LEED Green Associate
Activity #4 – Sustainable Sites (SS)
Before completing this Activity Read: GA02 - Pgs. 137-138 & GA09 – Pgs. 31-50 (see lorisweb.com)

Note the following abbreviations are used in this activity:
NC LEED BD+C: New Construction and Major Renovation
CS LEED BD+C: Core and Shell Development
S LEED BD+C: Schools
R LEED BD+C: Retail
DC LEED BD+C: Data Centers
WDC LEED BD+C: Warehouses and Distribution Centers
HOS LEED BD+C: Hospitality
HC LEED BD+C: Healthcare

Although the LEED BD+C reference guide does not number the LEED prerequisites and credits, for this exercise they have been numbered in the order presented in the credit category.

Fill-In, Multiple Choice, Matching

1. Test your knowledge of how well you know the names of the credits for the Sustainable Sites (SS) credit category:

LEED BD+C: NC, CS, S, R, DC, WDC, HOS, HC	
Credit	Name
P1	
C1	
C2	
C3	
C4	
C5	
C6	
LEED BD+C: Core and Shell Development	
C7	
LEED BD+C: Schools	
P2	
C7	
C8	
LEED BD+C: Healthcare	
P2	
C7	
C8	

2. Match the intent shown below to the prerequisite or credit:

LEED BD+C: NC, CS, S, R, DC, WDC, HOS, HC

Credit	ANS
SS – P1	
SS – C1	
SS – C2	
SS – C3	
SS – C4	
SS – C5	
SS – C6	
LEED BD+C: CS	
SS – C7	
LEED BD+C: S	
SS – P2	
SS – C7	
SS – C8	
LEED BD+C: HC	
SS – P2	
SS – C7	
SS – C8	

	INTENT
A	To assess site conditions before design to evaluate sustainable options and inform related decisions about site design.
B	To protect the health of vulnerable populations by ensuring that the site is assessed for environmental contamination and that any environmental contamination has been remediated.
C	To provide patients and staff with the health benefits associated with direct access to the natural environment.
D	To minimize effects on microclimates and human and wildlife habitats by reducing heat islands.
E	To reduce runoff volume and improve water quality by replicating the natural hydrology and water balance of the site, based on historical conditions and undeveloped ecosystems in the region.
F	To integrate the school with the community by sharing the building and its playing fields for nonschool events and functions.
G	To increase night sky access, improve nighttime visibility, and reduce the consequences of development for wildlife and people.
H	To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.
I	To educate tenants in implementing sustainable design and construction features in their tenant improvement build-outs.
J	To provide patients, staff, and visitors with the health benefits of the natural environment by creating outdoor places of respite on the healthcare campus.
K	To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation, and airborne dust.
L	To create exterior open space that encourages interaction with the environment, social interaction, passive recreation, and physical activities.
M	To ensure that the sustainable site benefits achieved by the project continue, regardless of future changes in programs or demographics.

3. Rainwater runoff carries such pollutants as _____, _____, _____, and lawn _____ directly to streams and rivers, where they contribute to _____ and harm aquatic ecosystems and species.

4. Abbreviation Name
   BUG _____

5. SS Prerequisite Construction Activity Pollution Prevention requirements:
   Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the _____
   or _____ equivalent, whichever is more _____. Projects must apply the _____ regardless of size. The plan must describe the measures implemented.

6. Abbreviation Name
   ESC _____

   CGP _____

7. List the three objectives that the Erosion and Sedimentation (ESC) plan must accomplish:

   1.

   2.

   3.

8. SS Prerequisite Environmental Site Assessment applies to _____ and _____.

9. SS Prerequisite Environmental Site Assessment requires:
   Conduct a Phase ___ Environmental Site Assessment as described in ASTM _____ (or a local equivalent) to determine whether environmental contamination _____ at the site. If contamination is _____, conduct a Phase _____ Environmental Site Assessment as described in _____ (or a local equivalent).

   If a site is _____, _____ the site to meet local, state, or national environmental protection agency region _____ (unrestricted) standards, whichever are most _____.

