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Green infrastructure refers to natural and human-made elements that provide ecological and hydrological functions. In addition to these functions, green infrastructure contributes to making streets more pleasant, comfortable and sustainable. Components may include natural heritage features and systems, park lands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, green roofs, and active and sustainable transportation modes.

Through the Toronto Green Standard, TransformTO, Wet Weather Flow Management Guidelines and Toronto's Strategic Forest Management Plan, the City of Toronto has established a wide range of environmental goals to address climate change, emissions, air quality, energy efficiency, stormwater quality and runoff, and the urban tree canopy. Green infrastructure is vital to achieving the City's environmental goals and is as integral to the City as other infrastructure.

7.0

STREET DESIGN FOR GREEN INFRASTRUCTURE

7.1

GREEN INFRASTRUCTURE DESIGN PRINCIPLES



For illustrative purposes.

**1. Street trees and landscaping.**

Seek ways to incorporate and provide healthy growing conditions for trees and/or landscaping to improve air quality, mitigate urban heat-island effect, enhance ecosystem health, and contribute to community character. Select planting locations, spacing and design details (e.g., adequate soil volume, water and sun access) so that trees and landscaping will flourish. Trees can frame and define streets, calm traffic by visually narrowing the roadway, and add texture, shade and visual interest.

2. Stormwater management.

Use a variety of “Low Impact Development” techniques to minimize stormwater load on Toronto’s sewer system and improve water quality through natural filtration. Reduce stormwater runoff and potential flooding of streets and natural areas. Strategies include minimizing impervious surfaces, and promoting infiltration of rainwater and stormwater runoff.

3. Visibility and safety. Ensure adequate visibility is maintained, especially at street corners, traffic lights, traffic signs, transit stops and driveways. Where there is vegetation, ensure maintenance programs maintain appropriate sightlines. Clear sightlines are important to the safety of all road users.

4. Universal accessibility. Design to promote universal accessibility, such as through the selection of materials and elements, to accommodate

people of all ages and abilities. Tree pits, openings and grates on the sidewalk are not considered part of the pedestrian clearway.

5. Operations and maintenance.

Design for ease of maintenance, such as through passive irrigation, selecting context-sensitive native plant species and planning for safe access to maintain green infrastructure. Coordinate green infrastructure with utilities during design, construction and for the long term. Seek opportunities to partner with BIAs and other local stakeholders to assist with the design and maintenance of green elements.

6. Achieving multiple environmental objectives. Consider ways to combine environmental design, such as tree canopy expansion, stormwater retention, and microclimate moderation into single street features like roadside rain gardens.

7. Sustainable energy. Consider energy generation, use and management by selecting, designing and siting street elements such as solar lighting, parking machines, Bike Share Stations and street furniture to contribute to an energy efficient city.

8. Sustainable transportation.

Provide greener, healthier mobility choices so that more people walk, bicycle, take public transit and carpool. Reduce vehicular congestion, greenhouse gas emissions and air pollution.

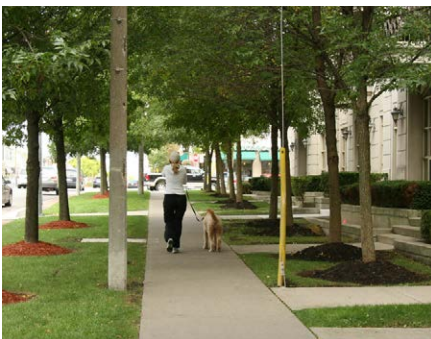
7.2

CONTEXT-SENSITIVE GREEN STREETS

The Green Streets Technical Guidelines provide a full range of locations for green infrastructure, along with a selection tool to help identify the best green infrastructure elements for a given context. Green streets are designed with attention to the ecological and hydrological functions of the street, and in particular, to the at-source treatment of stormwater runoff.



Green infrastructure may be provided in a variety of locations on a street.

