City of Mississauga

# Green Development Standard

## Industrial Development Guidebook Tier 2 and 3 Voluntary Metrics

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# Land Acknowledgement

We acknowledge the lands which constitute the present-day City of Mississauga as being part of the Treaty and Traditional Territory of the Mississaugas of the Credit First Nation, The Haudenosaunee Confederacy, and The Huron-Wendat and Wyandot Nations. We recognize these peoples and their ancestors as peoples who inhabited these lands since time immemorial. The City of Mississauga is home to many global Indigenous Peoples.

As a municipality, the City of Mississauga is actively working towards Reconciliation by confronting our past and our present, providing space for Indigenous peoples within their territory, to recognize and uphold their Treaty Rights and to support Indigenous peoples. We formally recognize the Anishinaabe origins of our name and continue to make Mississauga a safe space for all Indigenous peoples.


## Prepared for:

City of Mississauga

## Prepared by:

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# Abbreviations

**ADC:** Alternative daily cover

**BEAM:** Building Emissions Accounting for Materials

**BECxA:** Building Enclosure Commissioning Agent

**BOD:** Basis of Design

**BOP:** Builder Option Package

**CAGBC:** Canadian Green Building Council

**CHBA:** Canadian Homebuilder's Association

**CO2e:** Carbon Dioxide Equivalent

**CSA:** Canadian Standards Association

**EA:** Energy Advisor

**EV:** Electric Vehicle

**EVSE:** Electric Vehicle Supply Equipment

**EVEMS:** Electric Vehicle Energy Management Systems

**FLAP:** Fatal Light Awareness Program

**GDS:** Green Development Standard

**GHG:** Greenhouse Gas

**GHGI:** Greenhouse Gas Intensity

**ICI:** Institutional, Commercial and Industrial

**LCA:** Life Cycle Assessment

**LEED:** Leadership in Energy and Environmental Design

**LID:** Low Impact Development

**MCE2**: Material Carbon Emissions Estimation

**MEP:** Mechanical, Electricity, and Plumbing

**MFA:** Modelled Floor Area

**MURB:** Multi-Unit Residential Building

**NECB:** National Energy Code of Canada

**NIBS:** National Institute of Building Sciences

**NRCan:** Natural Resources Canada

**OBC:** Ontario Building Code

**OESC:** Ontario Electrical Safety Code

**OPR:** Owner's Project Requirements

**Pa:** Pascal

**PAM:** Pre-Application Meeting

**PV:** Photovoltaic

**TEDI:** Thermal Energy Demand Intensity

**TEUI:** Total Energy Use Intensity

# Guidebook Purpose

This Industrial Guidebook provides details on the performance measures, submission and documentation requirements, specifications and applicable site exclusions, and resources to assist applicants in completing their Green Development Standard (GDS) submission. The requirements presented in this Guidebook are applicable to mid-rise and high-rise multi-unit residential development with a height equal to or greater than 5 storeys. Applicants are required to complete the Developer Checklist using the information provided in this Guidebook.

Mississauga's GDS has been designed as three tiers of performance across five themes: energy and building performance, resilience, climate change, ecology, and natural systems.

- Tier 1 Mandatory Metrics provide the minimum criteria needed to be met across all themes and measures for the project submission. The subsequent tiers include increased performance criteria, all of which need to be achieved to meet the next tier. The performance and submission requirements for each mandatory metric are provided in the accompanying Mandatory Metrics Guidebook.
- Tier 2 and Tier 3 High-Performance Metrics provide additional criteria across all themes and measures. The performance and submission requirements for each high-performance metric are provided in the High-Performance Metrics section of this Guidebook.

## Green Development Standard Scope

The GDS applies to all new residential and non-residential development subject to the City's Site Plan Control By-law (0293-2006), which is designed to review the location and function of buildings and structures and maintain City standards. Table 1 provides a summary of the City's GDS scope.

*Table 1. Mississauga's Green Development Standard scope.*

| | **GDS SCOPE** |
|---|---|
| **Applicability** | As all lands in the city are designated as a Site Plan Control Area (per the City's Official Plan 19-9), the GDS applies to all new development subject to the Site Plan Control By-law (0293-2006). |
| **Exemptions** | The following classes of development are not required to submit a GDS application; however, applicants are encouraged to implement relevant sections of the GDS where possible:<br>• Residential buildings with less than 10 residential units.<br>• Limited Site Plans for site alterations, ground-based units, and telecommunications towers;<br>• Renovations and expansions to existing buildings;<br>• Applicant's that already have an approved Site Plan Application and/or active Site Plan Application submitted prior to March 1, 2025; and<br>• City of Mississauga corporate buildings, as the City has a separate Corporate Green Building Standard. |

| | GDS SCOPE |
|---|---|
| **Building archetypes** | Building archetypes align with the City of Mississauga's Official Plan classification and generally to the Ontario Building Code classifications:<br>• **Multi-unit residential:**<br>  • **Low-rise residential buildings** include multi-unit residential buildings less than four storeys with 10 or more residential units.<br>  • **Mid-rise to high-rise residential buildings** include multi-unit residential buildings greater than five storeys.<br>• **Non-residential buildings:**<br>  • **Institutional buildings** include education buildings, nursing homes, retirement homes, care facilities, health care facilities, etc.<br>  • **Commercial buildings** include retail, restaurant, grocery, automotive, repair services, office, hotels and lodging, entertainment, etc.<br>  • **Industrial buildings** include warehouses, distribution centres, research and development facilities, truck and distribution terminals, etc. |
| **Requirements** | Mississauga's GDS is a three tiered system:<br>• Tier 1 Mandatory Performance Requirements : Mar 1 2025 - Dec 31 2027<br>• Tier 2 Performance Requirements : Jan 1 2028 - Dec 31 2029<br>• Tier 3 Performance Requirements : Jan 1 2030 |
| **Financial incentives** | The City of Mississauga is exploring financial incentives for the Tier 2 and Tier 3 voluntary high-performance metrics. |

# Application Process

The Green Development Standard (GDS) is integrated into the City's existing Site Plan Approval Application process managed by the City's Planning Building Department - Development and Design Division. The GDS submission materials and supporting documentation will be submitted utilizing ePlans and form a part of a complete application. Table 2 outlines the Site Plan Application process and GDS submission requirements during each phase of the application.

*Table 2. Green Development Standard submission steps through the Site Plan Application process*

| STEP | PURPOSE | OUTCOME |
|---|---|---|
| **Pre-Application Meeting Request** | Applicants submit Pre-Application Meeting request via ePlans. | Detailed pre-screen review of Pre-Application Meeting request is completed.<br><br>Pre-application meeting scheduled (PAM). |
| **Pre-Application Meeting (PAM)** | GDS checklist identified as a submission requirement.<br><br>Applicants are advised of the GDS requirements relevant to their development application. | Submission requirements checklist for complete application identified and provided to applicant. |

| STEP | PURPOSE | OUTCOME |
|---|---|---|
| **Revisions (External)** | Applicant revises application based on feedback and submission requirements identified through PAM. | Applicant prepares GDS Checklist, plans/drawings, commitment letters and component studies to verify compliance with GDS. |
| **Pre-Submission Work and Application Submission** | Applicant uploads complete Site Plan Application including GDS checklist and supporting documents via ePlans. | Complete Site Plan Application is circulated for internal review. |
| **Circulation/ Technical Review (Internal)** | City staff review submitted plans/drawings and component studies to verify compliance with GDS. | Application review is completed within 30 calendar days of ePlans submission.<br><br>Project Status Report including application compliance to GDS and any outstanding documents or unmet metric targets provided by the City to the applicant. |
| **Resubmission** | Applicant resubmits application to address all outstanding comments associated with GDS requirements and compliance. | This step repeats until all outstanding comments on the Site Plan Application have been addressed.<br><br>Application review is completed within 20 calendar days of ePlans submission. |
| **Site Plan Application Approval** | Applicants demonstrate compliance with GDS requirements in the Site Plan Application submission. | Site Plan approval issued for development demonstrating compliance to GDS requirements. |

# High-Performance Voluntary Metrics

## Theme 1: Energy and Building Performance

### EB1: ENERGY PERFORMANCE

The Energy Performance requirements are designed to ensure that new industrial buildings are designed to reduce GHG emissions and enhance resilience. This objective is achieved through the following three performance targets:

- TEDI is a measure of the annual heating load per floor area of a building measured in kWh/$m^2$/year, as such, a lower TEDI improves the building's resilience by prioritizing the integration of design criteria that are difficult or expensive to retrofit in the future. A net-zero-ready building has a TEDI of 15 kWh/$m^2$/year.
- TEUI is the annual amount of energy used per floor area of a building measured in kWh/$m^2$/year. Similar to TEDI, TEUI can be optimized using both design and technology.
- GHGI is the total GHG emissions associated with the use of all energy utilities on site, measured in kg CO2e/$m^2$/year. A net-zero building for all building archetypes has a GHGI equivalent to 0 kg CO2e/$m^2$/year, whereas a net-zero-ready building has a GHGI equivalent to 5 kg CO2e/$m^2$/year. It differs from TEUI and TEDI as it converts the building's energy use into GHG emissions using an equivalent emissions factor for the energy sources used in the building. As a measure of the performance of different fuel types, GHGI can be decreased by prioritizing low-carbon fuel and energy sources.