10. Abbreviation Name
    ESA _____

11. SS Credit Site Assessment requires:
    Complete and document a _____or _____that includes the following information:
    _____. Contour mapping, unique topographic features, slope stability risks.
    _____. Flood hazard areas, delineated wetlands, lakes, streams, shorelines, rainwater collection and reuse opportunities, TR-55 initial water storage capacity of the site (or local equivalent for projects outside the U.S.).
    _____. Solar exposure, heat island effect potential, seasonal sun angles, prevailing winds, monthly precipitation and temperature ranges.
    _____. Primary vegetation types, greenfield area, significant tree mapping, threatened or endangered species, unique habitat, invasive plant species.

_____. Natural Resources Conservation Service soils delineation, U.S. Department of Agriculture prime farmland, healthy soils, previous development, disturbed soils (local equivalent standards may be used for projects outside the U.S.).
_____. Views, adjacent transportation infrastructure, adjacent properties, construction materials with existing recycle or reuse potential.
_____. Proximity of vulnerable populations, adjacent physical activity opportunities, proximity to major sources of air pollution.

The survey or assessment should demonstrate the relationships between the site features and topics listed above and how these features influenced the project _____; give the reasons for not addressing any of those topics.

12. SS Credit Site Development – Protect or Restore Habitat requirements:
Preserve and protect from all development and construction activity _____ of the _____ area on the site (if such areas exist).

AND

Option 1. On-Site Restoration (2 points except Healthcare, 1 point Healthcare)
Using _____ or _____ vegetation, restore _____ (_____the building footprint) of all portions of the site identified as _____ developed. Projects that achieve a density of _____ floor-area ratio may include vegetated _____ surfaces in this calculation if the plants are native or adapted, provide _____, and promote biodiversity.

Restore all disturbed or compacted soils that will be _____ within the project's _____ to meet the following requirements:
Soils (_____ and _____) must be reused for functions comparable to their original function.
Imported _____ or soil blends designed to serve as topsoil may not include the following:
soils defined regionally by the Natural Resources Conservation Service web soil survey (or local equivalent for projects outside the U.S.) as _____ farmland, _____ farmland, or farmland of statewide or local importance;
or soils from other _____ sites, unless those soils are a byproduct of a construction process.
Restored soil must meet the criteria of reference soils in categories 1–3 and meet the criteria of either category 4 or 5:

1. _____ matter;
2. _____;
3. _____ rates;
4. soil _____ function; and
5. soil _____ characteristics.

Project teams may _____ vegetated landscape areas that are constructed to accommodate _____ _____ from the vegetation and soils requirements, provided all such rainwater infiltration areas are treated consistently with SS Credit Rainwater Management.

Schools only:
Dedicated _____ fields that are _____ for athletic uses are _____ from the soil restoration criteria. These areas may _____ count toward the minimum required area.

OR

Option 2. Financial Support (1 point)
Provide _____ support equivalent to at least _____ per square foot (US$4 per square meter) for the total site area (_____ the building footprint).

Financial support must be provided to a _____ or _____ recognized land _____ or _____ organization within the same EPA Level III ecoregion or the project's state (or within _____ miles of the project [160 kilometers] for projects outside the U.S.). For U.S. projects, the land trust must be accredited by the _____.

13. Restoration must use _____ or _____ vegetation.

14. SS Credit Open Space requirements:
Provide outdoor space greater than or equal to _____ of the total site area (including building footprint). A minimum of _____ of that outdoor space must be vegetated (turf grass does not count as vegetation) or have overhead vegetated canopy.

The outdoor space must be _____ accessible and be one or more of the following:
a _____-oriented paving or turf area with physical site elements that accommodate outdoor social activities;
a _____-oriented paving or turf area with physical site elements that encourage physical activity;
a _____-space with a diversity of vegetation types and species that provide opportunities for year-round visual interest;
a _____-space dedicated to _____-gardens or urban food production;
_____ or _____ habitat that meets the criteria of SS Credit Site Development—Protect or Restore Habitat and also includes elements of _____ interaction.

