Western
UNIVERSITY · CANADA

Sustainable Design Guidelines Background Report

January 2016

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Sustainable Design Guidelines

01. INTRODUCTION

1.0 INTRODUCTION

Western University is committed to designing, building and operating facilities that minimize natural resource consumption and emissions to the natural environment while fulfilling the building's purpose (e.g., research, teaching, administrative etc.) and maintaining a healthy environment for its occupants. Within this context, Western commissioned the development of the Sustainable Design Guidelines (herein the 'Guidelines') to ensure that all capital projects, major and minor, on campus assist the University in achieving its sustainability goals. The intent of the Guidelines is to establish a sustainable design foundation for all future projects, which will be compatible with rating systems such as the LEED Green Building Rating System.

As signatory to the Council of Ontario Universities' Formal Declaration of Commitment to Environmental Sustainability and to the Talloires Declaration—a global action plan signed by more than 350 university presidents— the Guidelines will serve as an important tool for accelerating performance of Western's built portfolio. The Guidelines will also support Western in achieving its established energy, carbon, and water reduction goals for the campus, including the following targets:

- Achieve a 9% reduction in energy use intensity (ekWh/m^2) below 2012's levels;
- Reduce overall energy use by 4% below 2012's use;
- Reduce direct greenhouse gas emissions below 2009 baseline; and
- Reduce water use intensity (m^3/m^2) by 8% below 2012's levels.

1.1 Methodology and Approach

The development of the Sustainable Design Guidelines included the following key research steps:

1. A marketplace review of industry trends and best practices relating to sustainable design standards within the context of higher education institutions and municipalities was undertaken to identify leading policies, standards, and programs;
2. Analysis of Western's LEED certified projects was conducted to determine key performance criteria that should form potential minimum performance requirements in the Guidelines;
3. A stakeholder workshop was held to present findings from the marketplace review and to discuss design, construction, operations and maintenance challenges and opportunities experienced on Western's campus; and
4. Development of the Guidelines and Checklist was completed based on the above research.

The Guidelines are intended to serve as a standalone document that can be incorporated into Requests for Proposals and for project teams to consult as part of the design and construction of future projects on campus.

Additional resources are provided for campus and design team stakeholders in an Appendix.

02. SUSTAINABILITY INDUSTRY TRENDS

2.0 SUSTAINABILITY INDUSTRY TRENDS

Sustainable design is evolving rapidly across sectors including buildings, infrastructure, consumer products, and services. In North America, social and corporate responsibility are leading regulatory and code changes, with many voluntary programs at the forefront of innovation and performance. In Canada and North America, owners of real estate assets are acknowledging that investment in infrastructure must respond to intensifying environmental and social pressures to protect assets over the long term and support the health of humans and planetary systems at all scales. The following summary describes relevant trends in sustainability practice, discourse and thought leadership, to set the context for the Western Sustainable Design Guidelines.

2.1 Systems Thinking and Regenerative Design

Emerging approaches to sustainable design acknowledge the limitations of the past and current fragmented methods which have prioritized 'doing less harm' within the confines of a business as usual. Rating systems and frameworks have evolved to help us benchmark performance at specific scales, but to date have not recognized the opportunity of the built environment to restore, repair or regenerate our social, environmental or economic systems. The concept of Regenerative Design attempts to formalize an approach that can 'restore and regenerate' through the consideration of whole systems, where built environment interventions can be leveraged for transformational design. Regenerative Design also acknowledges that buildings must be connected to the communities and ecological systems in which they exist; the best opportunities for efficiency, vibrancy and restoration must reach beyond the boundaries of buildings alone to build robust local networks that leverage outputs of one process as inputs for another.

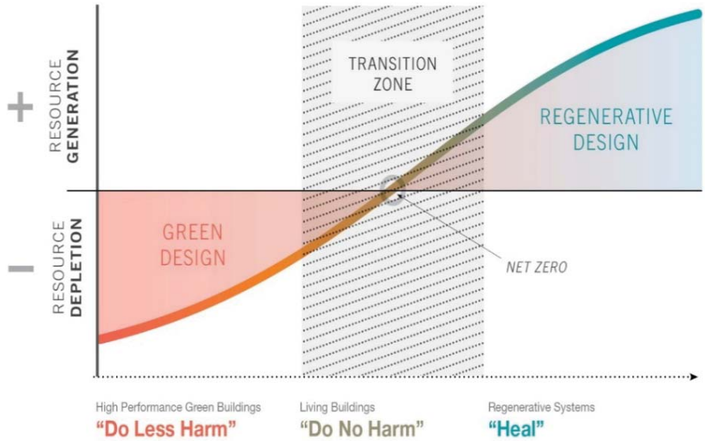


Figure 1: Trajectory of Building Design Extrapolated from the work of Dr. Raymond Cole, UBC and Bill Reed, Regenesis Group

2.2 Life Cycle Assessment (LCA)

In support of a strong systems approach, life cycle assessment methods are gaining traction as an important tool and are now embedded within several common green building rating systems and encouraged through municipal and provincial level policies and incentives. The impact of embodied energy is now considered and strongly acknowledged within the LEED v4 Green Building Rating System, and other product and material certification programs such as Cradle to Cradle, SMART Certification and the Environmental Product Declaration (EPD) program. Life cycle impacts of material choices can now be evaluated within building information management (BIM) software and the industry is demanding transparency around material extraction location, methods, transportation mode and social responsibility.

2.3 Energy and Carbon

Carbon emissions are recognized in the scientific, design and political community to be the most important contributor to climate change and poor air quality across the globe. Buildings and associated transportation infrastructure contribute more than half of the emissions to the atmosphere, giving designers, engineers, building owners and other professionals practicing in associated industries direct influence over eliminating or minimizing future impact of emissions.

In 2007, the American Institute of Architects (AIA) launched the 2030 Challenge, asking design professionals to commit to designing for reduced emissions in building infrastructure by increments of 10% in 5 year intervals until 2030, when all buildings must target carbon neutral. Committing to the 2030 Challenge requires public reporting of progress annually. In 2015, the 2030 Challenge increment goal increased to require a 70% savings over the regional or national average, and will require 80% savings by 2020. It is imperative that building owners acknowledge the impact of today's new infrastructure on the future, and design to support it.

