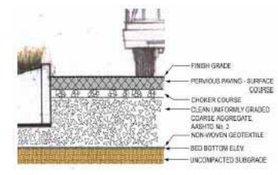
Description	Analysis	Strategy
Stormwater Management		
Porous pavement is a permeable pavement surface with an underlying stone reservoir that temporarily stores surface runoff before infiltrating into the subsoil.	Porous surface replaces traditional pavement, allowing runoff to infiltrate directly into the soil and receive water quality treatment. This reduces runoff impacts, if captured below grade it can be used for irrigation, and also reduces erosion. There are several pavement options, including porous asphalt, pervious concrete, grass pavers, and rock mulch/ decomposed granite. Surface types include open grid paving or decomposed granite with less than 50% average imperviousness. Typically the surface should have a general gradient no steeper than 2.5 % for the rainfall to be retained sufficiently long to infiltrate into the ground, demonstration areas can be steeper. During heavy rainfall events the excess water will be captured by the storm drain system.	**Porous Pavement**  
Sub-grade detention systems are comprised of structurally efficient storage cages fabricated from plastics with porous geotextile wrapping. They are cost effective, easy to install, and require little or no maintenance when properly detailed.	Sub-grade detention reduces runoff impacts, can potentially provide use of rainfall for irrigation and also reduces erosion. By allowing rainfall to run into vegetated swales then infiltrate into sub-grade storage, this method allows for an elegant and cost effective means of detaining peak run-off. This system has the added benefit of being applicable to landscapes that have slopes or soils that would otherwise hamper the effectiveness of on site percolation. In comparison with pervious surfaces, this system is comparatively less effective in filtering of surface borne contaminants and has no intrinsic climate modifying (heat island reduction) potential.	**Sub-Grade Detention** 
Constructed underground system for soil and surface drainage are used to capture stormwater from all impervious surfaces into storm drains for conveyance off site.	Rapid removal of all surface water. Minimal land requirements; also, land above drains is useable, verses a wetland.	**Engineered Storm Sewer System** 

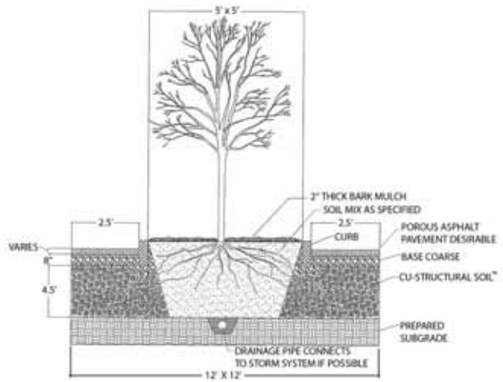
Description	Analysis	Strategy
A composting bin is a container or area designed to hold green waste and other organic materials in a location that can be kept moist, hot, and can be easily turned (mixed) while the material breaks down. Blood meal or manure can be added to accelerate the decomposition rate.	To avoid strong odors, compost must be turned, kept moist, and have exposure to air. Internal temperatures of 130 to 140 degrees F should be maintained. Green waste such as yard clippings will increase temperatures. Sawdust from particle board or pressure treated wood may contain arsenic or formaldehyde which will contaminate the compost. Meat and dairy products will attract vermin. Avoid waste material from walnut or buuternut trees, which contain juglone, known to be toxic to some plants. Maturity test kits can be purchased online or at garden centers.	**Composting Organic Waste** 
Bio-swales consist of a trench or ditch with vegetation and that encourages sub-surface infiltration, similar to infiltration basins and trenches. These areas may occasionally require maintenance and mowing.	Vegetated Filter Strips and Grass Swales utilize vegetation to filter sediment and pollutants from storm water. Strips are appropriate for treating low-velocity surface sheet flows in areas where runoff is not concentrated. LPC has a history of using swales and the current master plan builds on this understanding by coupling swales with a sub-grade detention strategy to absorb overflow events.	**Bio-Swale Filtration** 
Stormwater storage areas are an area of land dedicated to retention/ detention that provides peak runoff storage, infiltration of rainfall into the ground to reduce the flows and impacts of runoff downstream and removal of polluting sediments. These areas are sized depending on the watershed, but are allowed to dry out during summer months providing additional open space.	A Stormwater Pond: • Is of low cost and implements an environmentally sustaining treatment of runoff • Does not require any chemicals and provides groundwater recharge • Provides an opportunity of integration with open and recreation space	**Stormwater Pond/ Storage Area** 