For projects that achieve a density of _____ floor-area ratio (FAR), and are _____ accessible, _____ or _____ vegetated roofs can be used toward the minimum _____ vegetation requirement, and qualifying roof-based physically accessible paving areas can be used toward credit compliance.

_____ or naturally designed _____ may count as open space if the side slope gradients average _____ (vertical : horizontal) or less and are _____.

<u>For projects that are part of a multitenant complex only</u>
Open space can be either _____ to the building or at _____ location in the site _____ plan. The open space may be at another master plan development site as long as it is _____ from development. If the open space is not adjacent to the building, provide documentation showing that the requirements have been met and the land is in a natural state or has been returned to a natural state and _____ for the _____ of the building.

15. SS Credit Rainwater Management requirements:
Option 1. Percentile of Rainfall Events
Path 1. _____th Percentile (___ points except Healthcare, 1 point Healthcare)
In a manner best replicating _____site hydrology processes, manage on site the _____ from the developed site for the _____th percentile of _____ or local rainfall events using _____(LID) and _____.

Use _____ rainfall data and the methodology in the U.S. Environmental Protection Agency (EPA) Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act to determine the _____th percentile amount.

Or

Path 2. _____th Percentile (___ points except Healthcare, 2 points Healthcare)
Achieve Path 1 but for the _____th percentile of regional or local rainfall events, using LID and green infrastructure.

Or

Path 3. _____ Lot Line projects only—____th Percentile (3 points except Healthcare, 2 points Healthcare)
The following requirement applies to zero lot line projects in _____ areas with a minimum density of _____ FAR. In a manner best replicating natural site hydrology processes, manage on site the runoff from the developed site for the _____th percentile of regional or _____ rainfall events, using LID and green infrastructure.

OR

Option 2. Natural Land Cover Conditions (3 points except Healthcare, 2 points Healthcare)
Manage on site the _____ increase in runoff _____ from the _____ land cover condition to the _____condition.

Projects that are part of a multitenant complex only
The credit requirements may be met using a _____ approach affecting the defined project site that is within the _____ plan boundary. Distributed techniques based on a _____ approach are then required.

16. Abbreviation Name
    GI _____
    LID _____

17. SS Credit Heat Island Reduction requirements:
    Choose one of the following options:

    Option 1. Nonroof and Roof (2 points except Healthcare, 1 point Healthcare)
    Meet the following criterion:
    Complete the Equation:

Area of Nonroof Measures		Area of High-Reflectance Roof		Area of Vegetated Roof				
_____	+	_____	+	_____	+	≥	Total Site Paving Area +	Total Roof Area

    Alternatively, an _____ and _____ weighted average approach may be used to calculate compliance.

    Use any combination of the following strategies.

    Nonroof Measures
    Use the existing plant material or install plants that provide _____ over paving areas (including playgrounds) on the site within _____ years of planting. Install vegetated _____. Plants must be in place at the time of _____ permit and cannot include _____ turf.

Provide shade with _____ covered by _____ generation systems, such as solar thermal _____, _____, and _____ turbines.

Provide shade with _____ devices or structures that have a _____ aged solar reflectance (SR) value of at least _____. If three-year aged value information is not available, use materials with an initial SR of at least _____ at installation.

Provide _____ with vegetated structures.

Use _____ materials with a three-year aged solar reflectance (SR) value of at least _____. If three-year aged value information is not available, use materials with an initial SR of at least _____ at installation.

Use an _____ pavement system (at least _____ unbound).

High-Reflectance Roof

Use roofing materials that have an _____ equal to or greater than the values in Table 1. Meet the three-year aged SRI value. If three-year aged value information is not available, use materials that meet the initial SRI value.

Complete Table 1. Minimum solar reflectance index value, by roof slope

Table 1. Minimum solar reflectance index value, by roof slope

	Slope	Initial SRI	3-year aged SRI
Low-sloped roof	≤ 2:12		
Steep-slope roof	> 2:12		

Vegetated Roof

Install a _____ roof.