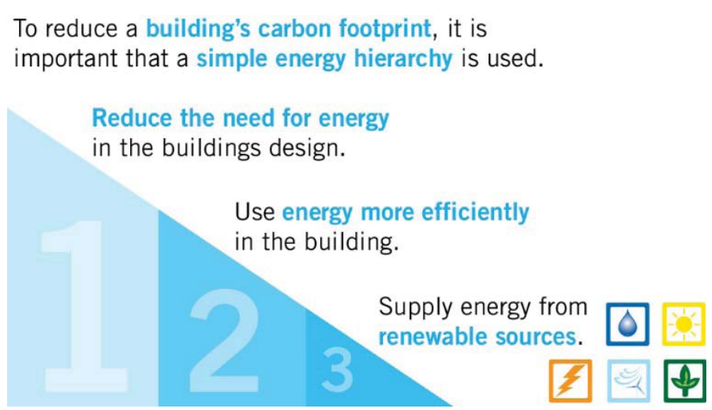


Figure 2: Energy Hierarchy

Designers are increasingly applying a Net Zero Energy design approach using a simple energy hierarchy to support long term energy efficiency and low carbon footprint for buildings. The first priority is to reduce the need for building energy; then use it most efficiently; and finally, supply energy from renewable sources as shown in Figure 2.

Ontario is in the process of developing a carbon cap and trade program similar to those in Quebec and the State of California. It will be important for Western University to closely monitor the development of such a program and the emerging requirements for large institutions with large greenhouse gas emissions profiles. The development of the Sustainable Design Guidelines will aid the University in adopting best practices with respect to energy and carbon management.

2.4 Water

Design trends related to water have moved from an attitude of conservation to an imperative of immediate concern. Using potable water only where needed, and making the most of lower quality water for irrigation, sewage conveyance, industrial uses, reuse, treatment technologies, localized and decentralized solutions to deal with grey water and blackwater.

Climate change and extreme weather are making responsible management of stormwater an imperative. In water poor regions such as central and northern California where long term drought has jeopardized access to drinking water for entire communities, regulatory requirements are in effect prohibiting municipal potable water connections in new development for uses that do not require potable water (toilet flushing, irrigation, maintenance).

2.5 Resilient Design and Climate Adaptation

The increasing frequency of extreme weather events has intensified and strengthened the notion of resiliency within sustainable design. Resiliency, as defined by the Rockefeller Foundation:

> *"...is the capacity of individuals, communities and systems to survive, adapt, and grow in the face of stress and shocks, and even transform when conditions require it. Building resilience is about making people, communities and systems better prepared to withstand catastrophic events—both natural and manmade—and able to bounce back more quickly and emerge stronger from these shocks and stresses."*[1]

The insurance industry worldwide is watching claims rise due to extreme weather events, making climate adaptation a priority for national, regional and local governments. An emphasis on robust, flexible and decentralized strategies for strengthening infrastructure is apparent globally, and highlighted in the McBean Report commissioned by the Insurance Bureau of Canada (IBC). The IBC also commissioned the development of the municipal risk assessment tool (MRAT) in collaboration with

1 Resilience. Rockefeller Foundation. www.rockefellerfoundation.org

Natural Resources Canada with research contributions from The Institute for Catastrophic Loss Reduction (ICLR), a disaster research institute affiliated with Western University.

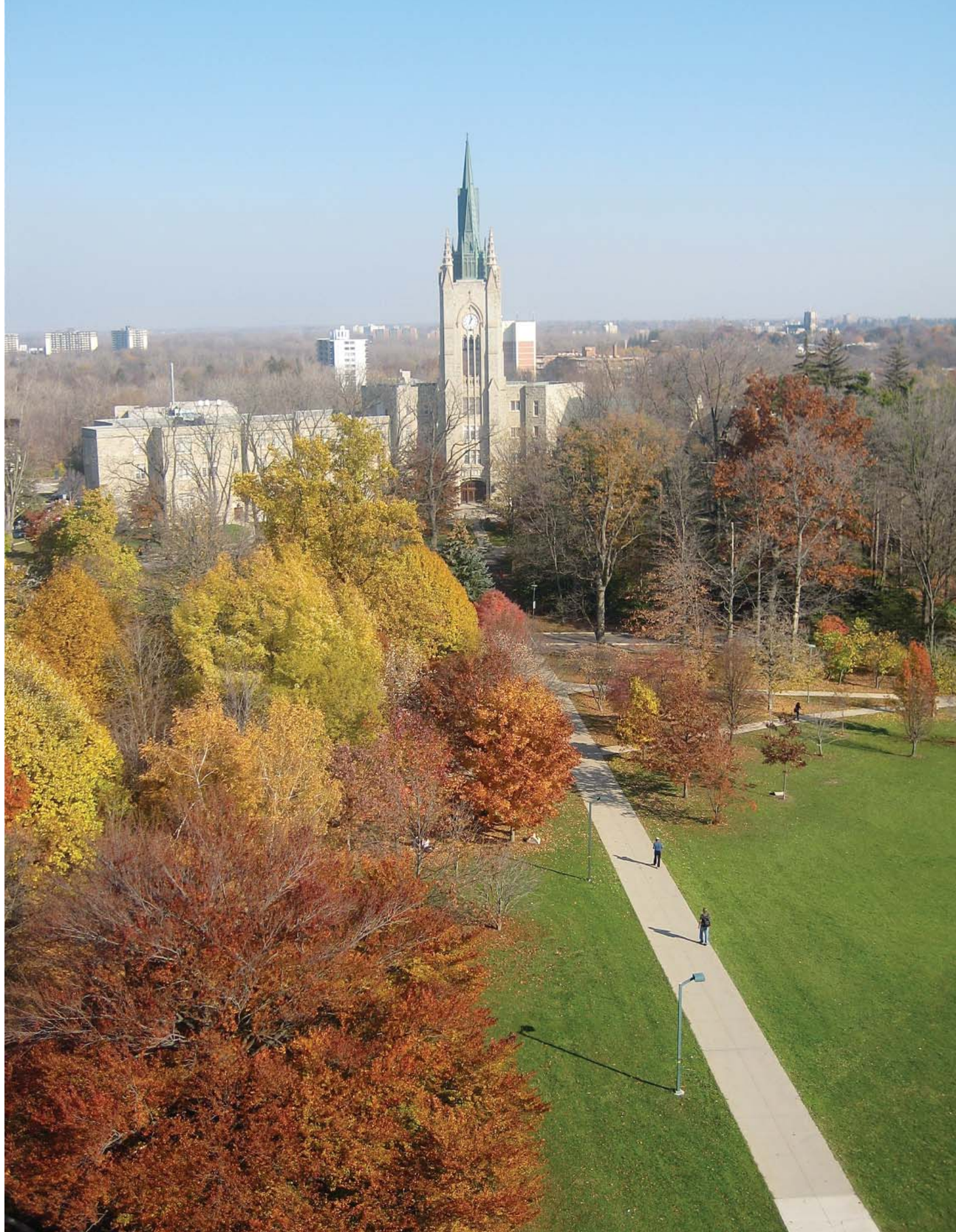
As part of the planning and design process at Western University, consideration should be given to how the University can make its campus infrastructure and built portfolio more resilient to future uncertainties such as flooding, severe storms, or temperature change along with possible escalation in utility rates. There is an opportunity for the Sustainable Design Guidelines to reflect this emerging priority for the University.

