

CITY OF HAMILTON

**SUSTAINABLE BUILDING AND
DEVELOPMENT GUIDELINES
PHASE 1 - LOW DENSITY RESIDENTIAL USES
BACKGROUND RESEARCH REPORT**





SUSTAINABLE BUILDING AND DEVELOPMENT GUIDELINES – BACKGROUND RESEARCH REPORT

CITY OF HAMILTON

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TABLE OF CONTENTS

1	BACKGROUND.....	1
1.1	Introduction.....	1
2	SUMMARY OF GREEN DEVELOPMENT STANDARDS	2
2.1	Impact Categories	2
2.1.1	Energy & GHG Emissions.....	3
2.1.2	Water	4
2.1.3	Air	5
2.1.4	Land.....	6
2.1.5	Social Well-being.....	7
2.1.6	Waste.....	8
2.1.7	Education.....	9
2.1.8	Food.....	9
2.1.9	Community Design.....	9
2.2	Emerging Trends.....	10
2.3	Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis	11
2.3.1	Strengths.....	11
2.3.2	Weaknesses.....	12
2.3.3	Opportunities.....	13
2.3.4	Threats.....	13

TABLES

TABLE 1	IMPACT CATEGORIES AND THEIR RELATED SUB-CATEGORIES.....	2
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APPENDICES

A	SUSTAINABILITY GUIDELINES OF CANADIAN MUNICIPALITIES
B	CONSULTATION SUMMARY

1 BACKGROUND

1.1 INTRODUCTION

The purpose of the Sustainable Building and Development Standards (SBDS) is to improve the environmental performance of new industrial, commercial, institutional and multi-unit residential development within the City.

This scope of work is the first phase, which will focus on targets and criteria for Low-Density Residential Uses in Zoning By-law No. 05-200. The new standard is to focus on land-use rather than building-specific measures for sustainable development.

The SBDS will establish the following items for Low Density Residential Uses:

- Minimum and aspirational targets / criteria with respect to building construction and design, natural environment and open space, mobility, infrastructure, etc.;
- A grading or scoring system to evaluate the performance of proposed developments against the targets / criteria; and,
- Minimum information requirements to be submitted with development applications to inform the evaluation of the proposed development against the SBDS.

This version of the Report reflects the work that the WSP team has completed thus far in conducting a Background Review and Analysis. This draft contains the following sections:

- 1 Review of existing documents and similar assessment tools from other municipalities
- 2 Review of existing sustainable building standards and land use policies, programs and best practices, and regional and provincial regulations that may impact the City of Hamilton
- 3 Overview of emerging trends
- 4 Strengths, Weaknesses, Opportunities and Threats (SWOT) Analysis of the application and implementation of the Sustainable Building and Development Standards within the City.

2 SUMMARY OF GREEN DEVELOPMENT STANDARDS

2.1 IMPACT CATEGORIES

Canadian municipalities that have implemented best practices in sustainable development standards have done so using educational guidelines or with more stringent prescriptive and performance-based requirements. Elements of these standards, guidelines and requirements may inform how the guidelines will be applied, which projects they will apply to, and how compliance will be tracked.

Each municipal establishes overarching environment requirements that are grouped according to their targeted goal (e.g. GHG reduction, Indoor Water use). For the purposes of this Background Review Report, these environmental themes have been combined into nine Impact Categories and summarized in the report sections below. This report explores a range of potential categories for the new SDBS within each area of focus outlined in the table below. Only requirements that are applicable to the low-density residential sector have been included.

Table 1: Impact Categories and their related sub-categories

1	2	3	4	5	6	7	8	9
Energy & GHG Emissions	Water	Air	Land	Social Wellbeing	Waste	Education	Food	Community Design
Energy labelling (Energy Star, etc.)	Indoor water use	Indoor air quality	Landscaping and Biodiversity	Public art	Construction waste	Promotion (green options)	Urban agriculture	Street and block patterns / design
Energy conservation	Outdoor water use	Toxic emissions (VOCs)	Tree canopy	Universal design and accessibility	Recycled / reused materials, building reuse	Communication (e.g. info packets)	Community Gardens and local farmers' markets	Proximity to amenities
Renewable energy	Stormwater management	Cool roofs and green roofs	Soil quality and quantity	Affordable housing	Sustainable harvesting practices	Innovation		Pedestrian / cycling networks
Building orientation	Rainwater harvesting	EV charging	Heat island	Safety				Exterior lighting
Building envelope		Bike parking	Erosion and Sediment Controls					Streetscape amenities
District Energy								

The municipal standards typically consist of both mandatory and optional criteria. In the case of some municipalities, higher tiers or performance levels (e.g. Tier 2, Silver level, etc.) can be achieved by demonstrating enhanced sustainable design.

2.1.1 ENERGY & GHG EMISSIONS

The Energy & GHG Emissions Impact Category focuses on buildings and their energy performance during the operational stage. In each of the municipal standards reviewed, energy was invariably found to be a predominant focus area, and while GHG emission targets were not always explicitly separated from energy targets, the two are closely related and were typically addressed.