OR

Option 2. Parking under Cover (1 point)

Place a minimum of _____ of parking spaces under _____. Any roof used to shade or cover parking must (1) have a three-year aged SRI of at least _____ (if three-year aged value information is not available, use materials with an initial SRI of at least _____ at installation), (2) be a _____ roof, or (3) be covered by _____, such as solar thermal collectors, photovoltaics, and wind turbines.

18. List examples of a project site's hardscape:

    1.

    2.

    3.

    4.

19. Read about extensive and intensive green roofs here, http://www.greenrooftechnology.com/green-roof-types

20. SS Credit Light Pollution Reduction requirements:
    Meet _____ and light _____ requirements, using either the backlight-uplight-glare (_____) method (Option 1) or the _____ method (Option 2). Projects may use different options for _____ and light _____.

Meet these requirements for all _____ luminaires located inside the project _____ (except those listed under "Exemptions"), based on the following:
the photometric characteristics of each luminaire when mounted in the same _____ and _____ as specified in the project design; and
the lighting _____ of the project property (at the time construction begins). Classify the project under _____ lighting zone using the lighting zones definitions provided in the Illuminating Engineering Society and International Dark Sky Association (IES/IDA) Model Lighting Ordinance (MLO) User Guide.

Additionally, meet the internally illuminated signage requirement.

Abbreviation	Name
BUG	_____
MLO	_____

Uplight
OPTION 1. BUG Rating Method
Do not exceed the following luminaire uplight ratings, based on the specific light source installed in the luminaire, as defined in _____, Addendum A.

Complete Table 1. Maximum uplight ratings for luminaires

Table 1. Maximum uplight ratings for luminaires

MLO lighting zone	Luminaire uplight rating

OR
OPTION 2. Calculation Method
Do not exceed the following percentages of total _____ emitted above _____.

Complete Table 2. Maximum percentage of total lumens emitted above horizontal, by lighting zones

Table 2. Maximum percentage of total lumens emitted above horizontal, by lighting zones

MLO lighting zone	Maximum allowed percentage of total luminaire lumens emitted above horizontal

AND

Light Trespass

OPTION 1. BUG Rating Method

Do not exceed the following luminaire _____ and _____ ratings (based on the specific light source installed in the luminaire), as defined in IES TM-15-11, Addendum A, based on the _____ location and _____ from the lighting _____.

Complete Table 3. Maximum backlight and glare ratings

Table 3. Maximum backlight and glare ratings					
	MLO lighting zone				
Luminaire mounting					
	Allowed backlight ratings				
> __ mounting heights from lighting boundary	B1	B3	B4	B5	B5
__ to __ mounting heights from lighting boundary and properly oriented	B1	B2	B3	B4	B4
____to __ mounting height to lighting boundary and properly oriented	B0	B1	B2	B3	B3
< ____ mounting height to lighting boundary and properly oriented	B0	B0	B0	B1	B2
	Allowed glare ratings				
Building-mounted > __ mounting heights from any lighting boundary	G0	G1	G2	G3	G4
Building-mounted __–__ mounting heights from any lighting boundary	G0	G0	G1	G1	G2
Building-mounted ____ to __ mounting heights from any lighting boundary	G0	G0	G0	G1	G1
Building-mounted < ____ mounting heights from any lighting boundary	G0	G0	G0	GO	G1
_____ other luminaires	G0	G1	G2	G3	G4

The _____ boundary is located at the _____ lines of the property, or properties, that the LEED _____ occupies.

The lighting boundary can be _____ under the following conditions:

When the property line is adjacent to a _____ area that is a _____, _____, _____, or _____ lot, the lighting boundary may be moved to _____ feet (1.5 meters) beyond the property line.

When the property line is _____ to a _____ street, _____ , or _____ corridor, the lighting boundary may be moved to the _____ line of that street, alley, or corridor.

When there are _____ properties owned by the _____ entity that are _____ to the property, or properties, that the LEED project is within and have the same or higher _____ lighting zone designation as the LEED project, the lighting boundary may be _____ to include those properties.