2.6 Human Health and Wellbeing

Long-term environmental degradation of the biosphere and decades of auto-oriented, low density development is affecting human health and wellbeing on an unprecedented scale. Substances of concern are appearing in our air, potable water sources, and soils and accumulating in our bodies[2]. Efforts to not only understand the impacts of these substances, but to simply identify where they occur in our material flows has gained traction recently. Environmental Product Declarations, Health Product Declarations, Cradle to Cradle Certification, and Declare Label and other certifications programs for building materials and products have emerged and go beyond publishing emissions data and simple LCA criteria required by programs such as Green Guard and Green Label Plus. These programs ask for transparency from manufacturers about their ingredients, and subjecting products to rigorous embodied energy analysis, building the body of knowledge, discourse and awareness about chemicals of concern in our materials.

Quality of and design of space is an important determinant of our health. As greater importance is placed on the health and wellbeing of building occupants, there is an opportunity for the Sustainable Design Guidelines to reflect these priorities by supporting and encouraging best practices that facilitate universal and increasingly inclusive solutions that encourage physical activity. Consideration should be given to best practices such the Center for Active Design's Active Design Guidelines and the International WELL Building Institute's WELL Building Standard that offer a range of tools and strategies for promoting health and wellbeing, and human activity within a building design.

2 United Nations Environment Programme. 2012. State of the Science of Endocrine Disrupting Chemicals. www.who.int/ceh/publications/endocrine/en/index.html



03. MUNICIPAL BEST PRACTICES

3.0 MUNICIPAL BEST PRACTICES

Higher education institutions operate much like local government organizations. In many ways, they resemble small cities, with their own energy, water and waste systems, forms of government, and opportunities for public engagement. It is therefore of value to assess sustainable design requirements at leading municipalities and cities in North America.

Many municipalities have requirements for energy, water, and carbon emission reductions, and some also reference third party green building rating systems such as LEED. This section summarizes a range of leading approaches to identify trends in targets, benchmarks and performance and processes related to sustainable design.

TORONTO GREEN STANDARD

The Toronto Green Standard (TGS) is drafted to reflect a minimum performance equivalent of LEED Silver, with some mandatory and additional requirements that closely align with the City's goals. Additional requirements include:

- Mandatory green roofs (based on building area),
- Bird friendly design considerations (85% of first 12m of the building),
- Stormwater management requirements (based on Toronto's Wet Weather Flow Management Guidelines),
- Extensive bike parking requirements (based on occupancy, use, and building area), and
- 15% energy efficiency improvement over the current Ontario Building Code.

The standard is structured as a two tier system; Tier 1 is mandatory, and Tier 2 is voluntary and incentivized with Development Cost Charge refunds. A copy of the TGS checklist is required to be submitted with all major project approval milestones to demonstrate compliance.

CITY OF LONDON, ONTARIO

The City of London's Community Energy Action Plan (2014-2018) establishes GHG emissions targets for the city, including a target of 15% GHG emissions reduction from 1990 levels by 2020, and an 80% GHG emissions reduction from 1990 levels by 2050. The newest City of London Plan (The London Plan) establishes biodiversity, open space, and ravine protection goals. It is also understood that the City will be adopting new stormwater management requirements, which will impact future development on Western's Campus.

CITY OF VANCOUVER GREEN BUILDING AND GREENEST CITY ACTION PLAN

The City of Vancouver has adopted the Greenest City Action Plan as a strategy for staying on the leading edge of urban sustainability. The Plan engages Council, residents, businesses, other organizations, and all levels of government as participants of implementation. The Plan sets out a set of measurable and attainable targets linked to City policy and regulatory mechanisms, and reports on progress annually. There are three principal categories of focus including Zero Waste, Zero Carbon and Healthy Ecosystems with ten goal areas and associated targets.

As part of the Plan implementation, the City requires all new buildings that require rezoning applications to commit to Passive House certification or LEED Gold certification and do the following:

- Achieve a minimum of 63 points (LEED® Gold),
- Earn 1 water efficiency point (30% potable water savings),
- 1 stormwater point (reduce stormwater by 25% or treat all stormwater that leaves the site), and
- Demonstrate a 22% reduction in energy costs as compared to ASHRAE 90.1 2010.

The Passive House requirement is a new alternative compliance path which the City now offers as an approach for realizing deep energy performance and greater greenhouse gas emissions savings.

CITY OF SEATTLE GREEN BUILDINGS AND SITES POLICY

The City of Seattle requires that all new buildings meet a LEED Gold Requirement. Pursuit of the Living Building Challenge is also encouraged and can supplant the LEED Gold Requirement. In addition to those requirements, Seattle also requires that a Life Cycle Costing exercise is carried out, including expectations and requirements for an Integrated Design Processes, and requirements for health, indoor environments and habitat creation.

CITY OF SANTA MONICA, CALIFORNIA

Santa Monica's Green Building Guidelines for Design provides a more prescriptive approach to sustainability, with requirements for specific system performance. These include guidelines for HVAC system performance, envelope performance (demonstrated R-values, U-values), expectations with regard to controllability of systems, and expectations with regard to systems commissioning.

Table 1 – Summary of Municipal Best Practices
The following table summarizes key attributes of the municipal policies and programs renewed in the preceding sections.