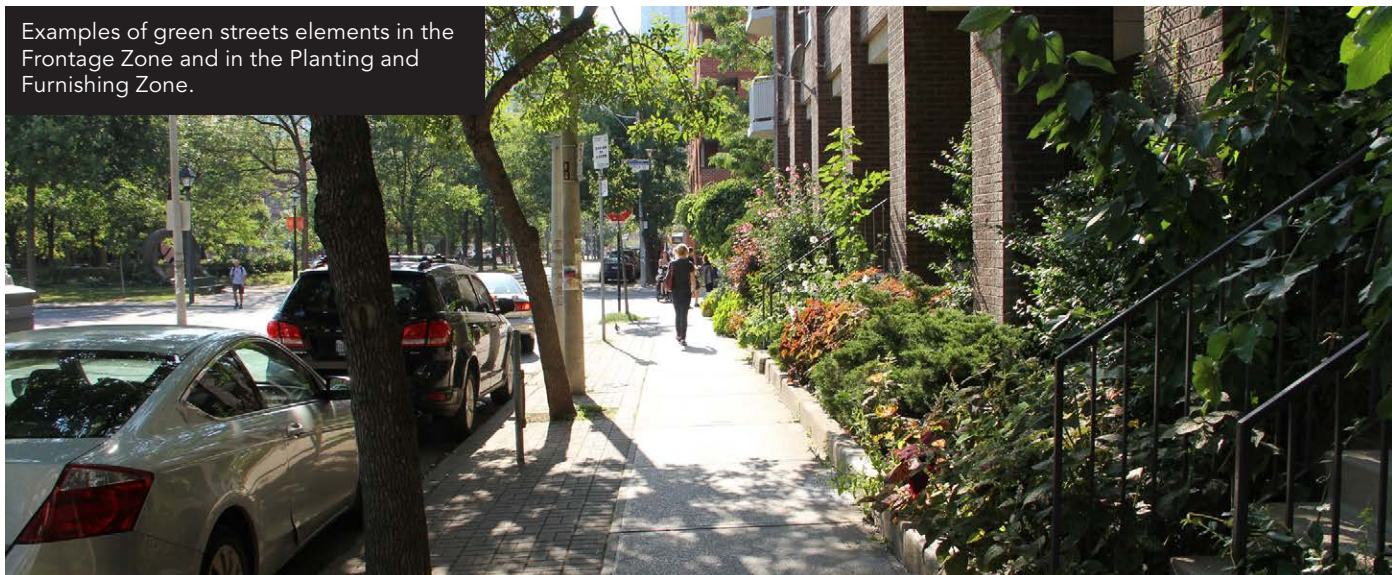


Green streets employ green infrastructure solutions to support human health and well-being and to relieve urban pressures on ecological systems, air quality, energy efficiency and water resources. Street trees and other plantings can provide vital and comfortable microclimates for humans and habitats for urban wildlife and pollinator species. Low Impact Development (LID) facilities can be designed to replicate the functions of a natural drainage system by attenuating and infiltrating stormwater as close as possible to where it lands. A holistic approach can reduce or even eliminate the need for a conventional stormwater management system.

Street contexts with adequate space and limited conflicting demands are ideal locations for green infrastructure; however it is possible to incorporate green infrastructure in a variety of places within the public right-of-way:

- **Frontage Zone**, such as where buildings are set-back from the street and sidewalk.
- **Planting and Furnishing Zone**, typically between the pedestrian clearway and edge zone or curb, is an ideal location for green street elements as it provides a buffer between pedestrians and vehicles. This zone may also make use of street poles for hanging planters, trellises and solar panels as long as adequate visibility and safety are maintained.
- **Curbside** in the roadway is where greening can often be enhanced through curb extensions, bioswales, rain gardens, permeable paving on the curb extension or edge zone, cycling facilities or parking laybys and other green street elements.
- **Medians or raised islands** in the roadway can be good places to include trees and other landscaping, but require special attention to ensure visibility and safety for travelers and long-term maintenance.

Examples of green streets elements in the Frontage Zone and in the Planting and Furnishing Zone.