THIRD-PARTY CERTIFICATIONS

While applicable building codes provide minimum energy efficiency targets, a number of the municipal standards reviewed mandate higher energy performance than are otherwise required. One of the main ways that the municipal standards benchmark building energy efficiency is through third-party standards. For example, Toronto and Whitby both require that all low-rise residential buildings are designed to achieve at least Energy Star for New Homes, version 17 or R-2000 requirements. Similarly, the Town of East Gwillimbury requires that all residential developments 3-storeys or less achieve Energy Star for New Homes certification or a minimum rating of 83 when evaluated in accordance with Natural Resources Canada's EnerGuide Rating: 0-100 Scale. Finally, the City of Langford requires that all one-family dwellings, two-family dwellings and townhouses are certified as Built Green bronze. Energy Star for New Homes requirements, higher EnerGuide ratings or Built Green certification levels as well as alternate high-performance standards such as the Passive House Standard, LEED (meeting Minimum Energy Performance targets), and the Canadian Home Builders' Association (CHBA) Net Zero Home Labelling Program are also presented as optional/higher tier measures in multiple municipal green development standards.

While none of the municipal standards reviewed mandate the inclusion of Energy Star certified appliances, Toronto, Whitby, Edmonton, Halton Hills, and North Vancouver each have optional/higher tier measures regarding high efficiency appliances. Energy Star appliance labelling applies to clothes washers, clothes dryers, dishwashers, refrigerators, light fixtures, and ceiling fans, among others.

PASSIVE STRATEGIES

Improving building energy efficiency can also be achieved via passive strategies that reduce a building's energy consumption. These strategies typically consider the building orientation for optimal solar gain and natural ventilation from local predominant winds, and a high-performing building envelope to reduce heat loss and unnecessary heat gain.

The incorporation of passive design strategies are encouraged through various options or higher tier measures, with the passive solar alignment as the most common. For example, East Gwillimbury's green development standard includes an optional measure to identify opportunities for maximizing solar gain through site layout and building orientation in an Energy Efficiency Report. East Gwillimbury also encourages the east-west orientation of units to maximize passive solar gain but does not provide a specific way to measure the alignment, whereas Langford specifically encourages all buildings to be sited with the longest axis of the building within 15° of geographical east-west.

Richmond Hill, Vaughan, Brampton, and Whitby each encourage strategies that are similar to Langford, but that relate to blocks rather than buildings themselves: 50% (or more) of the blocks have one axis within 15° of geographical east-west and east-west lengths of those blocks are at least as long as the north-south lengths of blocks. Further green development strategies related to the massing and orientation of projects is noted in section 2.1.9 Community Design.

Additional passive building strategies are included in the City of North Vancouver's sustainable development guidelines are high efficiency windows (Energy Star labelled), airtightness (at most 1.5 ACH @ 50 Pa blower door test and appropriate ventilation strategy), and superior insulation (thick wall exclusion in Zoning Bylaw sought for insulation above BC Building Code). Finally, Edmonton also places value airtightness by encouraging buildings to be constructed to meet a low level of air leakage (1.5 ACH @ 50 Pa), including the utilization of qualified insulation contractors.

RENEWABLE ENERGY

The use of renewable sources of energy in lieu of non-renewable sources is encouraged by municipalities in varying degrees. The least stringent of the guidelines is mandated by Whitby, which requires a feasibility study of on-site energy generation from renewable resources. East Gwillimbury requires that buildings are designed to be solar-ready

(accommodate future use of solar technologies), while Edmonton, Langford, Vaughan, Brampton, Richmond Hill, Toronto, and Whitby include this measure as optional/higher tier.

A more proactive approach is to encourage the installation of on-site renewables. East Gwillimbury, Langford, Vaughan, Brampton, Richmond Hill, and Whitby each encourage that projects provide a percentage of on-site renewable energy supplied, based on the building's total energy use. These percentages range from 1% to 30%. The Toronto Green Standard is the only municipal standard reviewed that requires a minimum percentage (5%) of each building's annual energy consumption be supplied by on-site renewable energy; however, this requirement applies only to City-owned, low-rise residential buildings.

OTHER STRATEGIES

Other measures that reduce a building's energy consumption include providing indoor or outdoor clotheslines to discourage the use of electric clothes dryers, providing zonal HVAC heating and cooling controls, and supplying on-demand water heating. These measures are all optional in the Halton Hills Green Development Standard and the on-demand hot water heating is required in East Gwillimbury.

Optional/higher tier district energy requirements are also included in Langford's Green Development Checklist and East Gwillimbury's Development Standards for new Draft Plan of Subdivision and Site Plan applications. These options include providing the necessary infrastructure and a connection to the District Energy System (where District Energy is available for hook-up) or even constructing a District Energy, other communal energy system or combined heat and power system for heating and/or cooling for the development. Finally, Vaughan, Brampton, and Richmond Hill each have an optional measure to carry out a district energy feasibility study if the development is located in an area where district energy has been deemed viable by the municipality.

2.1.2 Water

The Water category focuses on reducing the use of potable water for indoor and outdoor water uses, as well as rainwater management. Reducing potable water use, harvesting, and re-using stormwater, and managing the quantity and quality of stormwater are all common themes in this Impact Category. Each of the municipal standards reviewed include requirements that address one or more of these themes.

INDOOR WATER USE

Reducing potable water use by installing low-flow indoor fixtures, fittings, and appliances is one of the main targets that municipalities have adopted. Vaughan, Brampton, and Richmond Hill mandate specific maximum flow rates for toilets, bathroom faucets, and showerheads (6 LPM, 8.3 LPM, and 9.5 LPM, respectively). Another approach that ensures high-efficiency fixtures are used is via the US EPA WaterSense labelling program. WaterSense labeled products are 20% more water efficient than average products in that category and perform as well or better than their less efficient counterparts. East Gwillimbury requires that all toilets and bathroom faucets are WaterSense labeled and Halton Hills includes WaterSense labeling of water fixtures as an optional measure.