MUNICIPALITY	GREEN BUILDING REQUIREMENT	SUSTAINABLE DESIGN GUIDELINES	NOTABLE DETAILS
Toronto	Yes	Toronto Green Standard (LEED Silver equivalent)	• Green roof requirements • Extensive bike parking requirements • Minimum energy target
London	Yes (homes)	Community Energy Action Plan (2014-2018)	• 15% GHG emissions from 1990 levels by 2020 • 80% GHG emissions from 1990 levels by 2050
Vancouver	Yes	Green Building Programs	• Civic Buildings: LEED Gold • Large Site Rezoning: LEED Gold or Passive House
Seattle	Yes	Sustainable Buildings and Sites Policy	• LEED Gold requirement with Living Building Challenge Option • Life Cycle cost requirement • Integrated Design Process requirement • Health indoor environments and habitat creation requirements
Santa Monica	Yes	Green Building Guidelines for Design	• Includes guidelines for HVAC system, envelope, control systems, commissioning

04. UNIVERSITIES AND COLLEGES BEST PRACTICES

4.0 UNIVERSITIES AND COLLEGES BEST PRACTICES

Higher education institutions are uniquely positioned to provide leadership in sustainability. In general, they are single owner-occupiers of significant capital stock; many have their own energy, water and waste systems; they are public institutions that may consider longer term pay-back and returns on investment; they have mandates to research societal problems and create solutions; and they teach the next generation of leaders. No other organization has this combination of capacity. In addition, many post-secondary institutions are signatories of the University and College Presidents' Climate Change Statement of Action for Canada, which recognizes that higher education institutions have a 'responsibility to advance knowledge for society and our obligation to demonstrate leadership in areas of community, national and global importance'.

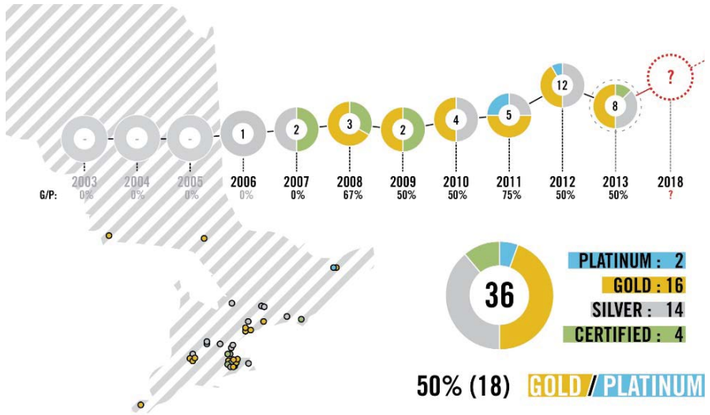


Figure 3 Ontario University LEED Projects

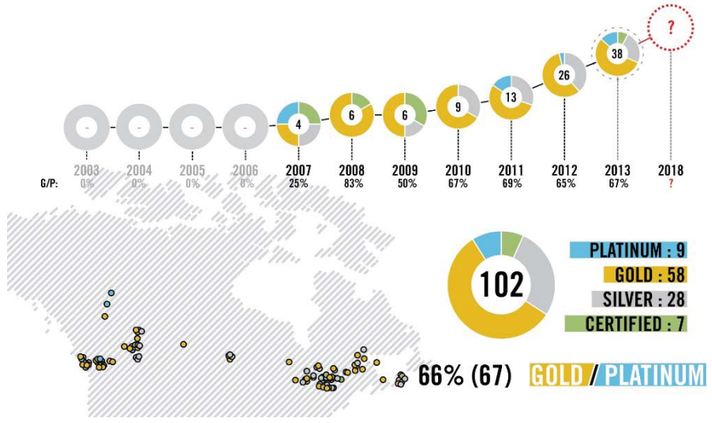


Figure 4 Canadian University LEED projects

In Ontario and throughout Canada, Universities and Colleges are pursuing increasing levels of sustainable design performance. Using LEED project performance as a proxy for sustainable design achievement, it is evident that Universities and Colleges are building ever-higher percentages of LEED Gold and Platinum projects. Extrapolating this trend to the future, it suggests that LEED Gold will become a standard achievement on University and Campus projects.

From a review of best practices in sustainability guidelines at higher education institutions across North America, four institutions were selected and assessed in greater detail to inform the development of Western's Guidelines. The four examples include Harvard University, University of British Columbia, University of Massachusetts at Amherst, University of Connecticut. These institutions were selected because they:

- demonstrate a spectrum of options for how Western might structure the SDG, from focusing directly on LEED requirements, to providing mandatory and optional requirements, to providing both process and technical guidelines; and
- they also offer a spectrum of options for the level of sustainability achievement, from requiring compliance with accepted standards, to requiring LEED v4 compliance, to providing the opportunity for exploration of cutting-edge sustainability concepts

HARVARD UNIVERSITY GREEN BUILDING STANDARDS

Harvard is a global leader in higher education and institutional sustainability best practices. The campus has a carbon reduction goal of 30% below 2006 levels by 2016, and is on track to meet that target. The campus has over 120 LEED certified projects on campus, and LEED v4 Gold certification is a requirement of their Green Building Standards. The Standards outline several key process requirements and milestones, such as a Life Cycle Costing exercise (20 year time frame), an exploration of Living Building Challenge and/or Net Zero Energy feasibility, Integrated Design Process Requirements, and a Measurement & Verification Strategy.

The Green Building Standards apply differently to project types (called 'Tiers'), and are structured primarily as a set of mandatory requirements, with some encouragement of exploration with the goal of learning (both on behalf of the design team as well as the University) about the feasibility of certain goals. For example, the feasibility of some of the LEED v4 Building Product Disclosure and Optimization credits is unknown currently, as it is in some ways 'ahead of the industry'. Encouraging teams to explore the feasibility of these credits means that the University will be aware of the state of the industry's up-take of these initiatives.

SUMMARY OF TARGETS	
ENERGY	• Requires team to establish max EUI • Requires exploration of Net Zero Energy • Requires 30% reduction from ASHRAE 90.1-2010
WATER	• Requires 35% reduction • Irrigation must be sub-metered
MATERIALS	• Requires LEED v4 Material Transparency credits

ASSESSMENT	
PROS	**CONS**
• Ambitious • Mandatory and Optional Requirements • Broken down by different project type • Willing to pilot and explore feasibility of innovative solutions • Relies on third party verification	• Not holistic—limited discussion of site/biodiversity/ecology
UNIQUE ASPECTS/INNOVATION	
• LEED v4 Gold required • Focus on Process • Requires M&V strategy • Requires LCC (20 year time frame) • Requires exploration of Living Building Challenge and Net Zero Energy	

UNIVERSITY OF BRITISH COLUMBIA LEED IMPLEMENTATION GUIDE

The UBC Implementation Guide provides specific direction for the UBC Vancouver Campus to implement the LEED Canada Building Design and Construction 2009 Rating Systems. It outlines mandatory requirements in terms of LEED credit achievement, as well as optional requirements the design team should consider. As a part of the process at UBC, design teams are provided a Project Design Brief that outlines sustainability expectations for the project and is based on a triple bottom line approach (social, economic and environmental performance areas). The Implementation Guide offers a structured process, tools, and resources to help teams assess what is possible in their project from a LEED perspective. The UBC expects to update the Guide based on LEED v4 requirements.