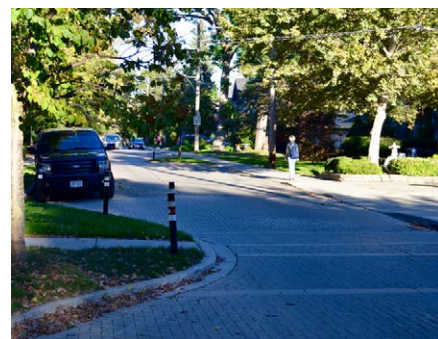


The following contextual factors are considered when identifying streets (and locations on streets) for green street design:

- Street type – including components such as intensity of demand from other users and uses
- Available right-of-way width and building setbacks
- Site physiography (soil permeability, topography, depth to water table or bedrock, soil contamination)
- Surface water flow routes
- Sunlight
- Open space context – adjacent natural heritage systems, open space and parks
- Storm drainage infrastructure
- Underground transit infrastructure
- Utilities infrastructure (underground and overhead)
- Proximity to known flooding
- Urban forest cover
- Watershed context – erosion vulnerability
- The need and availability of operation and maintenance
- Curbside accommodations for goods movement, delivery and loading
- Sightlines and other safety considerations
- Setbacks from intersections and other street infrastructure



Some green street elements collect stormwater from sidewalks and roadways.



Green street elements are sometimes located curbside or combined with speed management components.

7.3

KEY GREEN STREET ELEMENTS

A wide variety of Green Street Elements are possible in Toronto to support the goals of sustainable street design. The Green Streets Technical Guidelines provide a comprehensive list of green infrastructure options and factors to select features that are appropriate for a given site context. Two of the most common options include street trees and landscaping, and Low Impact Development (LID) practices for stormwater management. These elements should be considered in the street design process.

South Station Street in Etobicoke-York is a City of Toronto green streets demonstration site. It features trees, landscaping and stormwater retention components.



Some larger sidewalks are candidates for a double row of trees, like this one on The Esplanade.



STREET TREES AND LANDSCAPING

Street trees and landscaping comprise a number of elements including groupings of trees, single trees, shrubs and perennial plants. Trees and planting materials are most commonly installed in open landscape at grade, in planters (that may double as seating) or in covered tree pits and may be installed in LID features such as stormwater tree pits/trenches, bioswales and rain gardens. They have numerous benefits related to ecology, air quality, temperature moderation, safety, microclimate, land value, and human well-being. Toronto City Council has set a goal to reach 40% tree canopy cover over the next 40-50 years.

Street trees form a significant part of the City's urban forest, and are found on all types of streets. Consider enhanced planting conditions for street trees wherever noticeable deficiencies or gaps in the tree canopy are present. Special

engineering solutions are required for trees in hard boulevard surfaces to provide adequate soil volumes and optimum growing conditions. Urban and drought tolerant plant materials and native plant species can facilitate ease of maintenance. Open planters, tree pits and above-ground planters are all possible elements to contain trees and landscaping on streets, but are not considered part of the pedestrian clearway.

Street trees and landscaping are ideally located where growing conditions are best, where people can enjoy them, and where they can be efficiently maintained. The two most common locations for tree plantings are within the Frontage Zone, and Planting and Furnishing Zone (see the Chapter 4 on Pedestrians for the various zones of the sidewalk and boulevard). See Section 7.2 for other locations in the street to include trees and landscaping.

To successfully incorporate plant material within a streetscape made of so many elements, it is essential that the design team consider planting conditions and street context as part of the street design process for projects. Coordination with utilities early in the design process is critical. Consideration should be given to minimizing conflicts between the layout of utilities and the planting plan at the time of construction and with future growth.

The City of Toronto's Tree Planting Solutions in Hard Boulevard Surfaces and Green Streets Technical Guidelines provide detailed design guidance, and should be consulted throughout the street design process.

This green street demonstration site features a rain garden as part of a new parkette, that was derived from excess roadway space at Fairford Ave. and Coxwell Ave. in East York.



TORONTO CITY COUNCIL ADOPTED AMENDMENTS TO TORONTO'S OFFICIAL PLAN TO INCLUDE IN ITS VISION:

- a healthy natural environment, including clean air, soil, energy and water;
- infrastructure and socio-economic systems that are resilient to disruptions and climate change; and,
- a connected system of natural features and ecological functions that support biodiversity and contribute to civic life.