The performance requirements summary for industrial buildings are provided in Table 3.

*Table 3. EB1: Energy Performance requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **EB1: ENERGY PERFORMANCE** | GHGI: 10 kg$CO_2$e/$m^2$/yr<br>TEUI: 100 kWh/$m^2$<br>TEDI: 50 kWh/$m^2$ | GHGI: 5 kg$CO_2$e/$m^2$/yr<br>TEUI: 70 kWh/$m^2$<br>TEDI: 37 kWh/$m^2$ | Design Development Stage **Energy Modeling Report**.<br><br>**Letter of Commitment**: Energy Modeling Report can be submitted at time of application.<br><br>**Letter of Commitment**: Energy Modeling Report based on as-built construction drawings. |

### Submission Specifications

1. All new buildings greater than 2000 $m^2$ gross floor area must complete and submit an Energy Modeling Report. Follow the Energy and Emissions Requirements for each building type outlined in the Energy Modeling Report Terms of Reference and submit completed Design Development Stage Energy Modeling Report.
2. Acceptable software for whole-building energy modeling include: EQuest v. 3.64 or higher, Energy Plus, and IES Virtual Environment, and for Tier 3 projects, Passive House Planning Package (PHPP).
3. At the approval of the City of Mississauga, applicants may pursue alternative compliance options. These include the CAGBC Zero Carbon Building Standard version 2 or later or Passive House Standard certification. If pursued, the Zero Carbon Building Standard and Passive House Certification align with the performance criteria for EB2: Air Tightness Testing, and CI1: Embodied Carbon.
    a. If pursuing, provide proof of registration in the CAGBC Zero Carbon Building (ZCB) Standard or Passive House Standard. Final verification must include either the ZCB design certification and a complete ZCB workbook or a copy of the Passive House Design Documentation Review Report and a Design Stage Assurance Letter and a copy of the final certification to the City once available for either program.

### Resources

- BC Energy Step Code: Design Guide (2019)—Design and performance strategies for achieving TEDI, TEUI, and GHGI targets.
- CAGBC Zero Carbon Building Performance Standards and Design Standards—Industrial building archetypes' TEDI, TEUI, and GHGI targets.
- CAGBC Zero Carbon Building Performance Standards and Design Standards: Appendix B1 (page 59) —Industrial building archetypes' TEDI, TEUI, and GHGI targets.
- Canadian Association of Consulting Energy Advisors—A list of Energy Advisors familiar with GDS Energy Modeling Reports.
- City of Toronto: Energy Efficiency Report Submission and Modeling Guidelines (2022)—Energy Modeling Report guidelines for TGS V4.
- National Energy Code of Canada for Buildings (NECB)—Overview of the National Energy Code of Canada for Buildings.

## EB2: AIR TIGHTNESS TESTING

The Air Tightness Testing requirements are designed to measure air tightness and identify issues related to air leakage that will impact the overall building performance, energy efficiency, and indoor air quality. This is achieved through the use of a whole-building air leakage test of the building's envelop at a pressure of 75 Pascal (Pa), which stimulates the typical conditions experienced by a building due to temperature and wind variations. The practice involves sealing all operable openings and pressurizing the building to gauge resistance to air leakage through the envelope. The performance and submission requirements summary for industrial buildings are provided in Table 4.

*Table 4. EB2: Air Tightness Testing requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **EB2: AIR TIGHTNESS TESTING** | Conduct a whole-building air leakage test to improve the quality and airtightness of the building envelope. | Achieve Tier 2 requirements, plus:<br><br>The project must target equal to or less than 3.0 L/s/m$^3$ (at 74 Pa) through whole-building air infiltration testing. | **Letter of Commitment**: Air leakage testing plan from third-party testing agency during Construction Document Stage.<br><br>**Letter of Commitment**: Post-construction air leakage testing report. |

1. During the Construction Document Stage, develop an air leakage testing plan prepared by a third-party testing agency outlining the timing of construction, detailed reviews, envelope mock-ups, site inspections, and the final air infiltration testing and report.
    a. Air leakage testing plan must follow the ASTM-3158-18 Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building and the City of Toronto's: Whole-Building Air Leakage Testing Protocol to demonstrate compliance with specified air leakage rates for the building type.
    b. If whole-building air leakage testing is not feasible (as identified by a third-party agency), guarded testing is permitted. Guarded testing includes sample air leakage testing performed at the podium, base of tower, top of tower, unique floors, and at two contiguous floors every 10 floors.
2. Following project completion, the air leakage testing report must be submitted to the City.
3. If the building is pursuing Passive House Certification as part of the EB1: Energy Performance requirements, testing as per the Passive House requirements can be used to demonstrate compliance with EB2: Air Tightness Testing. Convert the final results to L/s/m2 @ 75Pa.

**Resources**

- ASTM-3158-18 Standard Test Method for Measuring the Air Leakage Rate of a Large or Multizone Building—Required testing standards for large and multi-zone buildings.
- BC Housing: Illustrated Guide Achieving Airtight Buildings (2017)—Guidance for achieving airtight building envelopes.
- Toronto Green Standard Guideline: Whole-Building Air Leakage Testing Protocol—Guidance for completing multi-zone buildings.

## EB3: BENCHMARKING AND COMMISSIONING

The Benchmarking and Commissioning requirements are designed to ensure the design, construction, and operation of the building meets energy, water, indoor air quality, and durability best practices. The requirements use the following to achieve the objectives:

- ENERGY STAR ® Portfolio Manager: Energy benchmarking tool to monitor, rate, and optimize the building's energy use through an online platform.

- LEED v4 requirements for Fundamental Commissioning and Verification: Provides framework to document and verify the building's performance in accordance with the design documentation and intent and according to the operational requirements from the design phase to one year post construction.

The performance and submission requirements summary for industrial buildings are provided in Table 5.

*Table 5. EB3: Benchmarking and Commissioning requirements for industrial developments.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **EB3: BENCHMARKING AND COMMISSIONING** | Enrol the project in ENERGY STAR® Portfolio Manager to benchmark and report on operational energy performance.<br><br>Complete the following commissioning (Cx) process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies, in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1–2007 for HVAC&R Systems, as they relate to energy, water, indoor environmental quality, and durability. | Achieve Tier 2 requirements | Benchmarking Report: Provide proof of enrollment in ENERGY STAR ® Portfolio Manager to benchmark and track energy and water consumption during operations.<br><br>Building Commissioning: Report in accordance with ASHRAE Guideline 0–2005 and the National Institute of Building Sciences (NIBS) Guideline 3–2012, exterior enclosure technical requirements for the commissioning process, as they relate to energy, water, indoor environmental quality, and durability. |

**Submission Specifications**

To complete the benchmarking requirements:

1. Enroll project in ENERGY STAR ® Portfolio Manager to benchmark and track energy and water consumption. Complete tracking in accordance with Ontario Regulation 506/18 for privately owned buildings.

