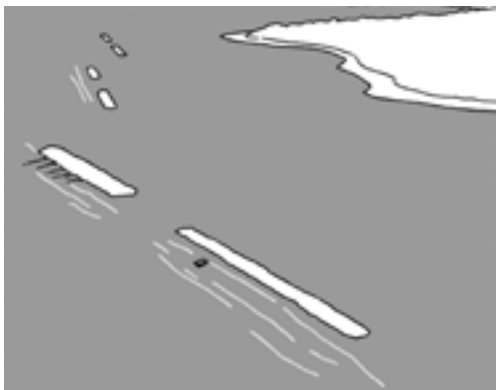
Limit Exposure to Coastal Storms

swa

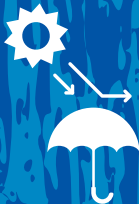
Reconfigure shorelines to attenuate wave energy

- using “hard” infrastructure like seawalls, levees, breakwaters, tetrapods, riprap, etc.
- using “soft” infrastructure like engineered wetlands, living shorelines, beach nourishment programs, etc.

New York City, NY



After a record-breaking super storm brought considerable damage to New York City's shoreline, SCAPE designed Living Breakwaters, a string of offshore breakwaters to reduce erosion and lessen wave impacts while improving habitat for marine wildlife. The breakwaters were custom designed to include "niches and crevices" that introduce habitat complexity, creating space for a range of targeted species, including juvenile fish, oysters, and other shellfish.



Modulate Excess



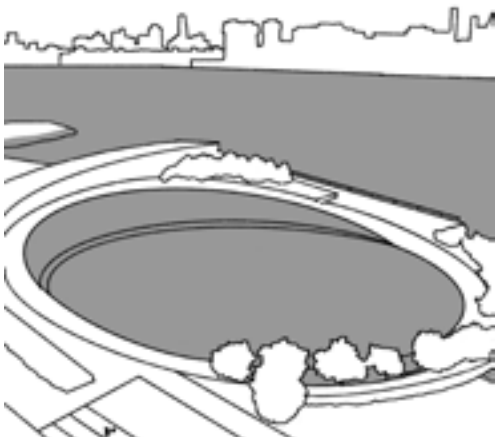
3.1

Limit Exposure to Coastal Storms

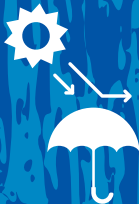
swa

Reduce excess water by exiting it as quickly as possible without overtaxing the storm system

New York City, NY



For the first phase of Hunter's Point South Park, SWA designed a large lawn area at the edge of the urban waterfront. Constructed with artificial turf, the lawn is designed to drain stormwater quickly during typical rain events. During major storms, when the river breaches its banks, the lawn, which is sunken below street grade, is designed to withstand long periods of complete inundation before releasing floodwaters back into the river instead of draining it back into the city's sewer system.



Modulate Excess



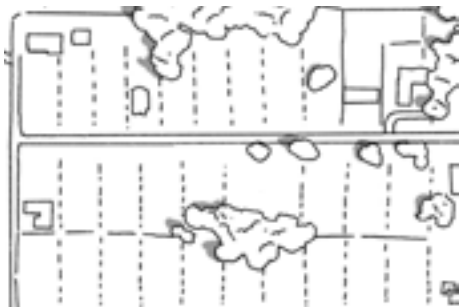
3.2

Limit Exposure to Wildfire

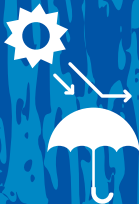
Move activities away from high-risk areas

- by locating structures away from hazardous topography (ridge lines, canyons, or steep slopes)
- by siting structures on the leeward side of slopes
- by locating structures in the site away from high or very high fire hazard severity zones
- by planning the removal or reduction of structures and people in high or very high fire hazard severity zones (managed retreat)

Paradise, CA



A pilot program called the Paradise Voluntary Buyout Program, managed by the city's recreation department and funded largely by nonprofit grants and donations, offers voluntary buyouts to help support the relocation of homes away from high-risk areas. As of summer 2022, the department had secured 100 acres through the program.