Requiring a specific reduction over baseline water fixtures and appliances (not including irrigation) is a common approach that the municipal standards reviewed take to reducing indoor potable water use. East Gwillimbury, Vaughan, Brampton, Richmond Hill, and Toronto all have optional or higher tier measures that encourage reductions ranging from 10% to 50%. The baselines used to calculate the percent reductions achieved vary depending on the municipality, but the baselines used in the LEED Indoor Water Use Reduction credit are most typical.

OUTDOOR WATER USE

Irrigation is another typical use for potable water in low-rise residential developments. Reducing potable water used for irrigation also has synergies with the Land Impact Category, which is discussed in section 2.1.4.

Both Edmonton and Langford encourage the installation of high-efficiency irrigation systems (i.e. drip or trickle). Similar to the approach taken to indoor water, specifying a percent reduction in potable water used for irrigation is another common measure in municipal green development standards. Vaughan, Brampton, Richmond Hill, and Whitby each have optional measures that encourage reductions ranging from 50% to 100%.

Using non-potable water such as captured stormwater, recycled wastewater, or other non-potable water source, is a strategy that could enable the greatest reductions in potable water use. East Gwillimbury's Thinking Green! Development Standard requires that for all residential developments 3-storeys or less, each house includes a separate, non-potable watering system with a minimum capacity of 180L for irrigation purposes. Langford takes a less specific approach with an optional measure that encourages irrigation system to utilize captured rainwater, recycled wastewater, or other non-potable water source. Finally, Halton Hills has an optional requirement that is to provide one rain barrel per 100 square metres of dwelling unit roof area.

Non-potable water can also be used for sewage conveyance, but this was not specifically mandated in any of the municipal standards reviewed.

STORMWATER MANAGEMENT

In addition to water conservation, stormwater management is a key component of the Water Impact Category. Both the quantity and the quality of stormwater runoff are important considerations in proper stormwater management, and both can be addressed in municipal green development standards.

Reducing impermeable surfaces and using low-impact development (LID)/green infrastructure (GI) practices can improve infiltration and reduce stormwater runoff. A number of municipal standards (Halton Hills, North Vancouver, Edmonton, and Langford) encourage the incorporation of on-site stormwater management features, but do not have any specific or mandatory requirements. Other municipalities have more stringent requirements and use varying metrics to measure the quantity of stormwater runoff. For example, East Gwillimbury has a mandatory requirement that that post-development peak flow rates are equal to or do not exceed pre-development peak flow rates for the 2- to 100-year storm events and a minimum volume and that a minimum volume reduction of 5mm is achieved. Further volume reductions (12.5mm and 25mm) are also presented as options but are not mandatory. Whitby also compares pre- and post-development runoff volumes in optional measures that encourage the on-site retention (i.e. infiltration, evapotranspiration, or collection and reuse) of runoff from the developed site. Further, Whitby encourages the reduction of local rainfall event runoff by an additional 5% to 15%, and water balance modeling for the one to ten years post-development.

A different approach that is taken by Toronto, Vaughan, Brampton, and Richmond Hill is to require that the runoff generated from a minimum 5mm depth of rainfall be retained on site. Retaining the runoff volume from the 5mm rainfall event on-site is a mandatory requirement in each of these municipalities, while retaining the runoff volume from the 10mm to 25mm rainfall events is optional.

In addition to managing the quantity of stormwater leaving the site, managing its quality is also important. The municipal green development standards in East Gwillimbury and Toronto both include a mandatory requirement that at least 80% of total suspended solids (TSS) on an annual loading basis be removed from all runoff leaving the site. Vaughan, Brampton, and Richmond Hill's standards also include this mandatory requirement; however, it is notes as not applicable to single family homes.

2.1.3 AIR

The Air Impact Category focuses on providing a healthy indoor air quality for building occupants, and improving local outdoor air quality by mandating requirements or restrictions on airborne pollutant source control and reductions.

INDOOR AIR QUALITY

Indoor air quality affects the health of building occupants and is a consideration that not many of the municipal standards reviewed directly address at the low-rise residential scale. Toxic emissions from Volatile Organic Compounds (VOC) found in building products are common source of indoor air contaminants that can be mitigated or eliminated by selecting interior finishings with low or even zero VOC content. Both Edmonton and Halton Hills have optional measures that encourage the use of low or zero VOC building products (e.g. paints, adhesives, sealants, flooring).

LOCAL AIR QUALITY

The local outdoor air quality can be affected by several elements addressed in other Impact Categories, but the use of cool/green roofs and Electric Vehicles (EV) directly impacts local air quality and will be addressed in the Air category.

Other strategies that relate to local air quality but are primarily concerned with mobility will be addressed in section 2.1.9 Community Design.

Reducing the urban heat island effect through the use of cool (highly reflective building materials) and/or green roofs is encouraged by several municipalities in the context of larger scale developments, but Toronto and Halton Hills both target the low-density residential scale as well. Halton Hills and Toronto employ the same strategy in their optional measures related to cool and green roofs. Both municipalities encourage the implementation of one out of three options for available roof area: install a green roof for at least 50% of the available roof space, use cool roofing materials for 100% of the available roof space, or use a combination of green roof and cool roof materials for a minimum of 75% of the available roof space. Toronto also specifies that roof area used for solar photovoltaics (PV) can count towards the 75% minimum in the latter option. Urban heat island effect can also be reduced with non-roof measures, which will be further discussed in section 2.1.4 Land.