Description	Analysis	Strategy
Alternative Transportation		
By establishing connections with existing public transportation network like the bus, rail and other transportation means, LPC will encourage alternative transportation systems.	Encourage staff to use public transport by offering pre-tax salary deferments for public transport use. Negotiate with public transport providers to provide better services to the campus and provide adequate information on campus such as: • Develop a map showing public transport route connections to LPC • Establish intranet links • Post leaflets on notice boards	**Connection To Public Transport** 
By encouraging bicycle usage, LPC will reduce local road congestion as well as air pollution, noise pollution and helps reduce greenhouse gas emissions.	Design and construct safe bicycle paths and secure bicycle storage areas with convenient changing/ shower facilities for cyclists near major buildings on campus. This reduces the need for impervious surfaces required for parking lots and thereby potential water runoff problems. A significant obstacle to greater cycling on campus was noted to be the lack of transit connections and the adequacy of off-site cycling paths.	**Bicycle Paths/ Storage** 
Alternative internal transportation system will provide an alternative means of low emission transportation within the campus.	The college could create a vehicle emissions free campus by developing an alternative intra-campus transportation network of electric vehicles.	**Alternative Internal Transportation Systems** 

Description	Analysis	Strategy
LPC can reduce pollution and land development impacts from single occupancy vehicle use by providing preferred parking for carpools and/ or vanpools.	A Rideshare Program is designed to reduce the number of single occupant vehicle (SOV) trips to the campus. A major part of this effort is aimed at faculty and staff and is designed to reduce vehicle emissions and to comply with the Federal Clean Air Act. Commute options include carpool, rail-transit, walking, biking and vanpool. A secondary goal of the Rideshare Program is to mitigate parking demand and traffic congestion on the campus.	**Rideshare Program** 
Electric or hybrid vehicles use low polluting, non-gasoline fuels such as electricity, hydrogen, propane or compressed natural gas. Efficient gas-electric hybrid vehicles are also included in this category.	Electric and Hybrid vehicles do not contribute to noise pollution and have lower emissions relative to internal combustion engines. Provide priority parking and install an adequate number of easy-to-use refueling stations for alternative fuel vehicles or investigate the possibility of sharing facilities with other partners in close vicinity.	**Electric Or Hybrid Vehicles** 

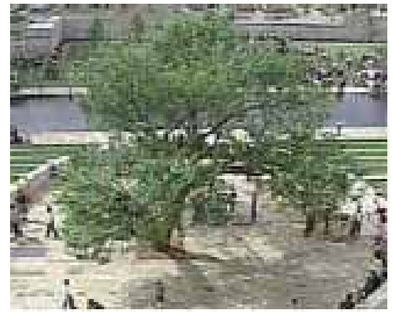
Heat Island Effect

Tree shading of asphalt parking lots and 20% minimum shading of new parking lots minimize heat island effect.	These shading percentages would need to be higher if the extent of parking surface constructed with pervious surfaces cannot be achieved.	**Shading Parking Lots** 

Description	Analysis	Strategy
Increase parking lot planter "islands" to reduce heat island effect at existing parking lots. A square or "diamond" planter inserted at the intersection of four parking stalls allows for the incorporation of shade trees in dense lots and does not impact the number of existing stalls.	Given the significance of the extensive and unplanted parking stall density at LPC parking lots, and the massive asphalt surfacing of the existing lots, the incorporation of planters is a principal strategy for Heat Island Reduction, improving the appearance and performance of the site. New trees should be introduced to help alleviate solar heat gain. Based on research from Cornell's Urban Horticulture Institute, a reasonable 'rule-of-thumb' is to plan for two cubic feet of soil per square foot of crown projection. For a tree with a 20' diameter canopy, existing asphalt should be removed to create at least a 12'x12'x4.5' deep pit. The preferable method would be to introduce Cornell's Structural Soils into the tree planting pit. A minimum 5'x5' planter shall remain open at the surface for planting. A native and drought tolerant tree species shall be selected. (See plant palette)	**Parking Lot Planter**  TREE IN RETROFIT PARKING LOT ISLAND
Heat Island Effects occur as a result of solar energy retention on constructed surfaces. Principle surfaces that contribute to the heat island effect include streets, sidewalks, parking lots and buildings. Shaded west building faces are especially effective in reducing Heat Island effects, as they mitigate the effect of late afternoon sun on the building cooling system (typically the peak cooling hours).	Trellises and other exterior structures can support vegetation to shade parking lots, walkways and plazas. The result is a comfortable exterior gathering space, improved indoor working conditions, and a significantly reduced building cooling loads. The College has excellent existing examples of shaded walkways, as growth continues, the campus should continue the use of shaded circulation space via built structure with or without plant material.	**Shaded Walkways** 
Fenestrations (openings in buildings) are normally placed to provide a view of the outdoors and for the admission of daylight illumination to the interior. Along with these generally desirable features come solar radiant heat gain (generally desirable in winter and undesirable in summer) and conductive heat transfer. The latter adds to the cost of heating the building in winter and cooling it in summer. Daylight illumination, while generally desirable, can also be a source of unwanted glare. The solar heat gain accompanying it can induce occupant discomfort as well as increased air conditioning costs. Designing, orienting, shading, and sizing windows to increase their benefits while reducing problems (glare, overheating, condensation, cold draft, large heating or cooling loads) is an important goal of the building designer.	At on site locations where tree planting is not possible, using optimized fenestration details or vegetation to shade buildings should be encouraged. This would also add to the psychological and physical comfort of students. Vegetation reduces the heat gain via shading and evapotranspiration, effectively creating a 'double skin' at building perimeters. Vegetated west building faces are especially effective as they minimize the effect of late afternoon sun on the building cooling system (typically the peak cooling hours).	**Building Exteriors** 