To complete the building commissioning requirements:

1. Follow LEED v4 requirements for Fundamental Commissioning and Verification, complete the following commissioning (Cx) process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies in accordance with ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC Systems, as they relate to energy, water, indoor environmental quality, and durability.
2. Exterior enclosures are limited to the inclusion of the Owner's Project Requirements (OPR) and Basis of Design (BOD). The review of exterior enclosure design may be performed by a qualified member of the design or construction team who is not directly responsible for the building envelope design. NIBS Guideline 3-2012 for exterior enclosures provides additional guidance.

**Resources**

- NRCan ENERGY STAR® Portfolio Manager—Access page for ENERGY STAR ® Portfolio Manager and additional guidance and information on using portfolio.
- ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007—Guidance for completing commissioning process activities.
- ASTM E2947-16: Standard Guide for Building Enclosure Commissioning—Guidance for including for the enclosure commissioning process from its project planning through design, construction and occupancy and operation phases and roles and responsibilities for Building Enclosure Commissioning Agent (BECxA).
- LEED v4 requirements for Fundamental Commissioning and Verification—Guidance for completing commissioning process activities for mechanical, electrical, plumbing, and renewable energy systems and assemblies.
- NIBS Guideline 3-2012–Guidance for exterior enclosures BECx process.
- Ontario Regulation 506/18 for privately owned buildings—Regulation for reporting energy consumption and water use in privately owned buildings

# Theme 2: Climate Impact

## CI1: EMBODIED CARBON

The Embodied Carbon requirements are designed to measure (Tier 1) and reduce (Tier 2 and Tier 3) the energy and carbon associated with the materials, manufacturing, and other processes throughout the building's life cycles. There are three life cycle stages for measuring embodied carbon:

- **Upfront carbon (life cycle stages A1–A5):** Product stage (raw material supply, transport, manufacturing) and construction process stage (transport and construction–installation process).
- **Use-stage embodied carbon (life cycle stages B1–B5):** Use, maintenance, repair, refurbishment, and replacement stages.
- **End-of-life carbon (life cycle stages C1–C4):** Deconstruction/demolition, transport, waste processing, and disposal stages.

The performance requirements summary for industrial buildings are provided in Table 6.

*Table 6. CI1: Embodied Carbon requirements for industrial developments.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **CI1: EMBODIED CARBON** | Conduct an Upfront Embodied Emissions Assessment for A1–A5 life-cycle stage emissions in accordance with CAGBC Zero Carbon Building Standard. The report must identify reductions and material switching from high- carbon materials like concrete and demonstrate an emissions intensity less than 370 kg $CO_2e/m^2$. | Achieve Tier 2 requirements, plus:<br><br>Demonstrate an emissions intensity of less than 275 kg $CO_2e/m^2$. | Applicants are only required to report on A1–A5 life-cycle stages. The LCA could be combined with the Energy Modeling Report, EB1 metric.<br><br>Complete the CAGBC Zero Carbon Building Embodied Carbon Reporting Template (V3 or later). Include the LCA software used, the input assumptions, and the preliminary assessment results identifying the changes made to minimize embodied carbon impact and further reductions. |

### Submission Specifications

1. Acceptable methods include the CAGBC Zero Carbon Building Standard and CAGBC Zero Carbon Building Embodied Carbon Reporting Template (V3 or later).
2. Acceptable software include One Click LCA , Athena Impact Estimator, and TallyLCA.
3. Follow the National Research Council's National Guidelines for Whole-Building Life Cycle Assessment's Appendix A to calculate gross floor area.
4. Calculate the total embodied carbon in kilograms of carbon dioxide equivalent (kg CO2e) and express the building average in kg $CO_2/m^2$ for the cradle-to-substantial-completion (upfront emissions) life-cycle stages (A1–A5) and complete a contribution analysis by building assembly or material type.
    a. The following materials and features must be included: envelope and structural elements, including footings and foundations, complete structural wall assemblies (from cladding to interior finishes, including basement), structural floors and ceilings (not including surface finishes like paint and stain), party walls, roof assemblies, and parking structures.
    b. The following materials and features can be excluded: fixtures and appliances; mechanical, electrical, and plumping (MEP) materials; paints and surface finishes; millwork and trim; stairs; cabinetry; decks; driveways; site development; and works (i.e., excavation).
    c. Existing structures reused as part of a renovation/rehabilitation and/or salvaged material incorporated into the project can count as embodied emissions of zero.
5. The baseline and proposed buildings must be of comparable size, function, orientation, and operating energy performance.
    a. The baseline assumptions must be based on standard design and material selections for the location and building type.

**b.** The service life must be a minimum of 60 years for both buildings to account for maintenance and replacement.

**c.** The same life-cycle assessment software tools and data sets (compliant with ISO-14044) must be used to evaluate the baseline building and the proposed building and report all listed impact categories.

**Resources**

- CAGBC Zero Carbon Building Standard and CAGBC Zero Carbon Building Embodied Carbon Reporting Template (V3 or later)—Methodology to calculate and track embodied carbon for all buildings.
- CAGBC Embodied Carbon: A Primer for Buildings in Canada (2021)—Policy primer for understanding embodied carbon in Canada.
- City of Toronto: Policy Primer for Regulating Embodied Emissions in Buildings (2022)—Policy primer for setting embodied carbon caps in buildings.
- ISO 14044: Environmental Management, Life Cycle Assessment Requirements, and Guidelines —Compliance standards for data sets for baseline and proposed buildings.
- National Research Council's National Guidelines for Whole-Building Life Cycle Assessment's Appendix A—Required methodology to calculate gross floor area.

## CI2: ELECTRIC VEHICLE INFRASTRUCTURE

The Electric Vehicle (EV) Infrastructure requirements are designed to support the adoption of electric vehicles by providing access to the following electric vehicle charging infrastructure:

- EV-Capable: Parking spaces that have the electrical panel capacity and conduit installed during construction to support future implementation of EV charging with 208/240-volt (or greater), 40-ampere (or greater) circuits. This strategy ensures the reduction of up-front costs for EV charging station installation by providing the electrical elements that are difficult to install during a retrofit. Anticipating the use of dual head EVSE, the same circuit may be used to support charging in adjacent EV-Capable spaces.
- EV-Ready: Parking spaces that have full circuit installations of 208/240-volt (or greater), 40-ampere (or greater) panel capacity, raceway wiring, receptacle and circuit overprotection devices. This strategy provides all required electrical hardware for the future installation of EV Supply Equipment (EVSE). Anticipating the use of dual head EVSE, the same circuit may be used to support charging in adjacent EV-Ready spaces.
- EVSE-Installed: EVSE that is fully installed from the electrical panel to the parking space.

The performance and submission requirements summary for industrial buildings are provided in Table 7.

*Table 7. CI2: Electric Vehicle Infrastructure requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **CI2: EV CHARGING INFRASTRUCTURE** | Equip 20% of all parking spaces with an energized outlet—Level 2 charging or higher—installed adjacent to the space for the purpose of EV charging. and provide signage indicating that spaces with charges are for customers and/or employees.<br><br>OR<br><br>Achieve the following requirements:<br>• Equip 5% of parking spaces with an energized outlet installed adjacent to the space for the purpose of EV charging.<br>• Equip 10% of parking spaces (minimum one space) with EVSE capable of Level 2 charging or higher.<br>• Equip 5% of spaces (minimum one space) with EVSE capable of Level 3 charging.<br>• Provide signage indicating that spaces with chargers are for customers and/or employees. | Equip 30% of all parking spaces with an energized outlet—Level 2 charging or higher—installed adjacent to the space for the purpose of EV charging. and provide signage indicating that spaces with charges are for customers and/or employees.<br><br>OR<br><br>Achieve the following requirements:<br>• Equip 10% of parking spaces with an energized outlet installed adjacent to the space for the purpose of EV charging.<br>• Equip 15% of parking spaces (minimum one space) with EVSE capable of Level 2 charging or higher.<br>• Equip 5% of spaces (minimum one space) with EVSE capable of Level 3 charging.<br>• Provide signage indicating that spaces with chargers are for customers and/or employees. | Parking plan identifying the total number of parking spaces included per building on the site, the total number of parking spaces that will have EVSE and be EV-Ready, the percentage of parking spaces that will have EVSE and be EV-Ready, and the signage that will indicate parking spots are equipped with EVSE.<br><br>**Letter of Commitment**: Confirming the number of EVSE and rough-ins provided and the percentage of parking spaces with EVSE and rough-ins.<br><br>**Site Statistics Template** indicating the total number of parking spaces and total number of EV-Ready and EVSE spaces. |

## Submission Specifications

1. Follow the City of Mississauga's Parking Studies Terms of Reference for completing and submitting a parking study.
2. Refer to the City of Mississauga's Parking, Loading, Stacking Lane, and Bicycle Parking Regulations for parking rates and regulations.