Modulate Excess



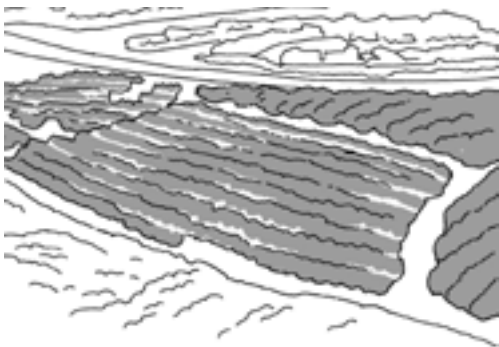
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Limit Exposure to Wildfire

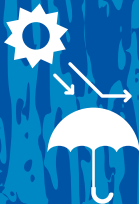
Create obstacles to stop the advance of fire

- ☐ with defensible space (land, planning)
- ☐ with structures (masonry walls)
- ☒ with irrigated areas between structures and areas with high fuel loads (orchards, vineyards, athletic fields)
- ☐ with firebreaks (roadways, parking areas)

Orange County, CA



SWA helped transform Rancho Mission Viejo, a 23,000-acre ranch into a fire-adapted mixed-use development. Buffer zones with irrigated orchards are designed to catch embers ahead of wind-driven fires. In some areas, these buffer zones are more than 500 ft wide.



Modulate Excess



3.2

Limit Exposure to Wildfire

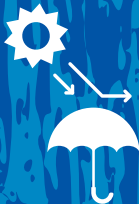
Reduce excess fuels

- with plant material containing high year-round foliar moisture or turgidity (like those from a regional fire-safe plant list)
- with fuel management practices (prescribed burns, thinning & pruning, etc.)

Mariposa County, CA



The Mariposa County Recreation and Resiliency Plan by Design Workshop outlines clear goals and strategies that can enable planners to successfully integrate wildfire adaptation measures including vegetation management programs into parks, trails, and open spaces.



Modulate Excess



3.3

Limit Exposure to Flash Floods

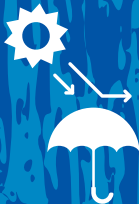
Move activities away from high-risk areas

- by planning the removal or reduction of structures and people in flood zones (managed retreat)
- by raising a portion of the site higher than the current 100- or 200-year flood level
- by designing high clearance bridges far above projected flood levels to avoid strainers that catch debris and create extra pressure
- by locating structures in the site above the current 100- or 200- year flood level
- by eliminating essential infrastructure or elements from low lying areas

Jinhua City, China



As part of Turenscape's design for Yanweizhou Park, a serpentine pedestrian bridge snakes across two seasonally flooded rivers. The main bridge is elevated above the 200-year flood level, while auxiliary ramps connecting to the riparian wetland park below can be submerged during periodic flood events.



Modulate Excess



3.3

Limit Exposure to Flash Floods

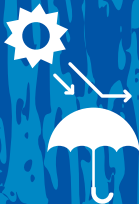
Create obstacles to attenuate water speed, volume, and sediment flows

- with speed humps, large softscape areas, bioswales, rain gardens, or other features that slow and spread water out
- with floodplain benches that allow silt to deposit with the slowing and spreading of water
- through detention (green roofs, temporary storage, tanks, detention ponds, cisterns, trenches) or retention (retention ponds, wet ponds) that attenuate the release of water to the storm sewer

Houston, TX



SWA transformed a former golf course into a series of five retention ponds, designed to hold 100 million gallons of floodwater each. By keeping rain out of the local bayous during heavy precipitation events, Exploration Green acts as a natural sponge, helping to reduce the chances of catastrophic system failure. Even when partially complete, it helped save as many as 150 homes during Hurricane Harvey.



Modulate Excess



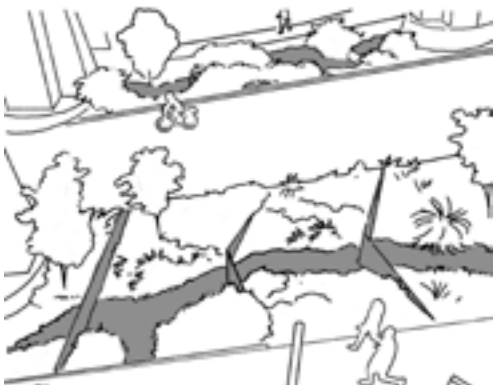
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Limit Exposure to Flash Floods

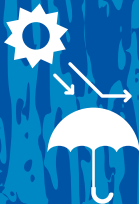
Reduce excess water

- by exiting water off site as quickly as possible without burdening the storm sewer system (exiting the clean surface water of a park to a water body, etc.)
- by amending soil to increase its infiltration capacity
- by exiting water via infiltration to avoid the storm sewer (stormwater wetlands, permeable pavement)

Seattle, WA



As part of an effort to reduce the volume of polluted stormwater runoff entering nearby water bodies, Weber Thompson designed the Aurora Bridge Swales, a series of bio-retention cells that redirect, slow, and filter storm water from the north span of an overhead vehicular bridge.