SUMMARY OF TARGETS	
ENERGY	• Minimum energy reduction baseline (42% better than MNECB 1997, 32% better than ASHRAE 90.1-2007) • Measurement & Verification is mandatory
WATER	• 30% minimum water use reduction • 50% minimum irrigation water use reduction

ASSESSMENT	
PROS	**CONS**
• Uniquely tailored to campus context • Designed to make process easier and more efficient • Simple structure, user friendly • Relies on third party verification	• Strongly LEED-focused (potential con)
UNIQUE ASPECTS/INNOVATION	
• Mandatory and Optional Credit compliance • Reference maps showing credit feasibility based on where project is on campus, to improve efficiency	

UNIVERSITY OF MASSACHUSETTS (UMASS) AT AMHERST GREEN BUILDING GUIDELINES

The UMass Green Building Guidelines illustrate a fairly common approach to guidelines based on strict adherence to LEED processes, requirements, and standards. The main difference in approach from simply requiring LEED is that the Guidelines outline a structure for credit pursuit; high, medium, and low priority based on the individual project attributes and the campus sustainability goals. The Guidelines assess the level of feasibility of each credit; from easy, to moderate, to difficult.

SUMMARY OF TARGETS	
ENERGY	• Exceed Code by at least 20% • Strong focus on Measurement & Verification
WATER	• Requires 20% reduction • Reduce irrigation by 50%

ASSESSMENT	
PROS	**CONS**
• Has structure for credit pursuit (High, Medium, and Low priority) • Relies on third party verification	• Nothing outside the realm of LEED
UNIQUE ASPECTS/INNOVATION	
• Includes a Campus LEED Database and a Priority/Feasibility Checklist • “Challenge designers to challenge us” is part of their guidelines for innovation	

UNIVERSITY OF CONNECTICUT (UCONN) SUSTAINABLE DESIGN GUIDELINES

UConn's Sustainable Design Guidelines offer a strong approach in terms of structure and process, but is weaker in terms of targets, goals, and technical guidelines. In terms of structure, UConn's Sustainable Design Guidelines provide an overview of sustainability at UConn, followed by a set of process guidelines, and then a set of technical guidelines. The process guidelines outline what the University expects from the design team at each project phase, as well as what the design team can expect from the University at each project phase. The technical guidelines outline the specific requirements related to sustainable design. This two stage approach offers clarity of structure and expectations.

SUMMARY OF TARGETS	
ENERGY	• Meet ASHRAE 90.1-2001 • R-19 walls, R-20 roof minimum
WATER	• Requires 35% reduction • Irrigation must be sub-metered
MATERIALS	• Meet LEED low-emitting materials credit intents

ASSESSMENT	
PROS	**CONS**
• Strong structure (reference to LEED but not just a re-creation) • Process oriented requirements	• Limited concrete targets • Guidance language used rather than conformance based approached • No ambitious energy performance targets
UNIQUE ASPECTS/INNOVATION	
• LEED v4 Gold required • Focus on Process • Requires M&V strategy • Requires LCC (20 year time frame) • Requires exploration of Living Building Challenge and Net Zero Energy	

SUMMARY OF UNIVERSITY BEST PRACTICES

Based on the review of University trends and highlighted green building standards and guidelines, Table 2 summarizes an expanded list of Universities to compare and contrast the number of LEED Certified buildings, carbon reduction goals, and whether a Campus Sustainability Policy is in place.

Table 2 – Summary of University Best Practices

UNIVERSITY	LOCALE	CAMPUS POLICIES			LEED BUILDINGS		
		SUSTAINABILITY	CARBON	LEED	GOLD	PLATINUM	TOTAL
Harvard University	Urban	Yes	Reduce by 30% below 2006 levels by 2016	v4 Gold+	80	10	120
University of British Columbia	Urban	Yes	Reduce by 33% in 2015, 67% by 2020, Carbon Neutral by 2050	Gold+	5	1	6
University of Victoria	Urban	Yes	Carbon Neutral in 2010, Reduce Electricity by 20% in 2015	Gold	6		6
Western University	Urban	Yes	Reduce GHG emissions below 2009 baseline	Silver	2		8 (12)
University of Pennsylvania	Urban	Yes	Carbon Neutral by 2042	Silver	3	1	4
University of Calgary	Urban	Yes	Reduce by 45% by 2015, 80% in 2050	Silver	1	2	3
McMaster University	Urban	Yes	20% reduction in Energy by 2020	Silver	3		3
University of Connecticut	Urban	Yes	10% reduction in Energy by 2020	Silver			4
UMass at Amherst	Rural	Yes	none	Gold	6		16
University of Waterloo	Urban	Yes	none	Silver		1	1

05. WESTERN CAMPUS SUSTAINABILITY POLICY REVIEW

5.0 WESTERN CAMPUS SUSTAINABILITY POLICY REVIEW

Western has established sustainability policies which set out campus level targets, including greenhouse gas reduction targets, energy use reduction targets, and water use reduction targets. Policies that were reviewed include:

- Creating a Sustainable Western Experience: 10-year Goals & 5-year Outcomes for Sustainability (Nov. 2012)
- Western University Energy and Water Management Master Plan: 2013-2023 (May 2013)
- Western University Conservation and Demand Management Plan: 2014-2019
- From Purple to Green Western's Green Procurement Guidelines (June 2014)
- Western University Campus Master Plan 2015 (June 2015)

The University has the following targets, to be met by 2023:

- Primary: 20% EUI (GJ/m^2) reduction, 18% WUI (L/m^2) reduction
- Secondary: 10% overall energy use reduction (L), 7% overall water use reduction (L)
- Tertiary: GHG emissions below 2009 levels

In support of the targets, there has been significant work carried out to quantify the costs and returns of enacting energy reduction targets. For example, an operating cost audit showed that retrofitting all buildings on campus would cost roughly $29 million, but would reduce energy intensity by 15% and would yield nearly $54 million in annual savings. Studies such as this, in addition to policies related to creating a green building strategy, were outlined in the Campus Sustainability Plan and the Energy and Water Master Plan.