3. EV-Ready and EVSE parking spaces must be installed in accordance with the Ontario Electrical Safety Code (*OESC*) standards for EV charging systems, electric vehicle energy management systems (EVEMS), and EV supply equipment demand factors without EVEMS.[1]
4. EV-Ready parking spaces must be equipped with an energized electrical outlet with either a junction box with a cover plate or a receptacle, with Level 2 EVSE capabilities in the future.
5. EVSE parking spaces must be equipped with Level 2 or higher charging capabilities.
6. Signage must be provided indicating the location and use for energized outlets or EVSE parking spaces.
7. In order to ensure installation of EV charging stations, developers and builders must agree to installation prior to installation. This can be achieved through obtaining an agreement at the development stage and implementing at the building stage.

**Resources**

- Government of Canada: Zero-Emission Vehicle Infrastructure Program (ZEVIP) (2021).
- Electric Mobility Canada: Frequently Asked Questions About EVs in Canada—FAQs for EVs in Canada. v
- Clean Air Partnership EV Costing Study (2021)—EV costing study completed by the Clean Air Partnership.
- US Department of Energy Alternative Fuels Data Centre—Overview of charging infrastructure terminology and requirements of EVSE installation.
- Electric Vehicle Chargers Ontario Program Guide (2015)—Program guide for grant program designed to cover the purchase and installation cost of public EVSEs along major inter-city transportation corridors and in urban centres.
- Ontario Electrical Safety Code (OESC)–Required standards for EV charging systems, electric vehicle energy management systems (EVEMS), and EV supply equipment demand factors without EVEMS.

## CI3: CONSTRUCTION WASTE

The Construction Waste requirements promote the reduction, reuse, and recycling of construction materials in order to conserve natural resources and reduce GHG emissions related to waste disposal. The performance requirements for all building types align with the LEED guidelines to reduce construction and demolition waste disposed of in landfills and incineration facilities by recovering, reusing, and recycling materials. The performance and submission requirements summary for  industrial buildings are provided in Table 8.

[1] Note: as per Rule 8-500 EVEMS are permitted to monitor loads and automatically control EVSE, the system can control loads through connecting, disconnecting, increasing, or reducing electric power to the loads.

*Table 8. CI3: Construction Waste requirements for industrial developments.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **CI3: CONSTRUCTION WASTE MANAGEMENT** | Develop and implement a construction and demolition waste management plan, and divert at least 75% of total construction and demolition material from landfill.<br><br>OR<br><br>Produce less than 100 kg/ $m^2$ of construction and demolition waste through reuse and source reduction design strategies. Salvage or recycle renovation and demolition debris and utilize waste minimizing design strategies for new construction elements. | Develop and implement a construction and demolition waste management plan, and divert at least 90% of total construction and demolition material from landfill.<br><br>OR<br><br>Produce less than 75 kg/ $m^2$ of construction and demolition waste through reuse and source reduction design strategies. Salvage or recycle renovation and demolition debris and utilize waste minimizing design strategies for new construction elements. | Construction and waste management plan identifying reuse and resource reduction strategies.<br><br>**Letter of Commitment**: Post-construction report of all waste generated, including disposal and diversion rates. |

## Submission Specifications

1. Follow the LEED BD+C: New Construction, Construction, and Demolition Waste Management (V4) to develop a Construction and Waste Management Plan to:
    a. Identify strategies to reduce waste generation during project design and construction;
    b. Establish waste diversion goals by identifying structural and non-structural materials targeted for diversion;
    c. Establish the project's diversion strategies; and
    d. Identify where materials will be taken, including expected diversion rates for each material.
2. The total waste generation is calculated by tracking all materials generated from construction to completion, including all waste and diverted materials.
    a. The following waste types are excluded from the total waste generation calculation: hazardous materials, and land-clearing debris.
3. Post-construction waste management report detailing all waste generated, including the disposal and diversion rates. Calculations can be either by weight or volume but must be consistent.
    a. Include all materials sent to alternative daily cover (ADC) waste (not diversion).
    b. Include materials sent to a commingled recycling facility for processing in the facility's average recycling rate and include any ADC as waste (not diversion).
    c. Exclude excavated soil and land-clearing debris.

### Resources

- LEED BD+C: New Construction, Construction, and Demolition Waste Management (V4)—Total waste generation calculation template.
- Ontario Environmental Protection Act, O. Reg. 103/94: Industrial, Commercial, and Institutional Source Separation Programs—Regulations for ICI waste reduction.

## CI5: BIKE PARKING AND AMENITIES

The Bike Parking and Amenities requirements support the use of long-term and short-term parking (as identified in the City of Mississauga's Parking, Loading, Stacking Lane, and Bicycle Parking Regulations) by providing electric bike (E-bike) charging, repair stations, and changing and showering facilities. The performance and submission requirements summary for industrial buildings are provided in Table 9.

*Table 9. CI5: Bicycle Parking and Amenities requirements for industrial buildings.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **CI5: BICYCLE PARKING AND AMENITIES** | Bike repair station: provide at least 1 bike repair station in a publicly accessible location at grade or on the first parking level of the build below grade.<br><br>Electric bicycle charging infrastructure: equip the greater of 15% of the long-term bike parking, or a total of 1 space, with an Energized Outlet (120V) adjacent to the bicycle rack or parking spaces. | Achieve Tier 2 requirements. | Transportation Study: Indicate the types and locations of cycling amenities included.<br><br>**Site Statistics Template** indicating total number of bike parking spaces and electric bicycle charging infrastructure. |

### Submission Specifications

1. Refer to the City of Mississauga's Parking, Loading, Stacking Lane, and Bicycle Parking Regulations for long- and short-term parking regulations.
2. Provide a minimum of 15% of the long-term bike parking, or a total of one space, with an Energized Outlet (120V) adjacent to the bicycle rack or parking spaces. Energized Outlets must be located within 1100 mm from the bike rack to accommodate the standard manufacturer-supplied power code.
    a. All Energized Outlets must include signage indicating the location of electric bicycle charging spaces.
    b. Bike repair stations must be located in an accessible location at grade or on the first parking level of the building below grade.
    c. All bicycle repair stations must include signage indicating usage and location.

### Resources

- LEED ND: Plan (V3), Bicycle Facilities—LEED bike parking requirements for non-residential, multi-unit residential, retail, and mixed-use buildings.

- City of Mississauga: Parking, Loading, Stacking Lane, and Bicycle Parking Regulations (2023)— Building and zoning bike parking requirements.
- Cycle Safe: LEED Credits for Bike Parking—Primer of LEED credits for bike parking and additional bike parking design recommendations.

# Theme 3: Resilience 

## R1: EMISSIONS-FREE ENERGY AND STORAGE

The Emissions Free Energy and Storage requirements are complementary features that support developers in achieving the EB1: Energy Performance requirements, and reduce the development's reliance on grid electricity during peak times. The performance requirements summary for industrial buildings are provided in Table 10.

*Table 10. R1: Emissions-Free Energy and Storage requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **R1: EMISSIONS-FREE ENERGY AND STORAGE** | Provide a minimum of 15% of building's annual energy consumption from one or a combination of acceptable renewable energy sources. | Provide a minimum of 50% of building's annual energy consumption from one or a combination of acceptable renewable energy sources. | **Letter of Commitment**: Quantify percentage of energy consumption from one or combination of renewable energy sources.<br><br>Design Development Stage **Energy Modeling Report**.<br><br>Building elevations and floor plans: Modifications to enable renewable energy systems and storage. |

### Submission Specifications

1. Annual energy consumption percentages can be achieved using one or a combination of the following acceptable renewable energy sources:
    - **a.** Solar photovoltaic (PV)
    - **b.** Solar thermal
    - **c.** Biogas and biofuel systems
    - **d.** Battery storage
    - **e.** Wind systems
    - **f.** Geo-exchange
    - **g.** District Energy System
    - **h.** Innovative Energy System or Technology (subject to city approval)
2. A third-party whole-building energy modeling tool should be used to demonstrate energy savings and energy performance.