Modulate Excess

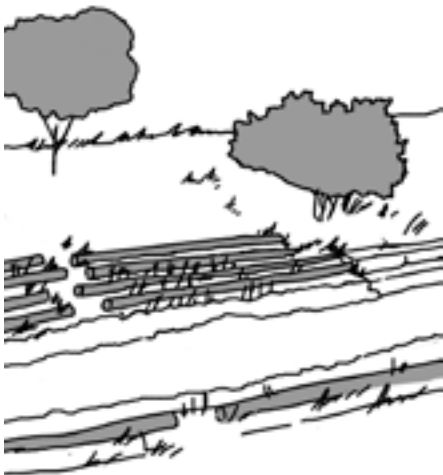


3.3

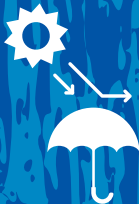
Limit Exposure to Flash Floods

Reduce excess sediment through erosion prevention

Austin, TX



As part of MVVA's redesign for Waterloo Greenway, a degraded urban creek, several streambank stabilization strategies were identified. Trees removed for the project were salvaged and buried at the toe of the channel. Live fascines, stakes, and other plant materials were used to further reduce soil erosion. In places where hard infrastructure was necessary, "kickback walls" were constructed from limestone blocks salvaged from the offcuts of a nearby quarry.



Modulate Excess



3.4

Limit Exposure to Excess Heat

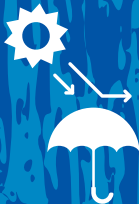
Move activities away from high-risk areas

(hottest, most exposed, most populous)

Foshan, China



For Sanshan Hillside Park in southern China, where mid-summer heatwaves can bring sweltering temperatures and high humidity, SWA took advantage of a well shaded part of the site by clustering active recreation elements like basketball courts, children's play areas, and adult exercise equipment underneath an elevated section of the 6-lane highway that cuts through the park.



Modulate Excess



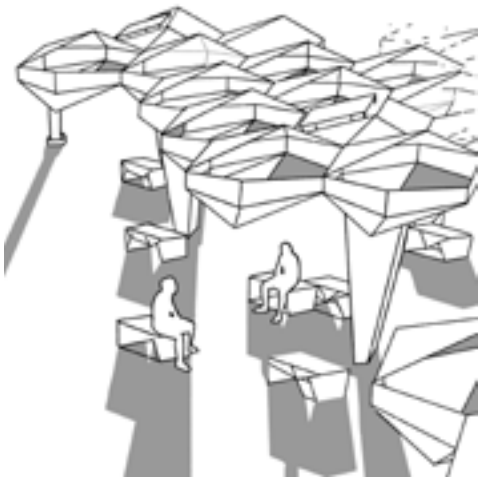
3.4

Limit Exposure to Excess Heat

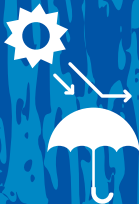
Create obstacles to surface warming

- with large canopy shade trees over hardscape and streets
- by shading dark pavements with more reflective shade structures

Phoenix, AZ



Shadow Play, Höweler + Yoon's sculptural shade structures, are made from folded steel cells, which filter the sunlight, casting shadows and reducing temperatures below. The geometry of the canopy maximizes shade while allowing for breezes and air movement to penetrate.



Modulate Excess



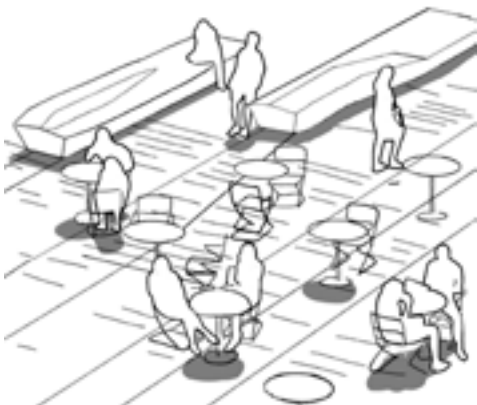
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Limit Exposure to Excess Heat

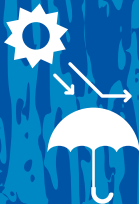
Reduce excess heat by lowering surface temperatures

- with permeable paving in areas of regular rainfall
- with a green roof
- with high-albedo and reflective surface materials (cool roofs, pavements)
- with green parking lots (Grasscrete)

Cambridge, MA



As part of Stoss Landscape Urbanism's update of a 2-acre public plaza at Harvard University, the design team replaced a series of asphalt walkways with light-colored, high-albedo pavers in order to limit thermal gain throughout the site. Light-colored wood was selected for the sculptural seating elements, which stay cool to the touch even in the summer sun.