From this campus policy review, building related requirements are summarized in Table 3, and show that the University is committed to reducing its impact on the environment through action plans, and that initiatives like the Sustainable Design Guidelines will help the University to achieve its goals. The Guidelines are, therefore, an integral part of the sustainability action plan on campus.

Table 3 – Summary of Western's Sustainability Policies and Relevant Building Performance Goals

METRIC CATEGORY	CREATING A SUSTAINABLE WESTERN EXPERIENCE: 10-YEAR GOALS & 5-YEAR OUTCOMES FOR SUSTAINABILITY (NOVEMBER 2012)	WESTERN ENERGY AND WATER MANAGEMENT MASTER PLAN. 2013-2023 (MAY 2013)	WESTERN CONSERVATION AND DEMAND MANAGEMENT PLAN: 2014-2019
ENERGY, CARBON AND WATER	Main campus' direct GHG emissions will be reduced below 2009 levels.	Current state: • 63 buildings (~670,000 m^2) • 356 million ekWh/ year ($27.6 million) • Overall energy intensity: 531 ekWh/m^2	Energy, GHG, and Water Conservation Goals: • 9% reduction in EUI below 2012's levels • Reduce overall energy use by 4% below 2012's use • Reduce GHG emissions below 2009 baseline • Reduce WUI by 8% below 2012's levels
	Formulate a green building strategy for introducing green building technologies in the municipality.	Targets • Primary: 20% EUI (GJ/m^2) reduction, 18% WUI (L/m^2) reduction • Secondary: 10% overall energy use reduction (L), 7% overall water use reduction (L) • Tertiary: GHG emissions below 2009 levels	
	Deliver a high level of sustainability with respect to the provision and use of energy, the disposal of waste and water, the development of buildings, and the enhancement of the natural environment and cultural heritage.	Operating cost audit showed that retrofitting all 63 buildings would: • Cost ~$29 million • Yield ~$54 million ekWh in annual savings • Reduce energy intensity in existing buildings by ~15%	
BIODIVERSITY, HEALTH AND MOBILITY	The campus connection to the Thames River is celebrated and drives involvement in restoration efforts.		Project and enhance air quality
	Model green infrastructure projects will be identified and piloted, in areas such as information technology services, stormwater management, permeable surfacing and green-roofs.		
	Partnerships with the City of London will facilitate increased access for bike and pedestrian travel to and from campus.		
	Make access to healthy, local, organic and fair trade food with vegan and vegetarian options widely available throughout campus.		

5.1 Western Campus LEED Performance

A review of 12 LEED projects on Western's Campus (8 certified, 4 underway) was conducted, in order to assess sustainability areas that the University is performing well in, identify challenge areas, and suggest opportunities for baseline performance thresholds based on past success. This information was presented to the workshop participants in order to have a discussion of the opportunities and challenges experienced on campus. This section provides an overview of this analysis and discussion, broken down by LEED Category (Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process). A summary of observations and recommendations that address items beyond the scope of the Sustainable Design Guidelines is presented at the end of this section.

SUSTAINABLE SITES

Opportunities for Mandatory Requirements

SSc4.2—Alternative Transportation: Bicycle Storage and Changing Rooms was achieved on more than 75% of the projects. Considering the London Plan and Western Creating a Sustainable Western Experience Plan's focus on alternative transportation, this supports the notion of making the provision of bike parking a mandatory requirement for projects moving forward.

Challenges Faced

The Open Space requirements related credits (SSc5.1 and 5.2) were rarely achieved. An issue voiced during the workshop was that with the campus intensifying/densifying through infill development, the provision of open space will become more difficult as the campus develops. There was, however, a desire voiced to manage open space (SSc5.2) and provide opportunity for habitat creation (SSc5.1).

The Stormwater Management credits (SSc6.1 and 6.2) were similarly difficult to achieve, with only 3 of 12 projects targeting or achieving SSc6.1—Stormwater Quantity. Comments regarding this did not identify any definable challenge related to achieving these credits, aside from planning and (to a small extent) budgetary concerns. It was also identified that the City of London is becoming more stringent in their stormwater management requirements, and so the intent of this credit should be captured in the Sustainable Design Guidelines.

No projects achieved SSc4.3—Alternative Transportation: Low-emitting and Fuel-Efficient Vehicles. In discussions with the workshop stakeholders, this was said to be primarily due to two reasons: 1) a sense that the only way to achieve it is through electric vehicle charging stations, for which there is little appetite at Western, and 2) when informed that share programs would also support the intent of this credit, it was noted that due to Western's staff rental car discount, a car share program is not desired by many of the staff. There was, however, some discussion of a student car share program, and that this may provide some merit for the campus and should be explored.

Over 50% of projects achieved the credits relating to reducing urban heat island effect (SSc7.1 and 7.2). Based on feedback gained from campus stakeholders, measures to support compliance with these credits are often cost driven and often eliminated during value engineering exercises. For example, the campus has limited installation of green roofs largely due to costs associated with structural upgrades. With the development of City of London's Urban Forest Strategy and Urban Forest Strategy Implementation Plan (The London Plan), the Sustainable Design Guidelines should cross reference these guidelines as a complementary approach and best practice for reducing the urban heat island effect on campus and for the City as a whole.

Only 4 of 12 projects achieved SSc8—Light Pollution Reduction. While Western does have lighting standards that address full-cutoff, there are many parts of campus that do not have full cutoff. The primary challenge projects face in achieving this credit is due to the high amount of forests and ravines on campus. Projects that are adjacent to these areas do not meet the light spillage requirements, especially when campus safety and CPTED considerations are taken into account.

Summary

The intent of LEED credits SSc4.2, SSc6.1, and SSc8 should be captured in the Sustainable Design Guidelines. The requirements and best practices outlined in credits SSc4.3, SSc5.1, SSc5.2, SSc7.1 and SSc7.2 should be explored rather than be considered mandatory.

WATER EFFICIENCY

Opportunities for Mandatory Requirements

All projects achieved at least a 30% water use reduction and 100% potable water use reduction for irrigation, and these present good opportunities for mandatory baseline requirements.

Challenges Faced

Campus operations and maintenance staff have had challenges in the past with rainwater collection and reuse, and are wary of the operational requirements of these systems. However, there remains interest in having teams explore the feasibility of these systems on future projects.