Orient all luminaires less than _____ mounting heights from the lighting boundary such that the _____ points toward the nearest lighting boundary line. Building-mounted luminaires with the backlight oriented toward the building are _____ from the backlight rating requirement.

OR

OPTION 2. Calculation Method
Do not exceed the following _____ illuminances at the lighting boundary (use the definition of lighting boundary in Option 1). Calculation points may be no more than _____ feet (1.5 meters) apart. Vertical illuminances must be calculated on vertical planes running _____ to the lighting boundary, with the _____ to each plane oriented toward the _____ and _____ to the lighting boundary, extending from grade level to _____ feet (10 meters) above the height of the _____ luminaire.

Complete Table 4. Maximum vertical illuminance at lighting boundary, by lighting zone

Table 4. Maximum vertical illuminance at lighting boundary, by lighting zone

MLO lighting zone	Vertical illuminance

FC = _____

AND

Internally Illuminated Exterior Signage
Do not exceed a luminance of _____ cd/m2 (nits) during _____ hours and _____ cd/m2 (nits) during _____ hours.

Exemptions from Uplight and Light Trespass Requirements
The following exterior lighting is exempt from the requirements, provided it is controlled _____ from the nonexempt lighting:
specialized signal, directional, and marker lighting for _____;
lighting that is used solely for _____ and _____ lighting in MLO lighting zones ___ and ___, and is _____turned off from _____ until _____ a.m.;
lighting for _____ purposes for stage, film, and video performances;
government-mandated _____ lighting;
_____ emergency departments, including associated _____;
lighting for the national _____ in MLO lighting zones ___, ___, or ___; and
_____ illuminated signage.

21. SS Credit Site Master Plan applies to: _____

22. SS Credit Site Master Plan requirements
The project must achieve at least _____ of the following six credits, using the associated calculation methods. The achieved credits must then be _____ using the data from the master plan.

LT Credit: _____

SS Credit: _____

SS Credit: _____

SS Credit: _____

SS Credit: _____

SS Credit: _____

A site _____ plan for the school must be developed in collaboration with school _____. Previous sustainable site design measures should be considered in all master-planning efforts so that existing infrastructure is _____ whenever possible. The master plan must therefore include _____ construction activity plus _____ construction (within the building's lifespan) that affects the site. The master plan development footprint must also include _____, _____, and _____.

Projects where no _____ development is planned are _____ eligible for this credit.

23. SS Credit Tenant Design and Construction Guidelines applies to: _____

24. SS Credit Tenant Design and Construction Guidelines requirements:
Publish for tenants an _____ document with the following content, as applicable:
a description of the sustainable design and construction features incorporated in the core and shell project and the project's sustainability _____ and _____ , including those for tenant spaces; recommendations, including examples, for sustainable strategies, products, materials, and services; and information that _____ a tenant to _____ space design and construction with the building systems when pursuing the following LEED v4 for _____ Design and Construction prerequisites and credits:
WE Prerequisite: Indoor _____ Use Reduction
WE Credit: Indoor _____ Use Reduction
EA Prerequisite: _____ Energy Performance
EA Prerequisite: _____ Refrigerant Management
EA Credit: _____ Energy Performance
EA Credit: _____ Energy Metering
EA Credit: _____ Energy Production
EA Credit: _____ Refrigerant Management
MR Prerequisite: Storage and Collection of _____
EQ Prerequisite: _____ Indoor Air Quality Performance
EQ Prerequisite: Environmental Tobacco _____ Control
EQ Credit: _____ Indoor Air Quality Strategies
EQ Credit: _____-Emitting Materials
EQ Credit: _____ Indoor Air Quality Management Plan
EQ Credit: _____ Air Quality Assessment
EQ Credit: _____ Comfort
EQ Credit: _____ Lighting
EQ Credit: _____
EQ Credit: _____ Views
EQ Credit: _____ Performance
Provide the guidelines to all tenants _____ signing the _____.