Of the green development standards reviewed, East Gwillimbury is the only municipality that promoted EV charging infrastructure at the low-density residential contexts scale. While these measures are more commonly addressed in larger scale developments, East Gwillimbury requires that grade related (3-storeys or less) residential developments provide a minimum of 1 vehicle parking space per unit in a garage, carport, or driveway that is designed to permit the future installation of EV supply equipment. There is also an optional higher-tier measure which encourages the installation of the EV supply equipment.

2.1.4 LAND

The Land Impact Category focuses on the preservation, restoration, and enhancement of the site and surrounding areas. The municipal requirements reviewed focus on landscaping strategies to promote biodiversity and enhance the natural spaces surrounding the built environment. The urban heat island phenomenon is also addressed by the municipal standards reviewed by requiring the use of reflective roofing materials and hardscapes, or green roofs.

LANDSCAPING AND BIODIVERSITY

Landscaping and biodiversity are typically the main factors included in impact categories related to land. Halton Hills, East Gwillimbury, Edmonton, North Vancouver, Toronto, and Whitby each have requirements for a minimum percentage of site landscaping that must be native/adaptive or drought tolerant. Toronto has a mandatory requirement that at least 50% of the landscaped site area be planted using native plants (including trees, shrubs and herbaceous plants). East Gwillimbury has a similar mandatory requirement, but requires that 100% of new vegetation, including sodded and landscaped areas, are planted with native plant species. Halton Hills, Edmonton, North Vancouver, and Whitby each have similar optional requirements with encouraged percentages ranging from 50% to 80%.

Biodiverse and native species are support pollinators, which Toronto recognizes in an optional measure that recommends that a minimum of 30% (including the building footprint) of all portions of the site identified as previously disturbed be restored or protected with native vegetation that includes at least two native flowering species that bloom at all periods over the growing season.

TREES AND TREE CANOPY

Trees and tree canopy were key considerations of the Land Impact Category in all municipal green development standards reviewed. Requirements typically centered around preserving or replacing existing trees by offsetting the loss of existing trees, maintain trees of certain trunk diameter, or maintain all healthy trees.

East Gwillimbury's green development standard includes a mandatory requirement that for low-rise residential developments, street trees are provided on both sides of new and existing streets within the development adjacent to the vehicle travel lane at a rate of 1 tree per unit. Toronto's green development standard also includes a mandatory measure to create tree planting areas within the site and in the adjacent public boulevard that meet minimum required soil volume to provide tree canopy. Vaughan, Brampton, and Richmond Hill take a different approach and require all developments to provide an Arborist Report identifies and evaluates where on-site healthy mature trees will be protected (in-situ or moved) or removed.

Multiple optional measures are also included in many municipalities. For example, Langford encourages that large diameter trees or significant environmental features be maintained and/or enhanced within common or private amenity areas. Where existing trees must be removed, Edmonton recommends offsetting the loss of existing trees at a 2:1 ratio, while Vaughan, Brampton, and Richmond Hill simply encourage new trees (excluding street trees) be provided on site (or as determined by the municipality) to mitigate the lost canopy coverage of the trees removed.

URBAN HEAT ISLAND EFFECT

As discussed in previous sections, various strategies that are used to minimize the urban heat island effect can also work together with strategies in the Air and Water Impact Categories.

Vaughan, Brampton, Richmond Hill, and Whitby's green development standards include optional measures that aim to reduce the heat island effect from the built form; however, it is noted in each of the standards that the measures do not apply to low-rise residential buildings. Conversely, East Gwillimbury and Toronto have both mandatory and optional measures relating to heat island reduction that are applicable at the low-rise residential scale. The mandatory requirements in either municipality are to use a combination of strategies such as high-albedo paving materials, permeable paving, and shade from trees, to treat a minimum amount of the site's non-roof hardscapes (driveways, walkways, etc.). Toronto is more stringent with the minimum requirement being 50% of the site hardscaping, while East Gwillimbury requires only 25%. In addition to the minimum requirement, both municipalities further encourage the treatment of up to 75% of site hardscaping to reduce the heat island effect.

EROSION AND SEDIMENTATION CONTROL

While Erosion and Sedimentation Control during construction can be addressed in other guidelines or by-laws, Toronto and Whitby also specifically address it in their municipal green development guidelines. Toronto specifies that all low-rise residential developments must follow the Erosion and Sediment Control Guideline for Urban Construction during construction and demolition activities (per the Greater Golden Horseshoe Area Conservation Authorities Erosion and Sediment Control Guideline for Urban Construction). In contrast, Whitby has an optional measure to create and implement an erosion and sedimentation control plan for all new construction activities associated with the project. It is also specified that the plan must incorporate best management practices (BMPs) to control erosion and sedimentation in runoff from the entire project site during construction.

2.1.5 SOCIAL WELL-BEING

The Social Well-Being Impact Category focuses on elements of development that may affect human health and satisfaction. Public art, culture, equity and inclusion, and safety are among the factors considered in this category.

PUBLIC ART

East Gwillimbury, Langford, North Vancouver, and Whitby all have measures dedicated to providing public art. The measures are not highly specific and are optional each municipality, except for Whitby, which requires the incorporation of art into publicly accessible and visible spaces and into building designs as an architectural element. North Vancouver also specifies that public art should reflect local culture.