Summary

It is recommended that the Sustainable Design Guidelines state a 30% indoor water use reduction as a mandatory requirement with a 40% stretch goal, 100% irrigation water use reduction, and include a provision for the exploration of water recapture system feasibility.

ENERGY AND ATMOSPHERE (EA)

Opportunities for Mandatory Requirements

The averaged EAc1 score for the 12 projects was 4 points (30% over MNECB 1997, 18% over ASHRAE 90.1-2007). Based on discussions, it was recommended that a baseline energy performance target be established as part of the Sustainable Design Guidelines, and that the target should be reflective of emerging code advancements and the development of carbon cap and trade program.

Over 50% of the LEED projects pursued EAc3 Enhanced Commissioning. Based on discussions with Western stakeholders, commissioning is seen as a valued process that results in sustained building performance, and is recommended as a mandatory process for all large capital projects.

More than half of the LEED projects pursued the EAc5 Measurement & Verification, and the workshop stakeholders confirmed that this is a priority for Western and should form a part of the process requirements of the Guidelines.

Challenges Faced

No projects installed renewable energy systems, but this was mentioned as a good aspirational goal for projects on campus. It was noted that this should form an optional/preferred requirement for the Guidelines.

Summary

The Sustainable Design Guidelines should establish a percent reduction over code (i.e., 30%—40% reduction over MNECB 1997 or 18% over ASHRAE 90.1-2007 or an equivalent reduction over ASHRAE 90.1—2010) as a mandatory requirement for energy reduction in addition to adopting best practices for commissioning and metering. The Guidelines should also include a provision for the exploration of renewable energy system feasibility.

MATERIALS AND RESOURCES

Opportunities for Mandatory Requirements

Western has historically performed well in terms of MRc2 Construction Waste Management (almost always achieving at least 75% diversion rates), MRc4 Recycle Content (almost always achieving at least 20% recycled content), and MRc5 Regional Materials (achieving 30% regional materials on every project). These offer strong opportunities for mandatory requirements within the Sustainable Design Guidelines.

Challenges Faced

Few projects achieved MRc7 FSC Certified Wood. The availability of FSC certified wood through local distribution appears to be a contributing factor. Despite low achievement of this credit, selection of FSC certified wood is considered as a good practice and should therefore be 'encouraged' in the Sustainable Design Guidelines.

Summary

It is recommended that the Sustainable Design Guidelines include the following mandatory requirements of 75% construction waste diversion rate, 20% recycled content, 30% regional materials, and that a stretch goal for 50% FSC certified wood be considered.

INDOOR ENVIRONMENTAL QUALITY

Opportunities for Mandatory Requirements

Nearly all projects achieved the Low-Emitting Materials credits (EQc4.1-4.4), and this was identified as a priority area for Western and it should be incorporated into the Guidelines. Credits relating to thermal comfort (EQc7.1, 7.2) were frequently achieved by project teams. Compliance with the thermal comfort standard, ASHRAE Standard 55-2004, Thermal

Conditions for Human Occupancy, should be included as a mandatory requirement of the Sustainable Design Guidelines.

Challenges Faced

Few projects achieved the Controllability of Systems credits (EQc6.1, 6.2). The reasons were unclear for this, aside from cost reduction for the controls. It was noted that this should be achieved more often in order to help achieve the campus energy reduction goals. It was also observed that the University does a good job requiring operable windows, and that this approach should be formalized in an operable window policy and should be considered on a project by project basis.

No projects achieved EQc8.1 Daylight, and only 2 achieved EQc8.2 Views. A reason was not provided for these and it was not noted as a priority area for the campus.

Just over half of the projects achieved EQc1 Outdoor Air Delivery Monitoring and EQc3.2 Construction IAQ Management Plan—Before Occupancy. Few reasons were provided for EQc1, and scheduling conflicts and tight project timelines were provided as the reasons for limited compliance with EQc3.2.

Summary

There is an opportunity to establish mandatory requirements for minimum indoor air quality (LEED EQc1) and the use of low-emitting materials such as paints, coatings, adhesives, sealants, and furniture systems within the Sustainable Design Guidelines. To ensure that the indoor air quality goals are achieved upon occupancy, Western should consider setting an expectation of building flush out early in the project process to ensure scheduling is not missed at the end of construction.

INNOVATION AND DESIGN (ID) PROCESS

Opportunities for Mandatory Requirements

The most common ID credits that were achieved on the projects were: Green Cleaning, Green Education, Low Mercury Lamps, Exemplary Performance for Regional Materials, and Exemplary Performance for Water Use Reduction. Western has already formalized a number of important policies including a Green Cleaning Policy, Green Education Plan, Low Mercury Lamp purchasing plan and a Grounds Management Plan.

Summary

Western does well in terms of achieving Innovation and Design credits. Given the adoption of the best practices noted above, it is recommended that these performance requirements are included in the Sustainable Design Guidelines. Some possible additional areas for exploration were discussed with the workshop stakeholders, and the following items were deemed to be worthy of further exploration by project teams: Life Cycle Costing, WELL Standard incorporation, LEED v4 Material Optimization credits, Urban Agriculture, and Active Design Guideline incorporation.

06. SUMMARY OF RECOMMENDATIONS

6.0 SUMMARY OF RECOMMENDATIONS

Based on the a review of industry trends, green building standard and policy best practices, and green building performance on Western's Campus, a number of conclusions are drawn that influence the direction of the Sustainable Design Guidelines, and provide guidance for future policy or program development at Western:

Industry Conclusions:

- Performance based requirements: Successful green building programs are based on performance based requirements rather than being prescriptive in nature. These programs allow for greater design innovation and are easier to implement from an institutional perspective.
- Carbon Performance: With heightened awareness of climate change, governmental organizations are formalizing policy requirements with regards to carbon taxes or carbon cap and trade programs. Western should continue to closely monitor Ontario's move towards a carbon cap and trade program, and use the Sustainable Design Guidelines to advance its building performance requirements for energy and carbon as a means of reducing its future carbon liabilities.