Modulate Excess



3.4

Limit Exposure to Excess Heat

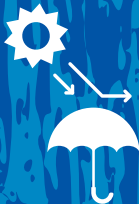
Increase evaporative cooling

- with planting and irrigating high transpiration trees that were regionally appropriate (for example, *Platanus hybrida*, *Ficus microcarpa*, *Gleditsia triacanthos*, and *Platanus racemosa* in Los Angeles)
- with a large surface area water feature (can include anything with constant water on the surface like skims, splash pads, stream daylighting, pond, retention basin, rainwater storage, canals, etc.)

Santa Cruz de Tenerife, Canary Islands, Spain



Located fewer than 200 miles off the coast of Western Sahara, where late summer heatwaves can bring temperatures well above 90 degrees Fahrenheit, Herzog & de Meuron's design for Plaza de España includes a 250 ft diameter water feature. The feature helps lower air temperature throughout the plaza through evaporative cooling.



Modulate Excess



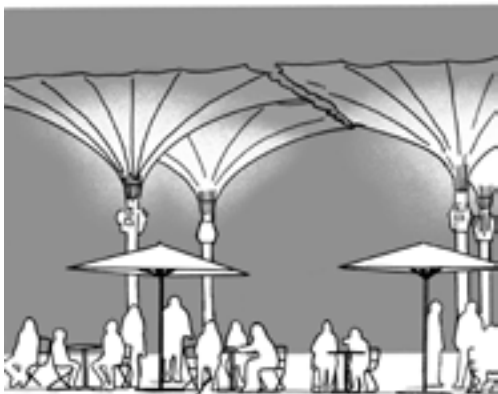
3.4

Limit Exposure to Excess Heat

Design for night time use

- with play equipment that doubles as adult workout equipment or vice versa
- with small, partially open structures for individuals or pairs
- with low-lumen, even coverage lighting that avoids hot spots
- with group program areas that include adjacent areas for lingering post-event

Fort Worth, TX



Sundance Square Plaza was designed by Michael Vergason Landscape Architects to serve as a central gathering place for downtown Fort Worth. In the evening, the plaza's water features are illuminated and color changing lights accent four monumental retractable umbrellas that double as glowing beacons.



Accommodate Disturbance



4.1

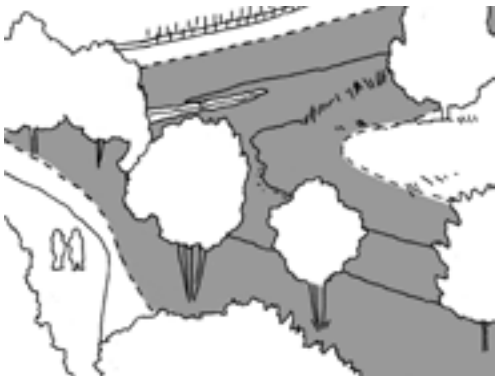
Design for Floodability

Design for robustness

(the capacity to withstand adverse conditions)

- with over-engineered or overbuilt elements (like heftier light poles, railings, trash cans, and furnishings anchored below ground; deep bridge pilings in soft soil)
- with the selection of plants with low soil oxygen requirements and salt-tolerance that can withstand prolonged salt water inundation
- with the selection of plants with low soil oxygen requirements that can withstand prolonged freshwater inundation

Stamford, CT



For Mill River Park and Greenway, an urban river renaturalization project, OLIN planted several inundation-tolerant species in the re-engineered riparian floodplain including river birch (*Betula nigra*), American sycamore (*Platanus occidentalis*), and swamp white oak (*Quercus bicolor*).



Accommodate Disturbance



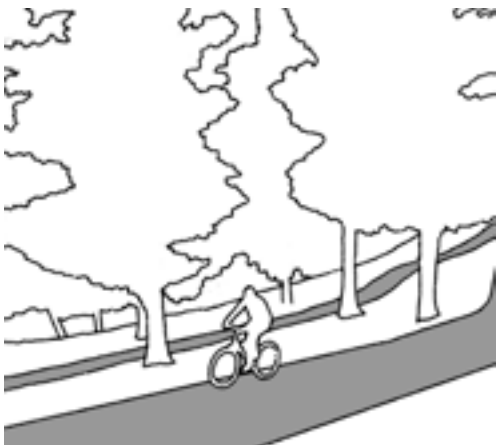
4.1

Design for Floodability

Incorporate redundancies

- with redundant features (like upper and lower paths)
- with low lying areas that could be sacrificed if badly damaged by water, sediment, or debris

Houston, TX



Buffalo Bayou Park was designed by SWA with redundant features like upper and lower pathways, which make it possible for pedestrians and cyclists to use even when water levels swell due to excess rainfall.