EQUITY AND INCLUSION

Universal design to promote physical accessibility is a feature that is already accounted for in local building codes and by-laws, but many of the municipal standards reviewed go beyond the minimum that is otherwise required. For example, North Vancouver encourages developments to include design features (beyond zoning by-law requirements) for people with disabilities, and encourages the inclusion of amenities for senior users.

East Gwillimbury, Langford, Brampton, Vaughan, and Richmond Hill also address physical accessibility in a variety of optional measures ranging from providing 30% of units with barrier-free paths of travel from street, to providing 20% of residential units that incorporate various adaptable design standards from the building code, to providing 20%-30% of units in accordance with International Code Council (ICC)/American National Standards Institute (ANSI) Universal Design Standards.

Economic accessibility is also addressed by all municipalities that have a social well-being or equivalent category. East Gwillimbury, Langford, North Vancouver, Whitby, Vaughan, Brampton, and Richmond Hill promote affordable housing, rentals units, and a variety of housing types via optional measures that encourage the inclusion of these types of residences. For example, all developments in Whitby must meet the affordable housing target of the Town's Official Plan, but the Whitby Green Standard also includes a voluntary measure to provide at least 30% of all new residential units produced as affordable to households of low and moderate income.

PUBLIC SAFETY

East Gwillimbury, North Vancouver, and Whitby each have a measure centred around Crime Prevention Through Environmental Design (CPTED). While the measure is optional in North Vancouver, it is mandatory in East Gwillimbury and Whitby. CPTED is a multi-disciplinary design philosophy that uses urban and architectural design along with effective use of the built environment to reduce the fear and occurrence of crime. CPTED strategies also aim to reduce victimization and build a sense of community among inhabitants.

2.1.6 WASTE

The Waste Impact Category focuses on reducing the waste generation during construction, and during the operational phases of the development, as well as the procurement of building materials that have lower environmental impacts.

CONSTRUCTION WASTE REDUCTION AND MANAGEMENT

Applicable standards and regulations related to construction waste management are in place and must always be met, but the further reduction of construction waste is a best practice that Edmonton, Langford, and Toronto specifically address in their municipal green development standards. These municipalities have optional criteria for diverting 50%-95% of waste from landfill during construction.

Whitby takes a less prescriptive and more educational approach to construction waste reduction by encouraging the development and implementation of a waste stream management narrative and plan focusing on waste diversion demonstrating the hierarchy of waste or source reduction (including prevention, minimization and reuse), recycling and materials recovery, and then disposal. This waste stream management plan, along with the specific waste reduction and diversion criteria above create a robust approach to construction waste mitigation.

SUSTAINABLE PROCUREMENT

Using sustainable materials is another typical way to mitigate solid waste from construction activities. Toronto, Edmonton, Vaughan, Brampton, and Richmond Hill all have criteria for using reclaimed materials or materials with recycled content. Toronto's optional measure references the LEED sourcing of raw materials credit for specific criteria and recommends that at least 25%, by cost, of the total value of permanently installed building products in the project meet these criteria.

Edmonton encourages the use of renewable or recycled materials or materials with recycled content in construction, but does not provide specific details, except for on-site hard surfaces, in which they recommend a minimum of 25% recycled content be incorporated. Vaughan, Brampton and Richmond Hill are more specific in their recommendations that a minimum of 25%-30% recycled/reclaimed materials should be used for new infrastructure (including roadways, parking lots, sidewalks, unit paving, etc.). These municipalities also encourage developers to provide that at least 5%-10% reused content and 10%-15% recycled content in building materials and/or landscaping materials.

The sustainable and responsible production and harvesting is another consideration that can be addressed in municipal green development standards. For example, Halton Hills encourages the use of at least 25% of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's (FSC) principles and criteria for wood building components.

OPERATIONAL WASTE REDUCTION AND MANAGEMENT

Waste in the operational phase is not typically addressed at the low-density residential scale; however, Toronto does address this topic via mandatory and optional measures. In terms of mandatory requirements, Toronto provide specific minimum floor space requirements that must be dedicated to waste and recycling collection (2 m² for every 5 units for garbage, 2 m² for every 4 units for recycling/bulky items, 2 m² for every 4 units for organics). Toronto also requires a

ventilated internal space, external to the living area and on private property, for the storage of separated recycling, organics, and garbage generated between collections. To achieve the higher tier optional measure, separated cabinet space in all kitchen suites for segregated collection of recyclables, organics, and garbage must be provided. While these measures are included in the Toronto Green Standard for low-rise residential developments, it should be noted that they only apply to development less than 4 storeys with a minimum of 5 dwelling units.

2.1.7 EDUCATION

The Education Impact Category focuses on the promotion and communication of green building features and technologies to help educate the general public on sustainable design. Not all municipalities focus specifically on education in their green development standards, but a few do include specific measures in this Impact Category.

The only two mandatory requirements in the Halton Hills standard are both focused on education and communication. The requirements are to Familiarize the homeowner(s) with the entire dwelling's green building features as part of the Pre-Delivery Inspection and to provide a Homeowner's Information Package outlining all of the dwelling's green building features, neighbourhood conveniences and information that promotes green lifestyle choices. The Package must also provide information on the proper use and maintenance of the home's green features and will include a copy of the Town's Green Plan and Community Sustainability Strategy. In addition, to the two mandatory education measures, the Halton Hills green development standard also includes an optional measure that works to promote and educate on green technologies. The measure requires each home purchaser(s) to be provided with the opportunity to select at least one additional green building option such as solar water and space heating; 100% native, non-invasive and/or drought-resistant xerophytic landscaping; advanced energy saving features; or universal accessibility packages.