3. Annual energy consumption percentages can be achieved based on consumption of the entire site and not on a unit-by-unit basis.
4. If the site is located within an area with high thermal energy density adjacent to a district energy system that is targeting new or future connections, the project must demonstrate one of the following requirements: plan to connect to an existing district energy system, be district-energy ready, and demonstrate less GHG emissions in the proposed design than in the district-connected reference case.

**Resources**

- NRCan Solar-Ready Guidelines for Domestic Hot Water and Photovoltaic Systems—Design and technical specifications for installing solar photovoltaic systems.
- City of Mississauga: District Energy in the Downtown, Feasibility Study—Study to consider the feasibility of a low-carbon District Energy System in the City of Mississauga's Downtown.

## R2: REFUGE SPACE AND BACK-UP POWER GENERATION

The Refuge Space and Back-Up Power Generation requirements are designed to enhance building resilience by ensuring the of social, economic, and environmental systems are designed to withstand the impacts of climate change and extreme weather, and respond to these events in ways that maintain their essential function. In addition, the inclusion of a Resilience Planning Checklist identifies resilient design features that protect occupants while reducing the economic burden associated with rebuilding and recovering after these events. The performance and submission requirements summary for industrial buildings are provided in Table 11.

*Table 11. R2: Refuge Space and Back-Up Power Generation requirements for industrial development*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **R2: REFUGE SPACE AND BACK-UP POWER GENERATION** | Submit a **Resilience Planning Checklist**.<br><br>Provide a refuge area with heating, cooling, lighting, potable water, and power.<br><br>Provide 48 hours of back-up power. | Achieve Tier 2 requirements, plus:<br><br>Provide 72 hours of back-up power. | **Resilience Planning Checklist**.<br><br>Floor plan: Identify location and size of refuge area and amenities.<br><br>**Letter of Commitment**: Identify the back-up power and thermal energy to a central refuge area and to essential building systems. |

**Submission Specifications**

1. Submit a completed Resilience Planning Checklist identifying additional features used in the building design to withstand the impacts of climate change and extreme weather.
2. Provide back-up power and thermal energy to a central refuge area and to essential building systems including security systems, domestic water pumps, sump pumps, one elevator, boilers, and hot water pumps. Non-fossil-fuel sources are preferred; however, both combustion-based or battery-based systems are permitted.

3. Refuge Area: minimum size should be 93 $m^2$ (1000 $ft^2$). Refuge areas must be designed with heating, cooling, lighting, potable water, and power. They may be designed to function as a building amenity during normal operations.
4. The following guidelines and recommendations for accessibility, location, and essential features should be considered in the design of refuge areas:
    a. Accessibility: Refuge areas should be accessible to all occupants and should comply with applicable accessibility codes and standards to ensure equal access for everyone.
    b. Location: Refuge areas should be located on above-grade floors away from hazards, providing a secure location until occupants can safely evacuate or receive assistance. A clear, well-lit passage must be provided to all refuge areas.
    c. Essential features: Refuge areas should be equipped with essential features such as ventilation, communication systems, emergency lighting, fire protection equipment, and emergency supplies.
5. For industrial spec buildings, indicate size of refuge area on Floor Plan (location is not required).

**Resources**

- LEED BD+C: New Construction, Design for Enhanced Resilience (v4)—Design recommendations for resilient buildings to withstand natural disasters and weather events.
- City of Vancouver's Resilient Neighbourhoods Toolkit—Resilience planning checklist for neighbourhoods.
- City of Vancouver: Resilient City (2019)—City-wide strategy that takes a comprehensive approach to addressing shocks, such as earthquakes, and stresses, such as aging infrastructure.

# Theme 4: Ecology

## E1: BIRD FRIENDLY DESIGN AND GLAZING

The Bird Friendly Glazing and Design requirements are designed to reduce bird collisions with buildings by using design features that have been scientifically proven to prevent or reduce risks to birds in the built environment. Mississauga's bird-friendly design measures align with the recommendations identified in the Canadian Standards Association (CSA) A460: 19: Bird-Friendly Building Design. The performance and submission requirements summary for industrial buildings are provided in Table 12.

*Table 12. E1: Bird-Friendly Design requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **E1: BIRD FRIENDLY GLAZING AND DESIGN** | Align bird-friendly designs with Canadian Standards Association A460: 19: Bird-Friendly Design standards for treatment of glazing materials.<br><br>Treat a minimum of 90% of exterior building glazing 16 meters above grade. Visual markers with maximum spacing of 50 mm x 50 mm with a minimum 6 mm in diameter. | Achieve Tier 2 requirements. | Building elevations, floor plan, landscape plan and roof plan (green roofs), indicating:<br><br>• For bird-friendly design: treatment area and material legend showing type, density, and colour of visual markers.<br><br>• For rooftop vegetation: treated area, type of treatment, surface, density, and color of visual markers.<br><br>• For ground-level ventilation grates: location of ground-level exhaust and ventilation systems with grate porosity. |

**Submission Specifications**

1. Reference the CSA A460:19 Bird-Friendly Design Standards (2019 or later) to design treatment of glazing materials, building integrated permanent structures, and overall building and site design.
2. Use a combination of the following strategies to treat a minimum of 90% of all exterior glazing within the first 16 m of the building above grade or to the height of the mature tree canopy, whichever is greater:
    a. Apply visual markers to the first surface of glass with a maximum spacing of 50 mm x 50 mm and with a minimum 6 mm in diameter. Visual markers must have a strong contrast under a wide range of daylight conditions. Non-linear pattern options and duotones are acceptable. Patterns that are too dense will minimize or eliminate the effectiveness of the markers.
    b. Mute reflections on glass surfaces with permanently fixed building-integrated structures, including opaque awnings, sunshades, exterior screens, shutters, grilles, and overhangs or balconies that provide shading below a projection (assume a 1:1 ratio of treatment below a projection).
    c. Use non-reflective glass including acid etch, full cover ceramic frit, or texture.

3. Implement visual markers in the following areas:
    a. Balcony railings and fly-through conditions and
    b. Elevations facing natural areas, parks, and other open space areas.
4. For rooftop vegetation features, treat the first 4 m of glazing above the feature and a buffer width of at least 2.5 m on either side of the feature using strategies from Bird-Friendly Glazing.
5. Ensure ground-level ventilation grates have a porosity of less than 20 mm X 20 mm.

**Resources**

- Canadian Standards Association CSA A460:19 Bird-Friendly Design Standards (2019)—Required standards for treatment of glazing materials, building integrated permanent structures, and overall building and site design.
- City of Toronto Bird-Friendly Design Guidelines (2016)—Design guidelines from the City of Toronto.
- LEED BD + C: New Construction, Bird Collision Deterrence Credit—Design guidelines from LEED.
- Bird-Safe Canada and Fatal Light Awareness Program: Bird-Safe Design and Standards (2021)—Design guidelines from FLAP.
- City of Ottawa: Bird-Safe Design Guidelines (2021)—Design guidelines from the City of Ottawa.
- American Bird Conservancy: Guidelines to Reduce Bird Collisions with Buildings—Downloadable resources for architects and designers to minimize bird collisions in building design.

## E2: EXTERIOR LIGHTING

The Exterior Lighting requirements are designed to minimize glare and reduce light trespass and skyglow, and reduce impacts on nocturnal animals through the use of the International DarkSky Association's Fixture Seal of Approval. Additional non-mandatory practices to manage exterior lighting and protect the night environment include using motion-sensor-controlled lighting and turning off non-essential exterior lighting between 10:00 p.m. and 6:00 a.m. The performance and submission requirements summary for mid-rise and high-rise multi-unit residential buildings are provided in Table 13.