Accommodate Disturbance



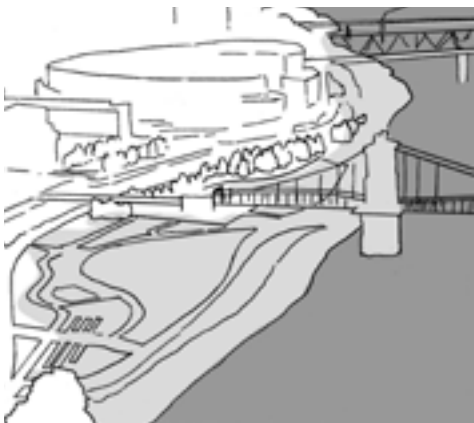
4.1

Design for Floodability

Design for the rapid containment of losses

- with a site design for easy cleanup post-event
- by educating people ahead of a disaster
- by incorporating early warning systems

Cincinnati, OH



Sasaki's design for the John G. and Phyllis W. Smale Riverfront Park includes a variety of removable features like picnic tables, restrooms, electrical equipment, and public artworks that can quickly be wheeled away from the floodplain by maintenance crews when flooding is forecast, and returned when water levels recede.



Accommodate Disturbance



4.1

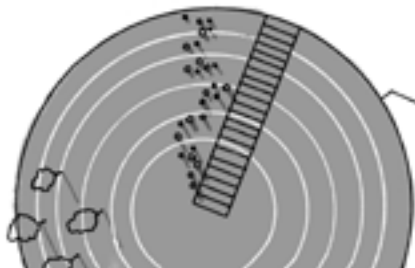
Design for Floodability

swa

Design for the capacity to absorb and recover

- with low-drag site elements that catch less debris when inundated or when draining (like sloped walk surfaces, sloped walls, rounded corners, curved railings, etc.)
- with material selection—those that bend but don't break with wind, wave, or water flow pressure
- with a moderately easy entry for water to the site so there will be less damage to site elements
- with constructed arroyos that can absorb runoff in arid or semi-arid precipitation regimes

Kokkedal, Denmark



As part of Kokkedal Klimatilpasning, a multi-phase flood adaptation plan for a flood-prone town, Schønherr designed a recreation facility and children's play area known as Bølgepladsen (wave square) as a series of sloped and rounded surfaces. These forms allow water to move in and off the site with limited drag, or resistance as a safeguard against heavy wear and tear.



Accommodate Disturbance



4.2

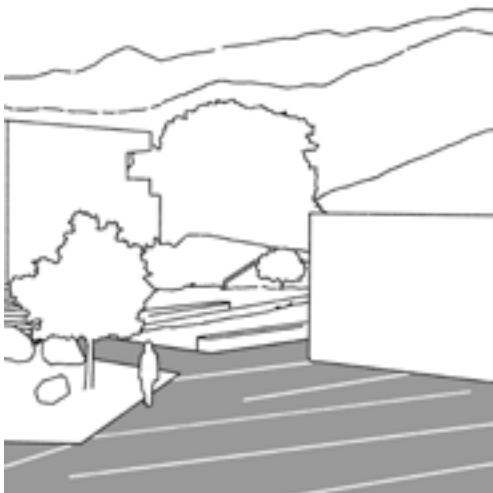
Design for Fire Disturbance

swa

Design for robustness

(the capacity to withstand adverse conditions)

Ojai, CA



After the Thomas Fire destroyed the Ojai Valley School's upper campus, Pamela Burton & Company worked with Frederick Fisher and Partners to redesign the school featuring a fire-resistant landscape that prioritizes large, noncombustible buffers, a central courtyard that can double as an emergency refuge area and a staging area for firefighting, and simple forms that eliminate places for burning embers to catch.



Accommodate Disturbance



4.2

Design for Fire Disturbance

swa

Incorporate redundancies

Napa County, CA



Much of the Meadowood Napa Valley resort and its surrounding forested landscape were destroyed by the Glass Fire, which burned over 65,000 acres and destroyed more than 1,500 structures. As part of SWA's redesign for the damaged grounds, all dead-end roadways longer than 1,000 ft were reconfigured as loops in order to help ensure maximum emergency egress options.