East Gwillimbury also requires that all new building owners/tenants be provided with a Town-approved sustainability handout outlining sustainability features, such as green building materials, waste management programs, transit stop locations and encouraging other activities. The sustainability handout shall also include an itemized list of all green technologies and programs that the applicant has committed to undertake within the green development standard.

Finally, while Whitby does not require the development and distribution of a sustainability handout to new residents to understand green/sustainable elements in homes/buildings, it is included in the standard as an optional measure.

The Education Impact Category can also tie into innovation strategies, which are accounted for in Halton Hills, Langford, North Vancouver, and Whitby's green development standard. In each of these municipalities, innovative or unique green features not included in the respective standard can be used to contribute towards compliance.

2.1.8 FOOD

The Food Impact Category focuses on access to gardens and encouraging the infrastructure to support the availability of local food. While it is not as commonly adopted as other categories, it is incorporated into a few municipalities' standards and presents a unique opportunity that is growing in interest and utility. Access to gardens and local food also contributes to the community's social well-being, and the resilience of the local economy and supply chains. This is discussed further in section 2.2 Emerging Trends.

Vaughan, Brampton, and Richmond Hill do not have any mandatory targets related to food, but they do have an optional measure to provide 80 ft² per dwelling unit of garden space dedicated to urban agriculture. Whitby also has an optional measure related to food; however, it does not specify minimum requirements, but rather indicates that where possible, community gardens, rooftop gardens, and spaces that support farmers' markets should be incorporated in appropriate locations to contribute to the accessibility of locally grown produce in urban areas. Finally, North Vancouver also has an optional food related measure which at least 50% edible landscaping for common space is encouraged.

2.1.9 COMMUNITY DESIGN

The Community Design Impact Category focuses on the massing and orientation of the project. Some aspects of community design can apply to buildings on an individual basis, but this category is typically more applicable to broader site and community plans. Since this is a broad topic, we have limited our findings to those that have impacts on the overall sustainability of the community.

STREET AND BLOCK DESIGN

As discussed in section 2.1.1 Energy & GHG Emissions, street and block design can contribute to reductions in building energy consumption. By ensuring that blocks are oriented to achieve passive solar gain, energy used for heating and cooling can be reduced.

Street and block design also impact the use of diverse forms of mobility and the promotion of active transportation. For example, creating street and block patterns using grid or modified grid patterns, discouraging the use of cul-de-sacs, and designing streets with medium to short block lengths (400 m to less than 250 m) and perimeters (550 m to 400 m) encourages active transportation and reduces automotive trip lengths. Additionally, providing mid-block pedestrian connections and other continuous pedestrian infrastructure throughout further promotes active transportation. The implementation of these strategies is recommended in Halton Hills, East Gwillimbury, and Whitby's respective green development standards.

Providing streetscape amenities such as benches, street trees, waste receptacles, pedestrian scaled lighting, bicycle racks, and water bottle fill stations can also create a more attractive pedestrian environment and further encourage active transportation. Providing streetscape amenities is a mandatory target in East Gwillimbury and a recommended measure in Halton Hills, Langford, Vaughan, Brampton, Richmond Hill, and Whitby. None of these municipalities define specific thresholds that must be met in order to achieve this measure, but simply provide general guidance and require a yes or no answer.

PROXIMITY TO AMENITIES

Proximity to amenities such as transit stops, schools, parks, grocery stores, or other retail/services is a measure that East Gwillimbury, Vaughan, Brampton, and Richmond Hill include in their green development standards. East Gwillimbury requires that all new residential lots and blocks to be within an approximate 800 m walking distance to at least 3 existing amenities (either internal or external to the development) or planned amenities (internal to the development). A shorter walking distance of 400 m is also provided as an additional optional measure. Vaughan, Brampton, and Richmond Hill do not have any mandatory targets related to proximity to amenities, but they do have a number of optional targets. For example, they each have recommended minimum targets that 50% of dwelling units are within an 800 m walking distance to existing or planned amenities. Further, they also each have aspirational targets that 75% of dwelling units are within a 400m walking distance to existing or planned amenities.

EXTERIOR LIGHTING

Reducing the energy consumption and light pollution caused by exterior lighting are community design measures that are both addressed by East Gwillimbury by mandating that 100% of exterior light fixtures are LED and are shielded or downfacing to reduce the amount of glare and light trespass experienced by neighbouring properties. Similarly, Toronto requires pedestrian-scale lighting be provided to illuminate sidewalks, paths, and outdoor public spaces, while also being downlit and Dark Sky Compliant to reduce light pollution. There is also an optional target of installing timers or motion sensors to turn exterior lights off when not in use in both the East Gwillimbury and Halton Hills standards.

Vaughan, Brampton, and Richmond Hill also recommend the use of LEDs and/or photocells on all exterior (exposed) lighting fixtures (applies to streetlights, park lights, pedestrian walkways) to reduce energy use.

2.2 EMERGING TRENDS

Impact Categories and/or sustainability criteria for consideration for the Hamilton Low Density Residential Standard. The following are examples of growing trends that are being slowly implemented in other municipalities and present an opportunity for the City of Hamilton to become a leader in these new areas of sustainable development.