25. SS Credit Places of Respite applies to: _____

26. SS Credit Places of Respite requirements:
Provide places of respite that are accessible to _____ and _____, equal to _____ of the net usable program area of the building.

Provide additional dedicated places of respite for _____, equal to _____ of the net usable program area of the building.

Places of respite must be _____, or be located in interior _____, _____, _____, or _____ spaces; such interior spaces may be used to meet up to _____ of the required area if _____ of each qualifying space's gross floor area achieves a direct line of sight to _____ views of _____.

All areas must meet the following requirements.
The area is accessible from within the building or located within _____ feet (60 meters) of a building _____ or _____ point.

The area is located where no _____ intervention or direct medical care is delivered.

Options for _____ or _____ sun are provided, with at least one seating space per _____ square feet (18.5 square meters) of each respite area, with one _____space per _____ seating spaces.

Horticulture therapy and other specific clinical or special-use gardens unavailable to all building occupants may account for no more than _____ of the required area.

Universal-access natural trails that are available to _____, _____, or _____ may account for no more than _____ of the required area, provided the trailhead is within _____ feet (60 meters) of a building _____.

Additionally, outdoor areas must meet the following requirements.
A minimum of _____ of the total outdoor area must be _____ at the ground plane (not including turf grass) or have overhead vegetated _____.

The area is open to _____ air, the _____, and the _____ elements.

Signage must meet the 2010 FGI Guidelines for Design and Construction of Health Care Facilities (Section 1.2-6.3 and Appendix A1.2-6.3:_____).

Places of respite may not be within _____ feet (7.6 meters) of a _____ area (see EQ Prerequisite Environmental Tobacco Smoke Control).

_____ places of respite on the hospital campus may qualify if they otherwise meet the credit requirements.

27. SS Credit Direct Exterior Access applies to: _____

28. SS Credit Direct Exterior Access requirements:
Provide direct _____ to an exterior _____, _____, _____, or _____. The space must be at least _____ square feet (0.5 square meters) per patient for _____ of all _____ and _____ of qualifying _____whose clinical length of stay (LOS) exceeds _____ hours. Patients whose length of stay exceeds four hours, and whose treatment makes them unable to _____, such as emergency, stage 1 surgical recovery, and critical care patients, may be _____.

Places of respite outside the building _____ that meet the requirements of SS Credit Places of Respite that are immediately _____ to clinical areas or with direct access from _____ units may be included.
Qualifying spaces must be designated as _____. The spaces must also meet the requirements for outdoor air contaminant concentrations enumerated in EQ Credit Enhanced Indoor Air Quality Strategies, Option 2 and be located more than _____ feet (30 meters) from building _____ air locations, loading _____, and roadways with _____ vehicles.

29. SS Credit Joint Use of Facilities applies to: _____

30. SS Credit Joint Use of Facilities requirements:
OPTION 1. Make Building Space Open to the General Public (1 point)
In collaboration with the school _____, ensure that at least _____ of the following types of spaces in the school are _____ to and available for shared use by the general _____:

_____;

_____;

_____;

one or more _____;

_____fields and _____; and

joint _____.

Provide access to _____ in joint-use areas after normal school hours.

OR

Option 2. Contract with Specific Organizations to Share Building Space (1 point)
In collaboration with the school authorities, contract with _____or other organizations to provide at least _____ types of _____-use spaces in the building, such as the following:

commercial _____;

_____ clinic;

_____ service centers (provided by state or local offices);

_____ office;

_____ or _____ center;

_____ lot; and

one or more _____ businesses.

Provide access to _____ in joint-use areas after normal school hours.

OR
Option 3. Use Shared Space Owned by Other Organizations (1 point)
In collaboration with the school authorities, ensure that at least _____ of the following six types of spaces that are owned by _____ organizations or agencies are accessible to _____:

_____;

_____;

_____;

one or more _____;

_____ pool; and

_____ fields and stadiums.

Provide _____ pedestrian access to these spaces from the school. In addition, provide _____ joint-use _____ with the other organizations or agencies that stipulate how these spaces will be shared.