Accommodate Disturbance



4.2

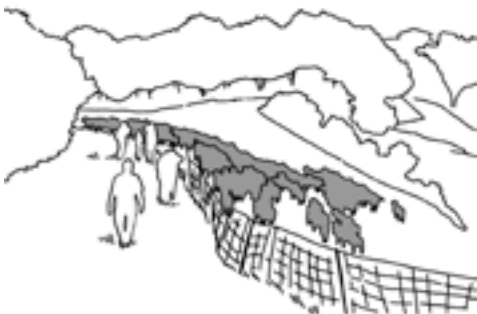
Design for Fire Disturbance

swa

Design for the capacity to absorb and recover

- with shaded fuel breaks that bring fire closer to the ground and make control easier
- by incorporating seasonal grazing (vegetation management with livestock)

Ojai, CA



Graze Ojai is a community-supported program from the Ojai Valley Fire Safe Council that uses the prescribed grazing of low-impact herd animals like goats and sheep to mitigate the risk of catastrophic wildfires. The grazing program covers approximately 360 square miles.



Accommodate Disturbance



4.2

Design for Fire Disturbance

Design for the rapid containment of losses

- by enabling quick access and operations for firefighting
- by warning people with wildfire detection systems (surveillance equipment)
- by educating people ahead of a disaster

Southern California



RIOS collaborated with the Santa Monica Mountain Resource Conservation District to transform the way people receive information about wildfire protection. The initiative resulted in a website with detailed information and resources to help improve property management on fire-prone sites.



Accommodate Disturbance



4.3

Design for Drought

Implement on-site water reclamation systems

- by collecting rainwater and HVAC condensate
- with greywater and/or blackwater capture for irrigation

Dubai, UAE



Terra, the Sustainability Pavilion was a part of Expo 2020. Desert INK designed a subterranean irrigation system that combines on-site greywater collection with a treated sewage effluent system. The effluent is filtered through an on-site reed bed before being recaptured for irrigation. The system is capable of reducing overall water use by 92% compared against similar sites.



Accommodate Disturbance



4.4

Incorporate Cooling Features for People

swa

Design for the rapid containment of losses

- with early warning systems
- by educating people ahead of a disaster

Melbourne, Australia



This 15-story building façade at 888 Collins Street, designed by Bruce Ramus, broadcasts hourly incoming weather forecasts. At all other times, the façade's 25,000 LEDs are programed to visualize real-time weather conditions collected by a instruments on the rooftop.



Accommodate Disturbance



4.4

Incorporate Cooling Features for People

swa

Lower core body temperature

- ☐ with deep water (a pool)
- ☐ with drinking fountains
- ☐ with new or improved access to swimmable natural water bodies
- ☐ with cooler air
- ☒ with shallow water (urban beach, interactive or immersive water feature, splash pad, scrim, walk in or ground fountain, water curtain, waterfall, water playground, sprayground, wet deck, spray pad, spray park, wet plaza, water play, playable fountain, wading pool)

Tampa, FL



In the United States, Florida is projected to see the biggest increase in the number of days with a heat index of 100 degrees Fahrenheit or above over the next 30 years. Bookended by an assortment of interactive fountains, misters, and splash pads, SWA designed Curtis Hixon Park to help visitors and local Tampa residents stay cool along the city's Riverwalk all summer long.



Accommodate Disturbance



4.4

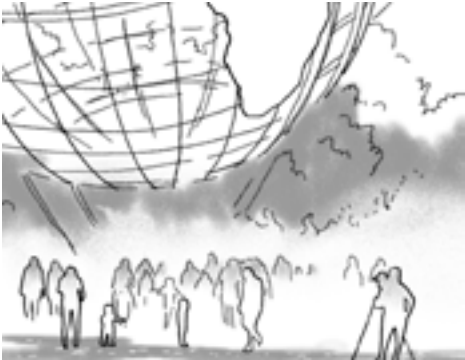
Incorporate Cooling Features for People

swa

Increase the perception of thermal comfort

- with misters or fog effects (mist garden, mist fountain, misting poles, fog fountain, fogscapes)
- with seating using cool surface materials
- with swings for air movement
- by maximizing wind movement in summer

New York City, NY



As part of the renovation of a historic World's Fair site, a 310-ft long reflecting pool was reconstructed as an interactive fog garden designed by Quennell Rothschild & Partners. Fountain of the Fairs' ephemeral, cooling cloud refreshes visitors on hot summer days while conforming to local water usage restrictions of no more than 25 gallons per minute.



Accommodate Disturbance



4.4

Incorporate Cooling Features for People

swa

Block solar radiation

- with shade structures
- by shading the most well-utilized areas of the site with trees

Boston, MA



Reed Hilderbrand's redesign of a formerly paved traffic island involved committing significant design and construction resources to ensuring that the below-grade infrastructure could sustainably support 26 mature mixed-species oaks in the new plaza. The resulting canopy covers 94% of the site and reduces the average ground-level temperature by 10 degrees Fahrenheit.