*Table 13. E2: Exterior Lighting requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **E2: EXTERIOR LIGHTING** | All exterior fixtures must be Dark Sky Compliant and all rooftop and exterior facade architectural illumination must be directed downward. | Achieve Tier 2 requirements | Engineer certified lighting plan to identify:<br>• Location of all exterior lighting and illumination direction;<br>• DarkSky compliance of all exterior lighting. |

### Submission Specifications

1. All exterior fixtures must be DarkSky Compliant, a third-party certification for lighting to minimize glare, reduce light trespass, and reduce light pollution.
2. All rooftop and exterior facade architectural illumination must be directed downward (no up-lighting).
3. When possible, the use of continuous green, blue, and white light should be avoided to reduce impacts on nocturnal migrating birds.
4. Applicants are encouraged to install motion-sensor activated lighting and to dim rooftop and exterior facade architectural illumination between 10:00 p.m. and 6:00 a.m.
5. Developments can apply for the following exemptions:
    a. If a DarkSky Fixture Seal of Approval is not available, fixtures must be full-cutoff (e.g. dark sky, all light is down, and comply with the glare requirement between 80° and 90°) and with a colour temperature rating of 3000 K or less.
    b. DarkSky Compliant does not apply to exterior lighting that is required by NAV Canada and traffic control lighting.
    c. Architectural illumination, including uplighting and event lighting, may be permitted through a heritage designation provided lighting is turned off year-round between 10 p.m. and 6 a.m.

### Resources

- Canadian Standards Association CSA A460:19 Bird-Friendly Design Standards (2019)—Required standards for treatment of glazing materials, building integrated permanent structures, and overall building and site design.
- City of Toronto Bird-Friendly Design Guidelines (2016)—Design guidelines from the City of Toronto.
- LEED BD + C: New Construction, Bird Collision Deterrence Credit—Design guidelines from LEED.

- Bird-Safe Canada and Fatal Light Awareness Program: Bird-Safe Design and Standards (2021)—Design guidelines from FLAP.
- City of Ottawa: Bird-Safe Design Guidelines (2021)—Design guidelines from the City of Ottawa.
- American Bird Conservancy: Guidelines to Reduce Bird Collisions with Buildings—Downloadable resources for architects and designers to minimize bird collisions in building design.

# Theme 5: Natural Systems

## NS1: HEAT ISLAND EFFECT

The Heat Island Effect requirements are designed to reduce heat island effect through a combination of the following strategies:

- **Solar Reflectance Index (SRI):** Indicator of a surface's ability to return solar energy to the atmosphere—materials with a higher SRI value reduce the surface temperature.
- **Permeable paving and landscaping:** Improves stormwater management and reduce surface temperature by allowing for more evapotranspiration.
- **Tree shading and shading from architectural structures:** Reduces surface and air temperatures by providing shading to reduce the peak summer temperatures.

The performance and submission requirements summary for industrial buildings are provided in Table 14.

*Table 14. NS1: Heat Island Effect requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS1: HEAT ISLAND EFFECT** | Use combination of the following strategies to treat at least 75% of the site's (non-roof) hardscape:<br>• High-albedo paving materials.<br>• Open grid pavement and/or permeable surfaces.<br>• Shade from existing or new tree canopy.<br>• Shade from energy generation structures. | Achieve Tier 2 requirements. | **Site Statistics Template** indicating the percentage of urban-heat island-treated areas to total non-roof hardscape area.<br><br>Materials list includes SRI of high-albedo paving.<br><br>Landscape plan indicating location of treated hardscape and soft landscaping. |

### Submission Specifications

1. Non-roof hardscape includes driveways, walkways, courtyards, surface parking areas, artificial turf, and other on-site hard surfaces. Industrial buildings with work yards and/or loading docks with limited options for shading or reflective surfaces can be excluded from the hard surface area calculation.
2. Use one or a combination of the following strategies to treat the site's non-roof hardscape:
    a. High-albedo paving materials with an initial solar reflectance of at least 0.33 or an SRI of 29.
    b. Permeable open-grid pavement with a minimum of 50% perviousness.
    c. Tree shading from existing tree canopy or new tree canopy within 10 years of landscape installation, completed using a shade study.[2]
    d. Shading from architectural structures that are vegetated or have high reflectivity (initial solar reflectance of at least 0.33 at installation or an SRI of 29).
    e. Shading from structures with energy generation systems consisting of solar photovoltaics or solar thermal collectors that provide shade.
3. Using the Site Statistics Template, calculate the area in metres squared that is treated by each strategy and determine the percentage of urban-heat-island-treated areas to total non-roof hardscape area.
4. Other design considerations:
    a. Shade cast by buildings is not considered an eligible heat island strategy.
    b. Open-grid pavement consists of concrete or hard plastic grid systems with large pore spaces filled with a planted growing medium or light-coloured aggregate. Open-grid and high-albedo pavement should not be used for driveways and loading areas for industrial sites.
    c. Wherever possible, use high-albedo, low-carbon concrete mixtures with a minimum of 25% supplementary cementitious material (SCM) and biobased materials for decorative stonework, retaining walls, walkways, or other landscape or architectural elements.

### Resources

- City of Toronto: Design Guidelines for Greening Surface Parking Lots—Strategies and measures for developers, designers, and reviewers of surface parking lots.
- LEED ND and BD+C: New Construction, Heat Island Reduction (V4)—Requirements for non-roof and roof surfaces.
- Green Infrastructure Ontario—Resources for infrastructure planning and policy development to enhance green infrastructure.
- Toronto and Region Conservation Authority: Sustainable Technologies Evaluation Program (STEP)—Resources for implementing technologies that protect water resources and reduce our carbon footprint.

[2] Note: For surface parking areas, projects may plant one tree per five parking spaces distributed within or along the border of the parking area. This method can be used in lieu of completing a shade study.

## NS2: TREE GROWTH

The Tree Growth requirements are designed to achieve the following objectives:

- Reduce urban-heat island effect and provide protection during heatwaves;
- Incorporate drought-tolerant and climate-resilient species that can withstand the impacts of climate change;
- Provide habitat and food sources for native insects, birds, and other wildlife; and
- Promote healthy tree growth by providing adequate soil volumes that support tree growth and structure, nutrient and water absorption, and promote stable root systems.

The performance and submission requirements summary for industrial buildings are provided in Table 15.

*Table 15. NS2: Tree Growth requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS2: TREE GROWTH** | Plant 'shade trees' 6-8 m (20- 27 ft.) apart along the street frontages, and should be drought tolerant and non-invasive.<br><br>Provide adequate rooting space to support tree health and growth, through the minimum soil volume of 30$m^3$ for each new tree. | Achieve Tier 2 requirements | Landscape plan indicating location of all new tree plantings and a species list.<br><br>**Soil Volume Breakdown Template**. |

### Submission Specifications

1. Refer to the City of Mississauga's Terms of Reference Arborists Reports, Tree Inventory/ Survey & Tree Preservation Plans for guidance on arborists reports, tree inventory, and tree preservation guidelines.
2. A completed Soil Volume Breakdown Template must be submitted indicating the soil depth used to calculate soil volume. Root ball may be factored into soil volume calculation. Provide a minimally compacted topsoil layer/upper horizon.
    a. Ensure each separate new or retained tree planting area has access to a minimum volume of 30 $m^3$ of soil.[3]
    b. Plant large-growing shade trees with appropriate spacing that accommodates the minimum volume requirement of 30 $m^3$ per tree and the mature trunk and root flare growth of each tree.
    c. A minimum depth of 0.9 m, maximum depth of 1.6 m and minimum width of 2.0 m. shall be used to calculate the soil volume provided. Root ball may be factored into soil volume calculation.
4. Species must comply with the NS3: Climate-Resilient Landscape requirements.

[3] If minimum soil volume requirements cannot be met due to site restrictions,a Qualified Professional must identify the minimum soil volume that will support the species' root growth and structure, nutrient and water absorption, and ensure structural stability. All soil volumes must be approved by the City of Mississauga staff.