GREEN STORMWATER MANAGEMENT INFRASTRUCTURE

Streets form a vital part of Toronto's stormwater management infrastructure. A Green Street in Toronto is a right-of-way that through a variety of design and operational treatments, manages stormwater at-source and achieves the broad objectives of the Toronto Green Standard (2014). Green Streets are designed with a particular focus on capturing rainfall, and treating runoff at the source. This approach is at the core of "Low Impact Development". The City of Toronto's Green Street Technical Guidelines (2016) are intended as the primary source for technical direction on green stormwater management.

Green infrastructure designed to capture rainwater is an emerging and important part of Toronto's streets. It can help minimize stormwater load on the City's sewer system, which has come under increasing pressure with the frequency and severity of storms.

Green Streets can help to reduce runoff volumes and manage stormwater runoff quality. This may lead to other benefits such as reduced operating infrastructure costs, enhanced water quality and water balance in Toronto's streams, rivers and Lake Ontario. Among the many health and environmental benefits, green streets can also provide a more aesthetically pleasing street and contribute to placemaking.

Trees and grass between the sidewalk and curb is a common green street feature in Toronto.

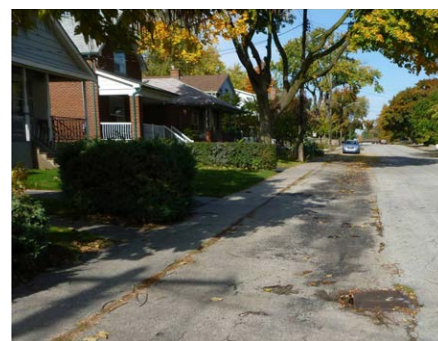


An attempt should be made in the street design process to assess ways to incorporate green infrastructure in appropriate parts of the right-of-way. Design options should weigh the benefits to other users, the water cycle and the overall ecosystem.

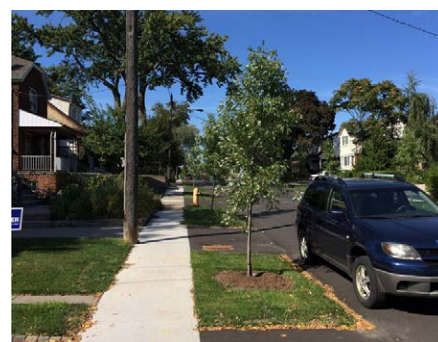
Furthermore, it is important to recognize that maintenance is required to ensure plants can thrive and infrastructure can maintain its functionality. Maintenance processes and owners are required to be clearly identified and agreed upon as part of the design process when assessing the viability of design options. Maintenance responsibility should be clear and agreed upon before moving onto the detailed design phase.

MORE INFORMATION:

- City of Toronto. [Design Guidelines for 'Greening' Surface Parking Lots](#). 2013. (includes adjacent sidewalk zone)
- City of Toronto. Green Streets Technical Guidelines. Anticipated 2017.
- City of Toronto. [Sustaining & Expanding the Urban Forest: Toronto's Strategic Forest Management Plan, 2012-2022](#). 2013.
- City of Toronto. [Toronto Street Trees: Guide to Standard Planting Options](#). 2010.
- City of Toronto. [Tree Planting Solutions in Hard Boulevard Surfaces: Best Practices Manual](#). 2013.
- City of Toronto. [Urban Design Streetscape Manual](#). 2010.
- Ministry of Municipal Affairs and Housing of Ontario. [Provincial Policy Statement Under the Planning Act](#). 2014. (includes direction on green infrastructure)
- Toronto Cancer Prevention Coalition. [Shade Guidelines](#). 2010.
- "Toronto Green Standard – Developing Toronto – City Planning." City of Toronto. Accessed October 13, 2016.
- Transportation Association of Canada. [Canadian Guide for Greener Roads](#). 2015.



Before tree planting on Holbrooke Ave. in Etobicoke.



After tree planting.