- **Greenhouse Gas Emission Reduction:** As described in section 2.1.1 Energy & GHG Emissions, municipal currently focus on energy efficiency and passive design principles, however higher tier requirements indicate the aspiration of reaching 2050 Climate targets. The federal government has recently updated its previous commitment to achieve an 80% reduction of 2005 carbon emissions by 2050 to a target of net zero carbon by 2050. Provincially, the Ontario Environmental Plan targets a 30% reduction below 2005 levels by 2030. Many municipalities are also establishing local reduction targets in line with, or beyond these federal and provincial goals. City of Toronto is targeting near zero

emissions in all new buildings by 2030. This means high-performance low-carbon pathway will be required for low-density residential sector as well. The City of Hamilton has not yet formalized a carbon reduction target or strategy but is currently working to develop City-Wide Design Standards.

- **Food:** As described in section 2.1.8 Food, a few Municipalities have incorporated local food production, but this Impact Category is not considered in most other Sustainability Standards. The City of Hamilton has included Urban Agriculture, Community Gardens and Farmers Markets in the Official Plan Zoning By-Law and is well positioned to include this emerging trend in the Sustainability Standard. An example of how urban farming can thrive when permitted by local by-laws is in Vancouver, where an organization converts regular yards into vegetable plots and maintains the crop with a team of urban farmers. Homeowners exchange part of their front or back yards for a share of the vegetables grown in the local plots. While this is not specifically encouraged in any of the municipal standards reviewed, removing potential barriers such as planting requirements for lawns are key to allowing for innovative solutions like the example noted above.
- **Resilience:** Climate Change, and the resulting changes to temperature, shifting precipitation patterns and more frequent and severe weather events will have an increasingly significant influence on our infrastructure. Durham Region is focused on improving disaster resilience of low-rise residential buildings and has structured their Standard to focus on Basement Flooding, Extreme Heat and Extreme Wind Protection to mitigate the impact climate change has on homeowners. Other Municipalities are starting to incorporate these criteria into their Standards by implementing more stringent stormwater management as described in section 2.1.2 Water, or the heat island effect per section 2.1.4 Land.
- **Air Tightness:** This criterion measures the uncontrolled inward or outward leakage of air in a building. Buildings can perform testing to identify any leakage points or areas of weakness in the building envelope. Once identified the air barrier can be sealed to reduce air leakage and heat transfer. Superior air tightness can improve a building's energy performance, occupant comfort and durability¹. As mentioned in section 2.1.1 Energy & GHG Emissions under Passive Strategies, North Vancouver and Edmonton are the only municipalities to encourage buildings to conduct air tightness testing and report the rate of air leakage. No other municipalities have considered building air tightness in their Low-Density Residential Standards.

2.3 STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS (SWOT) ANALYSIS

2.3.1 STRENGTHS

- **Reduction in Environmental Impacts and Risk:** The SBDS represents an important opportunity for the City to reduce environmental impacts that may occur as an outcome of development. The SBDS provides the City with an ability to measure potential environmental impacts from development and implement a solution-oriented framework to reduce undesirable outcomes in this regard. Where possible, reducing environmental impacts may also reduce risk that the City could be exposed to. Reducing the negative environmental impacts from development could affect the City's resiliency and its capacity to survive, adapt and thrive when confronting the stresses and shocks caused by environmental impacts. Stresses weaken a district on a chronic basis; examples are housing affordability or transportation issues. Shocks are sudden, single-event disruptions that threaten a district, such as a flood or power outage.
- **Meaningful Impact on Community Development:** The SBDS may represent one of the most tangible ways for the City to direct and influence more sustainable community development practices. While the City's official plan establishes broad sustainable policy direction, the SBDS could be considered an important implementation tool, along with other land use planning instruments, such as the City's zoning by-law. The SBDS may afford the City an

¹ It is important to note that an air-tight building may cause mould or humidity issues if the materials selected for the envelope assembly promote condensation. As such, measures to ensure that this does not occur (e.g. Engaging a building science professional) may be beneficial.

opportunity to address a breadth of emerging challenges associated with land use and development, such as public health, climate change, energy and resource use. By addressing a breadth of impact categories, the SBDS represents an impactful tool contributing to the responsible management of growth and change while improving the overall health and well-being of the community.

- **Precedence:** There is an emerging precedence among Canadian municipalities to advance and promote sustainable development standards for site and building design. In particular, sustainable design standards provide municipalities with an opportunity to implement both mandatory and/or optional standards through the planning process to evaluate the performance of proposed development in this regard, thereby advancing a community's vision for a more sustainable future.
- **Targeting a High-Impact Group :** Low-density housing continues to be one of the largest consumers of water and energy, while generating waste, and contributing to air pollution and greenhouse gas emissions. By focusing the SBDS on low-density housing, the City may realize improvements to construction practices, site design and building performance that results in the more efficient use of municipal infrastructure, better conserves water and energy, enhances the natural environment, and builds more complete communities.
- **Marketability:** Implementing the SBDS through the land use planning applications and approval process may create an incentive to potential home buyers who are increasingly aware and cognisant of sustainable development, while also offering an innovative, tailored and realistic framework for developers. In this regard, the SBDS may contribute to economic development while advancing the City's sustainability goals and objectives.