**Resources**

- City of Mississauga: Arborist Report, Tree Inventory/Survey, and Tree Preservation Terms of Reference —Required reference materials.
- City of Mississauga: Tree Planting Continuous Soil Trench (02950-17)—City of Mississauga guide for tree planting.
- City of Toronto: Continuous Soil Trench With Soil Cells Drawings and Green Infrastructure Drawings—Sample guidelines for soil cells.
- Trees Ontario—Resource for tree planting and conservation techniques and native tree species and drought-tolerant species lists.

## NS3: CLIMATE-RESILIENT LANDSCAPES

The Climate-Resilient Landscape requirements are designed to each the following objectives:

- Adapt to local climate conditions by incorporating native plant species and drought-tolerant plant species;
- Support biodiversity by providing habitat and food for pollinators, wildlife, and birds; and
- Reduce future landscape maintenance requirements.

*Table 16. NS3: Climate-Resilient Landscapes requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS3:CLIMATE-RESILIENT LANDSCAPES** | In all landscaped areas, including green roofs, plant a minimum of 75% native plants and comply with Ontario Invasive Plant Council Guidelines, including:<br>• Minimum of 2 native flowering species to provide continuous bloom throughout the growing season to support pollinators.<br>• Preference for drought tolerant native species.<br><br>For vegetated buffer areas, adjacent Significant Natural Features, plant 100% native plants.<br><br>Provide a natural heritage restoration and/or enhancement plan with the proposed locations of natural heritage restoration, design specifications, and ecological function. | In all landscaped areas, including green roofs, plant a minimum of 90% native plants and comply with Ontario Invasive Plant Council Guidelines, including:<br>• Minimum of 2 native flowering species to provide continuous bloom throughout the growing season to support pollinators.<br>• Preference for drought tolerant native species.<br><br>For vegetated buffer areas, adjacent Significant Natural Features, plant 100% native plants.<br><br>Provide a natural heritage restoration and/or enhancement plan with the proposed locations of natural heritage restoration, design specifications, and ecological function. | Landscape plan indicating:<br>• Location and percentage of native plantings.<br>• Plant list including information about common name, scientific name, size, quantity, stock type, native or non-native, drought-tolerance, and pollinator-friendly species.<br>• Irrigation requirements.<br>• Compliance with Ontario Invasive Plant Council Guidelines.<br><br>Natural Heritage Restoration Plan and/or Enhancement Plan identifying natural heritage restoration, design specifications, and ecological restoration. |

### Submission Specifications

1. Landscape plans must include the location and percentage of all native plantings, and a plant list including information about the common name, scientific name, size, quantity, stock type, native or non-native, and pollinator-friendly species.
2. Native plant species are plants that are indigenous to Southern Ontario, are adapted to the local conditions, and occur naturally within the region. Native planting requirements apply to trees, shrubs, and herbaceous plants.
3. Preference for drought-tolerant native species. If potable water is used for irrigation, all native and non-native plants must be drought tolerant.
4. Comply with the Ontario Invasive Plant Council Guidelines by avoiding the use of all invasive species in the landscape design. Invasive species are species that reproduce aggressively and become established in a natural area by displacing native species.
5. Pollinator plants should provide continuous bloom throughout the growing season to support pollinators. These can be maintained by an irrigation system to provide supplemental watering and should include a maintenance plan for year-round support of native pollinators.
6. Non-potable irrigation is preferred to support plantings and may include potable water supplies to make up irrigation sources for non-potable systems during drought conditions. The irrigation requirements must be completed by a Water Smart Irrigation Professional.
7. For specific sites abutting Natural Heritage Features, provide a Natural Heritage Restoration and/or Enhancement Plan with the proposed location(s) of the natural heritage restoration as well as the design specifications and the ecological function.

### Resources

- City of Mississauga: Natural Heritage and Urban Forestry Strategy —Resource for planning and management of Mississauga's Natural Heritage System.
- City of Toronto: Pollinator Protection Strategy—Guiding principles and priorities to protect pollinator communities.
- City of Toronto: Pollinators Resources—Resources for pollinator-friendly gardens, native flowers, trees, and shrubs.
- Credit Valley Conservation: Native Plants for Pollinators Guide (2017)—Planting guidelines to support pollinators.
- Credit Valley Conservation: Plant Selection Guideline - Species List for Planing within the Credit River Watershed—Planting guidelines for the Credit River Watershed.
- Conservation Halton: Native Species List—Native planting guidelines.
- Ontario Invasive Plant Council—Resource and guidelines for planting native species and managing invasive species.
- Ontario Native Plants—Resources for native plants, design guidelines, and native flora.
- Pollinator Partnership Canada—Resources for pollinator-friendly habitats.
- Toronto and Region Conservation Authority: Flora Species Native to the TRCA Jurisdiction (2022)—Resources native species.

## NS4: SUSTAINABLE ROOFS

The Sustainable Roof requirements are designed to improve climate resilience, stormwater management, biodiversity, and occupant comfort. These objectives can be achieved using the following sustainable roof features: intensive green roofs, and biodiverse green roofs.

- **Green Roof:** Designed with a root repellent system, a drainage system, a filtering layer, a growing medium, and plants. Green roofs are typically installed on flat roofs; however, sloped roofs can accommodate them with additional considerations. There are two types of green roofs:
- **Cool Roofs:** Designed to lower surface temperatures and minimize radiant heat transfer to the building and outdoor spaces.
- **Blue Roofs:** Designed to temporarily retain rainwater on the rooftop and release it slowly into the stormwater system to reduce flood risk and contribute to water conservation by allowing capture of rainwater for non-potable applications. There are four types of blue roofs: integrated design, modular tray design, roof dams and roof checks, and actively controlled systems.

The performance and submission requirements summary for industrial buildings are provided in Table 17

*Table 17. NS4: Sustainable Roofs requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS4: SUSTAINABLE ROOFS** | Buildings with an available roof area larger than 500m$^2$ must include one or a combination of green roof, cool roof, blue roof and/or solar PV:<br>• Green roof and/or blue roof for at least 50% of Available Roof Space.<br>• Cool roof installed for 100% of Available Roof Space.<br>• Use a combination of a green, blue, cool roof or solar PV for at least 75% of Available Roof Space. | Achieve Tier 2 requirements. | On floor and roof plans indicate green roof, cool roof, and/or blue roof locations.<br>• Notations include green roof, blue roof, and/or solar PV locations identified on elevations and roof plans.<br>• Notations include SRI of cool roof on roof plan and location of solar panels.<br>For green roofs: On a landscape plan, indicate the potable irrigation systems servicing the green roof and submit maintenance plan.<br>For blue roofs: On stormwater management report and stormwater management plan quantify blue roof storage and run-off.<br>**Site Statistics Template** indicating sustainable roofs portion copied directly onto the roof plan. |

### Submission Specifications

1. Available roof spaces are calculated according to the following guidelines:
    - For green roof and blue roof areas, the available roof space is the total roof area of the building, excluding areas designated for renewable energy devices and mechanical equipment, rooftop outdoor amenity areas, and private terraces abutting residential units at the roof level.
    - For cool roofs, the available roof space consists of the total roof area of the building, excluding private terraces no greater than the floor of the abutting residential unit at the roof level.
2. Green roof assemblies must consist of a root repellent system, a drainage system, a filtering layer, a growing medium, and plants. Green roofs are typically installed on flat roofs; however, sloped roofs can accommodate them with additional considerations. Green roof assemblies are categorized into two types:
    - Intensive Green Roofs require deeper substrates capable of supporting a wide range of plant species. If pursuing, the minimum requirements are a growing medium with a minimum depth of 150 mm and a diverse mix of native plants suitable for the depth of growing medium and roof height (e.g., sedums, grasses, drought-tolerant perennials, and, where appropriate, larger trees and plants)
    - Biodiverse Green Roofs aim to support pollinator species and are installed at or below the 8th storey of the building.
3. Green roofs should follow the Credit Valley Conservation Native Plants for Pollinators Guide.
4. Blue roofs are categorized into four primary types:
    - Roof-integrated designs intentionally store standing water for extended periods of time using a roofing membrane or a waterproofing system.
    - Modular tray designs are plastic trays that are physically attached to the roof or held in place with a ballast to temporarily detain water during rainfall.
    - Roof dams and roof checks are similar to roof-integrated design in that they are impermeable or semi-permeable dams/checks that break surface flow and pool water behind as a temporary detention. Dams are designed with an overflow or outlet that slowly releases stored water.
    - Actively controlled systems use a valve and controller to regulate discharge of flows from rooftops.
5. If installing blue roofs, the system can be designed to meet the NS5: Stormwater Management requirements.
6. Green roofs and blue roofs require a maintenance plan to ensure optimal performance. Applicants must submit a five-year maintenance plan outlining the installation of the permanent irrigation system to supply supplementary water (green roofs), the access locations for roof maintenance, and a green roof and/or blue roof maintenance contract with qualified professionals.