Design Strategies – Site Design & Planning

Exhibit S-01

Description	Analysis	Strategy
The use of deciduous vegetation can provide shade during the summer months, while allowing the infiltration of light (and heat gain) during the cooler months (when the vegetation loses its leaves).	Trees, in addition to serving as carbon-sinks, reduce the required cooling and therefore the energy consumption of the surrounding buildings. Trees alter the environment in which we live by moderating climate, improving air quality, conserving water, and harboring wildlife. Climate control is obtained by altering the effects of sun, wind, and rain. The more compact the foliage on the tree or group of trees, the greater the influence of the windbreak. Leaves filter the air we breathe by removing dust and other airborne particulates. Rain washes the pollutants to the ground. Leaves absorb carbon dioxide from the air to form carbohydrates that are used in the plant's structure and function. In this process, leaves also absorb other air pollutants - such as ozone, carbon monoxide, sulfur dioxide, and give off oxygen.	**Deciduous Trees/Climate Control** 
Specify high albedo (high reflectance) materials to reduce heat absorption.	LPC has the opportunity to facilitate and incorporate lighter colored paving materials in all new parking lots, minimizing solar heat gain. Dark paving materials absorb heat, making the walkways and parking lots warmer in summer months, whereas light colored paving reflects heat providing a more comfortable environment. Light colored paving can also last longer because it does not thermally expand and contract as much as darker colors.	**Light Colored Paving** 

Reflective Roof Materials

Reflective and High Emittance roof materials reflect more light upwards which alleviates heat gain. The greater ease with which a surface gives up (emits) its heat, the cooler it becomes.	Reflective materials reduce heat island effects, must exhibit a high solar reflectance, and a high thermal emittance over the life of the product. High albedo (reflectance) materials reduce heat absorption and also reduce the annual cooling energy use in almost all climates. Visit the energy star website http:// www. energystar.gov to look for compliant roofing products and the Cool Roof Rating Council website http:// www. coolroofs.org for references.	**Reflective & High Emittance Roof** 

Description

The benefits of vegetation can be extended to surfaces above ground. By shading a building's roof, a green roof will reduce radiant heat transfer into a building by replacing highly-absorbent roofing materials (e.g. asphalt/ bitumen) with a layer of vegetation. (Typical summer air temperatures can increase the surface temperature of a gravel roof to 140-175 degrees F).

The temperature of an equivalent green roof will be 10 to 20 degrees F cooler, resulting in significant energy cost savings. By reducing annual temperature swings, degradation of the roof structure is slowed in comparison to a conventional roof. Maintenance and replacement costs are also reduced.

Analysis

Heat absorbed by the vegetation is used in the process of photosynthesis, reducing maximum summer air temperatures within the microclimate of the building. In addition the vegetation filters air moving across the surface of the roof. 10 sq.ft. of grass roof can remove approximately 0.4 lb of airborne particulates from the air every year.

Use of native plants on the green roof could reduce the use of irrigation required and also reflect seasonal changes.

Strategy

Green Roof

Light Pollution Reduction

Effective and efficient site lighting improves aesthetics, reduces energy use and maintenance, reduces light pollution to adjacent sites, and preserves the night sky.

Provide site lighting appropriate for the security needs of the site while maintaining an overall "low-lighting profile" for the complex. Use high efficiency lighting (metal halide or high pressure sodium lamps) with low cut off angles and down lighting for landscaping. Utilize reflective-type lighting fixtures to reduce or eliminate glare and provide safer, more human-scaled nightscapes. To reduce dependence on high-wattage electrical lighting at night, use light colored or reflective edges along driveways or walkways.

Shielded Fixtures