2.3.2 WEAKNESSES

- **Complexity:** Green development standards typically evaluate a full range of impact categories through various technical metrics. While this may be necessary to meaningfully evaluate specific impact categories, the technicality of green development standards may pose a challenge in implementation by the City and uptake by the development industry. Effort should be made to use accessible, clear and simple language and metrics to produce a document that is easily understandable and that mitigates uncertainty or mis-interpretation.
- **Resourcing, administration, implementation and monitoring:** Ongoing marketing, communication and administration of the SBDS will be required to ensure its continued implementation and success. This may require heightened resourcing considerations from the City for ongoing administration and implementation.
The SBDS will require a heightened administrative effort from City staff during the planning application and approval process. Consideration will also need to be given to what, if any, impact the administration of the SBDS will have on the overall planning application and approvals timeline. These considerations may impact review timelines, require heightened inter-department collaboration for implementation and review, and may also require a robust process for coordination and follow-up with applicants that are subject to the SBDS.
The SBDS will likely need to be updated from time-to-time as changes to the Provincial and local land use planning framework emerge, or as sustainability best practices or initiatives evolve. This will require ongoing monitoring from City staff, with changes or updates to the SBDS benefiting from Council, stakeholder and community participation.
- **Definable Impact Categories:** Certain impact categories will require careful consideration to how they are defined and measured through the SBDS. These definitions will need to be measurable to ensure that an applicable impact category can be meaningfully evaluated through the SBDS. For example, in the absence well defined metrics, impact categories such as connectivity may be difficult to measure. However, this could be addressed by considering specific metrics such as such as proximity to local amenities or transit with regard to connectivity.
- **Lot and Building Requirements:** If through the development of the SBDS it is determined that certain impact categories will give specific consideration to zoning performance, such as lot and building requirements, the City will need to be satisfied that Zoning By-law 05-200 is representative of the goals and objectives of the SBDS, while still conforming to the City's Official Plan. The SBDS is not permitted to be more restrictive than Zoning By-law 05-200, and therefore the metrics will need to be consistent with the ZBL. On this basis, the City may consider ensuring Zoning By-law 05-200 implements a framework for managing land use and future development that conforms to the Official Plan, while reflecting the City's broader sustainability goals and objectives and the various implementation tools, such as the SBDS.

- **Future Development:** Application of the SBDS may need to be carefully monitored within the context of low-density residential development. Under the Provincial land use planning framework, minimum intensification and density targets increasingly require municipalities to consider medium to higher-density developments over the planning horizon. Within this context, the City may ultimately determine that the impact categories and associated metrics of the SBDS may be more applicable to higher density developments and that this may require different metrics.

2.3.3 OPPORTUNITIES

- **Effectiveness:** Green development standards are demonstrated to be an affective opportunity for municipalities to meaningfully realize more sustainable development practices and resilient communities. Many municipalities throughout Ontario and across Canada have adopted a similar approach that is implemented through the land use planning application and approvals process.
- **Breadth:** The breadth of potential metrics included in the SBDS enables the City to evaluate a full range of metrics that contemplate various sustainability considerations. The SBDS therefore represents an opportunity to implement a holistic and comprehensive approach to advancing the City's sustainability goals, objectives and mitigate risks brought about climate change and environmental damage from development.
- **Advance Municipal Priorities and Policies:** The SBDS represents an opportunity for the City to advance various local sustainability initiatives and policies. This principally includes the City's Official Plan, as well as the City-wide Corridor Planning Principles and Design, Site Plan Guidelines, and the Secondary Plan Urban Design Guidelines, for example. The SBDS also advances the City's Strategic Plan, including priorities such as being environmentally sustainable, a built environment and infrastructure that focuses on quality of life and community well-being, and healthy and safe communities, among others.
- **Other City Plans:** The SBDS may consider other City plans that share common or related goals and objectives. For example, this may include Hamilton's Age Friendly Plan that considers housing, mobility, and social participation, among others.

2.3.4 THREATS

- **Education and Communication:** The success of the SBDS will necessarily ongoing public education, awareness and communication from the City. The absence of a robust public education and awareness campaign, that includes direction on how to apply the SBDS through the planning application and approvals process, may hinder the long-term success of the SBDS.
- **Capital Costs:** Certain impact categories and associated metrics may result in heightened capital costs as a result of increased development and building costs required to satisfy the SBDS. These are not likely to be borne by developers, but rather downloaded to home buyers, thus potentially increasing housing costs in a real estate market that is undergoing significant appreciation. While the SBDS may advance the City's sustainability goals and objectives, consideration should be given to how the SBDS framework, including any supporting initiatives, can offset the unintended consequence of increased housing costs.
- **Planning Instruments:** The efficacy of the SBDS may also require the City to evaluate and/or consider if the in-effect land use planning instruments establishes the necessary framework for meaningful implementation of the SBDS. This may include the City's Site Plan Control By-law which does not apply to single detached dwellings, duplex dwellings or semi-detached dwelling in some cases, for example. Overall, consideration will need to be given to which categories of planning applications trigger application of the SBDS to ensure the City's land use planning framework gives appropriate effect and supports its implementation.
- **Operational Costs:** Long-term viability of the SBDS may need to consider operational costs, in addition to the potential for increased capital costs, as discussed previously. For example, certain impact categories may require building or design considerations that contribute to heightened operating costs over the life-cycle of the building. This could result in compounding increased costs associated with home ownership where the SBDS has been applied, with both heightened capital costs and operating costs being ultimately borne by a homeowner.