Accommodate Disturbance



4.5

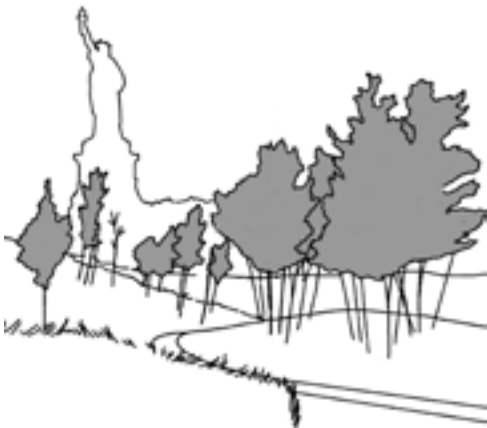
Prioritize Climate-Adapted Vegetation

swa

Select generally robust and regenerative native and non-native plants for climate extremes

(heat, drought, wind, inundation, salt)

New York City, NY



For the Hills at Governor's Island, 54 species of native or locally adapted species were chosen by the West 8-led team. To ensure survival in the harsh harbor environment and a warming climate, salt tolerance, root structure, and ability to thrive in more southern hardiness zones were selected traits. Tree species included those native to maritime oak forest communities including white oak (*Quercus alba*), sweet-bay magnolia (*Magnolia virginiana*), and sassafras (*Sassafras albidum*).



Accommodate Disturbance



4.5

Prioritize Climate-Adapted Vegetation

swa

Select specifically adapted native and non-native plants, according to regional climate projections

Monterrey, Mexico



As water scarcity continues to worsen in Northern Mexico, plants that require irrigation to thrive will become increasingly hard to sustain. SWA's campus master plan for Universidad de Monterrey focused on transitioning away from water-thirsty vegetation to a plant palette of indigenous species including several Mesquite (*Prosopis*) species, as well as non-native trees and shrubs such as Palo Verde (*Parkinsonia florida*) that are naturally drought-tolerant.



Accommodate Disturbance



4.6

Increase Biodiversity

swa

Protect habitat

- with an inventory of the species that existed pre-design and designing site specific conservation and adaptation
- by protecting sensitive habitat areas from increased climatic events such as floods and storm surges along coastal areas and rivers
- by protecting species from heat and chemical pollution (shading streams with topography and vegetative shade to regulate temperature, controlling sediment, etc.)
- with a buffer of aquatic habitat with at least 100' of undeveloped area
- by reducing disturbance from landscape maintenance or maintenance frequency to encourage nesting, mating, and hibernation

Sanya City, China



At Sanya Mangrove Park, Turenscape rehabilitated mangroves using interlocking landform fingers in order to allow tidal fluctuation while avoiding surges from annual tropical storms or direct exposure to polluted urban runoff. This strategy also helped maximize the “edge effects” by ensuring a diversity of water depth--key to improving biodiversity in aquatic shoreline habitats.



Accommodate Disturbance



4.6

Increase Biodiversity

swa

Connect habitat

- with large (2.5 acre+), contiguous, multi-species woodland or grassland plant patches with the maximum amount of interior, or minimum division into smaller patches (no habitat fragmentation)
- by designing for species migration, providing broad corridors and stepping stones to other temperature or precipitation gradients in landscapes less modified by human development (like up a mountain), or providing habitat that offers a range of microclimate refugia
- by connecting large planted patches (2.5 acre+) with other patches via habitat corridors, zones, or a corridor network (wildlife crossing, uninterrupted planted corridor, etc.)

San Antonio, TX



At Hardberger Park Land Bridge, a mixed-use wildlife crossing, STIMSON and Rialto Studio connected two large conservation areas across a six-lane highway. A vegetated corridor provides ample space and protective cover for opossums, deer, rabbits, armadillos, ring-tailed cats, while a separated pathway allows pedestrians to use the same crossing without conflict.



Accommodate Disturbance



4.6

Increase Biodiversity

swa

Increase complexity

(by adding new species to existing monocultures)

Cambridge, MA



By the 1990s, most of the elm trees in Harvard University's main quad had been infected by Dutch Elm Disease. MVVA developed the Harvard Yard Restoration, a long-term solution for replacing the campus canopy with more than 20 tree species pruned to a similar form, paying close attention to site microclimates and preserving the character of the space while escaping the inherent vulnerability of a monoculture.