Western Performance Conclusions:

- Integration of the Sustainable Design Guidelines within a wider institutional framework: In order for the Guidelines to be feasible, enforceable and relevant over the long term, Western may need to consider adjustments in the following areas for a holistic integration into the wider institutional framework;
  - Policies, strategies to enable cultural change management in the daily lives of students, faculty and staff who are the users of buildings and spaces influenced by the Guidelines.
  - Capital budgetary and planning practices to allow time and costs to adequately support the requirements of the Guidelines.
  - Integration of the Guidelines with the branding, vision, mission and public relations platform of Western University.
  - Integration of the Guidelines in campus community education, academic and research initiatives at Western.
- Grounds Best Practices: A number of best practices have already been established on campus through Western's Ground Management Plan for landscaping, irrigation and site lighting requirements. These requirements should be cross referenced and reflected in the Sustainable Design Guidelines.
- LEED Performance: Across the 12 LEED projects reviewed, a number of standards and baseline thresholds that were frequently achieved should form the basis for minimum performance requirements in the Sustainable Design Guidelines. LEED is the most widely used third party rating system in the marketplace, and is extensively used as a reference standard by institutional organizations. It is recommended that core LEED strategies and standards successfully implemented to date on campus be captured in the Sustainable Design Guidelines. This will ensure the Guidelines are compatible with the LEED rating system should LEED certification continue to be mandated on campus for specific projects.
- Operable Windows: Western already has a strong track record of designing buildings with operable windows. Through the adoption of the Sustainable Design Guidelines, there is an opportunity to formalize this as a policy and best practice on campus.
- Green Procurement: Western has a strong green consumables procurement strategy which will serve as a complementary tool for the Sustainable Design Guidelines. It is recommended that these guidelines are updated to reflect best practices and standards for items such as low-emission furniture, and energy efficient standards for equipment purchases. By installing furnishings and/or equipment that adhere to a set of sustainable performance criteria will aid in introducing energy intensive plug loads or furniture systems that off gas harmful substances.
- Design and Construction Schedules: It was noted that Western's design and construction schedules are aggressive and limit the opportunity for adequate building flush out prior to occupancy. It is recommended that Western review its project schedules to enable adoption of this best practices in terms of ensuring good indoor air quality upon occupancy.
- Integration of Western Operations and Maintenance teams: Operations and Maintenance teams are a critical part of the team for maintaining the long-term performance of the buildings that adhere to the future Sustainable Design Guidelines. It is recommended that Western review and consider how facilities and maintenance stakeholders are integrated into the design process to ensure they are engaged in a meaningful way and can help shape the performance of future buildings.
- Integration with Campus Sustainability Program: With the development of the Sustainable Design Guidelines, an opportunity exists to educate students, faculty, staff and the broader community of the University's sustainable design accomplishments.

The Sustainable Design Guidelines will serve as an important tool for advancing the performance of buildings across the campus to reduce greenhouse gas emissions, improving human health and quality of space, and supporting thriving ecosystems.

APPENDIX

APPENDIX A. RESOURCES

The following resources, categorized by performance area, are intended to serve as best practices and/or have directly been referenced in the Sustainable Design Guidelines. A consolidated list of Western's policies is provided.

Integrated Design Process

BC Green Building Roundtable. 2007. *Roadmap for the Integrated Design Process:*
www.greenspacencr.org/events/IDProadmap.pdf

Climate Change Adaptation

Natural Resources Canada Climate and Climate-Related Trends and Projections
www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/10261

The Rockefeller Foundation: Climate Change
www.rockefellerfoundation.org/our-work/topics/climate-change/

US Department of Energy, Energy Efficiency and Renewable Energy Weather Data
apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm

Metronorm (Database of 8325 meteorological stations worldwide)
meteonorm.com/en/features

Energy Modeling

CaGBC Experienced Modellers List
www.cagbc.org/cagbcdocs/CaGBCs_Experienced_Modellers_List-EN.pdf

Commissioning

ASHRAE Guideline 0 - 2013 – The Commissioning Process
www.ashrae.org

ASHRAE Standard 202 - 2013 – Commissioning Process for Buildings and Systems
www.ashrae.org

Canadian Standards Association Z320 - 11 – Building Commissioning Standard and Check Sheets
www.csagroup.org/

Performance Metering

International Protocol for Measurement and Verification – Core Concepts 2014
www.evo-world.org/

Energy Performance

Canadian Passive House Institute
www.passivehouse.ca/

Environmental Protection Agency ENERGY STAR Target Finder
www.energystar.gov/buildings/service-providers/design/step-step-process/evaluate-target/epa's-target-finder-calculator

National Research Council Canada. Adaptation Guidelines for the National Energy Code of Canada for Buildings 2011
www.nrc-cnrc.gc.ca/eng/publications/codes_centre/necb_2011_adaptation_guidelines.html

Water Performance

Energy Policy Act (Epact) 2005
eere.energy.gov/femp/regulations/epact1995.html

Health and Wellness

ASHRAE 62.1 – 2010 Ventilation for Acceptable Indoor Air Quality
www.ashrae.org

AHSRAE 55 – 2010 Thermal Comfort Conditions for Human Occupancy
www.ashrae.org

Center for Active Design: Active Design Guidelines
centerforactivedesign.org

International WELL Building Institute: WELL Building Standard
www.wellcertified.com/

Declare
www.declareproducts.com

Health Product Declaration Collaborative
www.hpd.collaborative.org

Cradle to Cradle Products Innovation Institute
www.c2ccertified.org

International Living Future Institute - Living Building Challenge
www.living-future.org/lbc

Site Considerations

The London Plan: City of London's Urban Forest Strategy and Implementation Plan
thelondonplan.ca/

City of Toronto Green Standard Bird Friendly Design requirements
www1.toronto.ca/city_of_toronto/city_planning/developing_toronto/files/pdf/mr_hr_tech.pdf

Constructability

CSA Building Durability Standard S478-95 (R2007)

Western Policies and Resources

Western University's Campus Master Plan
1drv.ms/1OIiAvS

Western University's Design Guidelines

Western University's Exterior Lighting Standards and Specifications

Western University's Grounds Management Plan

Western University's Green Cleaning Plan

Western University's Green Procurement Policy
sustainability.uwo.ca/initiatives/sustainable_procurement/index.html

Western University's Sustainability Plan
sustainability.uwo.ca/

Western University's Utility Metering Requirements

Western University's Utilities and Infrastructure Plan

LEED Resources

Canada Green Building Council
www.cagbc.org

CaGBC Experienced Modellers' List
www.cagbc.org/cagbcdocs/CaGBCs_Experienced_Modellers_List-EN.pdf

US Green Building Council
www.usgbc.org

USGBC Credit Library
www.usgbc.org/credits/new-construction/v4

Western
UNIVERSITY · CANADA

Facilities Development & Engineering
Western University
1393 Western Road, Room 2350
London, Ontario, Canada, N6G 1G9
Tel: 519-661-2111, ext 89300
mary.quintana@uwo.ca