7. Cool roofing material and coating systems must meet the following requirements:
    - Low slope (flat) roofs with a surface slope less than 16.7% or 9.5 degrees should have an SRI rating of 78 or higher and an emissivity equal to or greater than 0.9.
    - Steep slope (pitched) roofs with a surface slope greater than 16.7% or 9.5 degrees should have an SRI rating of 25 or higher and an emissivity equal to or greater than 0.9.
8. Applicants may seek an exemption under the following circumstances:
    - There is architectural detailing on the roof, making such installations impossible.
    - There is architectural detailing on the roof that features building materials that cannot support such installations.

**Resources**

- Green Roofs for Healthy Cities—Resources and guidelines for green roof design, installation, and maintenance.
- TRCA Low Impact Development Stormwater Management Planning and Design Guideline—Resources and guidelines related stormwater planning and practices.
- City of Toronto: Biodiverse Green Roofs—Design guidelines for biodiverse green roofs.
- City of Toronto: Green Roof Bylaw—Green roof construction requirements for new development and available roof space calculations.
- Cool Roof Rating Council: LEED Resources—Primer for cool roof construction requirements.

## NS5: STORMWATER MANAGEMENT

The Stormwater Management requirements are designed to reduce flood risk, improve water quality and erosion control, and create climate-resilient environments. With more intense and frequent storms, stormwater management requirements in new developments help communities adapt to these changing climate conditions by ensuring that infrastructure and drainage systems can manage increased runoff. The performance and submission requirements summary for industrial buildings are provided in Table 18.

*Table 18. NS5: Stormwater Management requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS5: STORMWATER MANAGEMENT** | Retain 80% runoff generated from a minimum of 27 mm depth of rainfall from all site surfaces using rain barrels integrated to supplement non-potable water uses (required), and a combination of the Stormwater Management Practices outlined in the Stormwater Management Planning and Design Manual Infill Development. | Retain 100% runoff generated from a minimum of 27 mm depth of rainfall from all site surfaces using rain barrels integrated to supplement non-potable water uses (required), and a combination of the Stormwater Management Practices outlined in the Stormwater Management Planning and Design Manual Infill Development. | Stormwater management plan identifying the Stormwater Management Practices implemented to meet the requirements. |

### Submission Specifications

1. Follow the City of Mississauga's Stormwater Management Report Terms of Reference to complete the Stormwater Management Plan.
2. The 27 mm of runoff shall be retained on-site and managed by way of infiltration, evapotranspiration, re-use or filtration. This is calculated as the product of impervious site area times 27 mm, excluding initial abstraction.
    a. Methods to achieve this can include measures such as permeable pavements, infiltration systems, rainwater harvesting tanks, bioretention systems or green roofs.
    b. Recognizing that the City requires roof leader downspouts to be disconnected, other measures that can be implemented include: Incorporation of rain barrels at the roof leader downspouts or rain gardens to absorb flows Use of infiltration galleries, if soil conditions are conducive, located on the property considering Ontario Building Code requirements Incorporation of permeable materials within the driveway where permitted by applicable zoning by-law Increase of topsoil depth around the property to 300 mm to allow for greater absorption
3. Follow the Stormwater Management Practices outlined in the Stormwater Management Planning and Design Manual for Infill Development to identify practices implemented to meet the runoff requirements.
4. Follow the Sustainable Technologies Evaluation Program for low-impact development stormwater management planning and design guides.

### Resources

- Ontario Ministry of the Environment, Conservation, and Parks: Ontario's Low Impact Development Stormwater Management Planning and Design Guide (2018)—Stormwater management practices for infill development.
- Toronto and Region Conservation Authority: Stormwater Management and Design Guidance Manual—Stormwater management guidelines from the Toronto and Region Conservation Authority.
- Credit Valley Conservation Authority: Stormwater Management Guidelines for the Credit River Watershed—Stormwater management guidelines for the Credit River Watershed.
- Lake Simcoe Region Conservation Authority: Lake Simcoe Region Conservation Authority - Stormwater Management Technical Guidelines (2019)—Stormwater management guidelines from Lake Simcoe Region Conservation Authority.
- STEP LID Planning and Design Wiki Guide—Guidance on how to design Low Impact Development (LID) features to meet the design criteria.
- Sustainable Technologies Resource Library—Guidance and publications for LID, water quality, bioretention, inspection, maintenance, etc.

## NS6: WATER CONSUMPTION

The Water Consumption requirements are designed to reduce potable and non-potable water consumption and achieve the following objectives:

- **Sustainable Water Management:** Conserving water ensures that water supplies remain sufficient and reliable, even during periods of drought or water scarcity.
- **Mitigating Water Stress:** Many regions are experiencing water stress due to population growth, climate change, and over-extraction of groundwater. Conservation and efficient use can alleviate water stress and preserve natural water sources.
- **Energy Efficiency:** Water treatment and distribution require significant energy inputs. By reducing water consumption, new developments can indirectly lower energy demands, leading to reduced GHG emissions.
- **Climate Resilience:** As climate change brings more frequent and severe droughts, water-efficient practices in new developments can enhance resilience by minimizing water-related risks and ensuring sustainable water availability.

The performance and submission requirements summary for industrial buildings are provided in Table 19.

*Table 19. NS6: Water Consumption requirements for industrial development.*

| METRIC | TIER 2 REQUIREMENTS | TIER 3 REQUIREMENTS | SUBMISSION REQUIREMENTS |
|---|---|---|---|
| **NS6: WATER CONSUMPTION** | Reduce irrigation water consumption by 60% using a combination of treatment measures for reuse of greywater and blackwater (e.g., rain barrels, cisterns, green roofs, filtration ponds).<br><br>Reduce building water consumption (not including irrigation) by 20% using water fixtures or non-potable water sources. | Reduce irrigation water consumption by 80% using a combination of treatment measures for reuse of greywater and blackwater (e.g., rain barrels, cisterns, green roofs, filtration ponds)<br><br>Reduce building water consumption (not including irrigation) by 40% using water fixtures or non-potable water sources. | **Letter of Commitment** confirming the project will:<br>• Be designed to reduce potable water requirements for irrigation;<br>• Feature a percent reduction in potable water used to irrigate relative to a mid-summer baseline;<br>• Implement strategies to reduce potable water demands; and<br>• Implement strategies to reduce building water consumption. |

### Submission Specifications

1. Follow LEED v4 BD+C WE Credit: Outdoor Water Use Reduction Option 2, and use the calculation tool to demonstrate reduction in irrigation consumption compared to a mid-summer baseline.
2. Follow LEED v4.1 BD+C: WE Credit Indoor Water Use Reduction to calculate the water consumption based on estimated occupant usage and baseline fixtures for toilets, urinals, faucets, and shower heads. As per the LEED Credit, the following baseline fixtures should be used:
    a. Toilets: 6.0 L
    b. Urinals: 3.8 L
    c. Residential faucets: 8.3 LPM at 414 kPa
    d. Shower heads: 9.5 LPM at 550 kPa
3. Reduce the project's irrigation requirements from the calculated baseline of the site's peak water month (mid-summer baseline). Reductions can be achieved using plant species (NS3: Climate-Resilient Landscapes), a combination of treatment measures for reuse of greywater and blackwater (e.g., rain barrels, cisterns, green roofs, and filtration ponds), alternative water sources, and smart-scheduling technologies.

### Resources

- LEED BD+C: WE Outdoor Water Use Reduction—Calculation requirements to demonstrate irrigation water consumption.
- Sustainable Technologies Resource Library—Guidance and publications for LID, water quality, bioretention, inspection, maintenance, etc.