Accommodate Disturbance



4.6

Increase Biodiversity

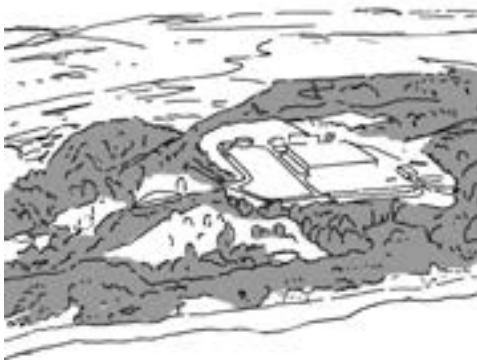
swa

Make or expand quality habitat

for diverse animals, insects, and plants

- ☐ with adequate light, air, and soil for plants
- ☐ with a complex forest edge in plan and section
- ☒ with nesting areas and shelter like snags
- ☐ with water sources
- ☐ with food and forage sources (pollinator-friendly plantings, bird-friendly, etc.)

Wonthaggi, Victoria, Australia



Aspect Studios helped plan and design the Victorian Desalination & Ecological Reserve, a 225-hectare ecological restoration area adjacent to a newly constructed desalination plant. The site, which had been denuded by grazing and mining operations, was revegetated with native species to reconnect an otherwise contiguous coastal habitat corridor.



Accommodate Disturbance



4.7

Build Social Infrastructure

swa

Facilitate social interaction

to engender community building, ownership, mutual aid, and collective well-being

Lawrenceburg, IN



For Lawrenceburg Civic Park, MKSK helped turn a 1.5-acre parking lot into a public park and outdoor entertainment venue. The centerpiece of the park is a performance stage that hosts an annual city concert series. The park is regularly programmed with community activities including a farmer's market, mobile library, Shakespearean plays, movies, and fitness classes.



Accommodate Disturbance



4.7

Build Social Infrastructure

swa

Facilitate socio-economic mixing

to help communities engender tolerance, develop social capital, and share opportunities for upward mobility

Philadelphia, PA



One of the initial project goals for Rail Park was to increase cross-group interaction between area residents with different cultural touchpoints. For phase one of the project, Studio Bryan Hanes reimagined a defunct section of elevated railway as a public promenade. Interactive seating and large wooden platforms establish playful visual connections to the neighborhoods below and shape a variety of options for both small and large gatherings and cross-cultural programming.



Accommodate Disturbance



4.7

Build Social Infrastructure

swa

Listen to feedback from stakeholders

to create places that feel safe and inviting

Colorado Springs, CO



The Colorado Springs Historic Parks Master Plan by Design Workshop, was the result of a yearlong process to reimagine the role of three parks over 150 years old. For local residents, 70% listed the perception of safety as a top concern. In response, the plan called for an increase in programming and space allocation for special events to boost safety and inclusivity.



Accommodate Disturbance



4.7

Build Social Infrastructure

swa

Integrate a community resilience hub or cooling center for support during disaster events

Houston, TX



The Alief Neighborhood Center & Park is a 37-acre public space that combines three municipal facilities—library, park, and rec center—in one location, elevated above the floodplain, as a refuge area for those seeking shelter during severe storms, power outages, or other environmental disturbances. The center is one of many community resilience hubs identified in a city-wide master planning effort led by SWA called Houston Lily Pad Plan.



Accommodate Disturbance



4.7

Build Social Infrastructure

swa

Integrate park space into other climate-ready civic assets

such as libraries, rec centers, police and fire stations, streets, transit areas, and schools

Mississauga, Ontario



MJMA's design of Churchill Meadows Community Centre and Mattamy Sports Park includes generous park space for both active and passive recreation. A walking trail around the perimeter of the park passes by a protected wetland, and connects the park to the surrounding neighborhood and trail network.



Accommodate Disturbance



4.7

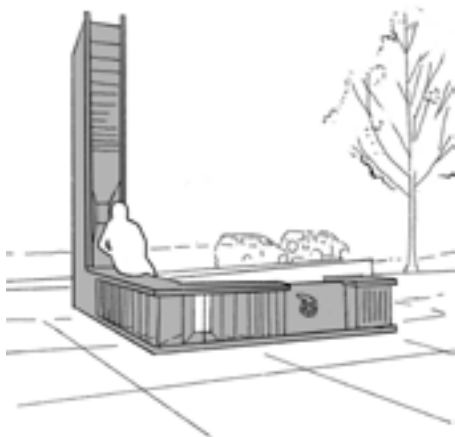
Build Social Infrastructure

swa

Program the site to educate users about climate risks

including what to do and where to go in the event of an emergency

Portland, OR



PREPHubs, a prototype by the Urban Risk Lab at MIT, are designed to increase natural disaster resilience. The off-grid units are strategically placed to activate public spaces. Should a disaster occur, they become nodes to access information and resources, and to connect with loved ones. Networked together, they provide a mesh communication system and serve as physical beacons illuminating evacuation routes.