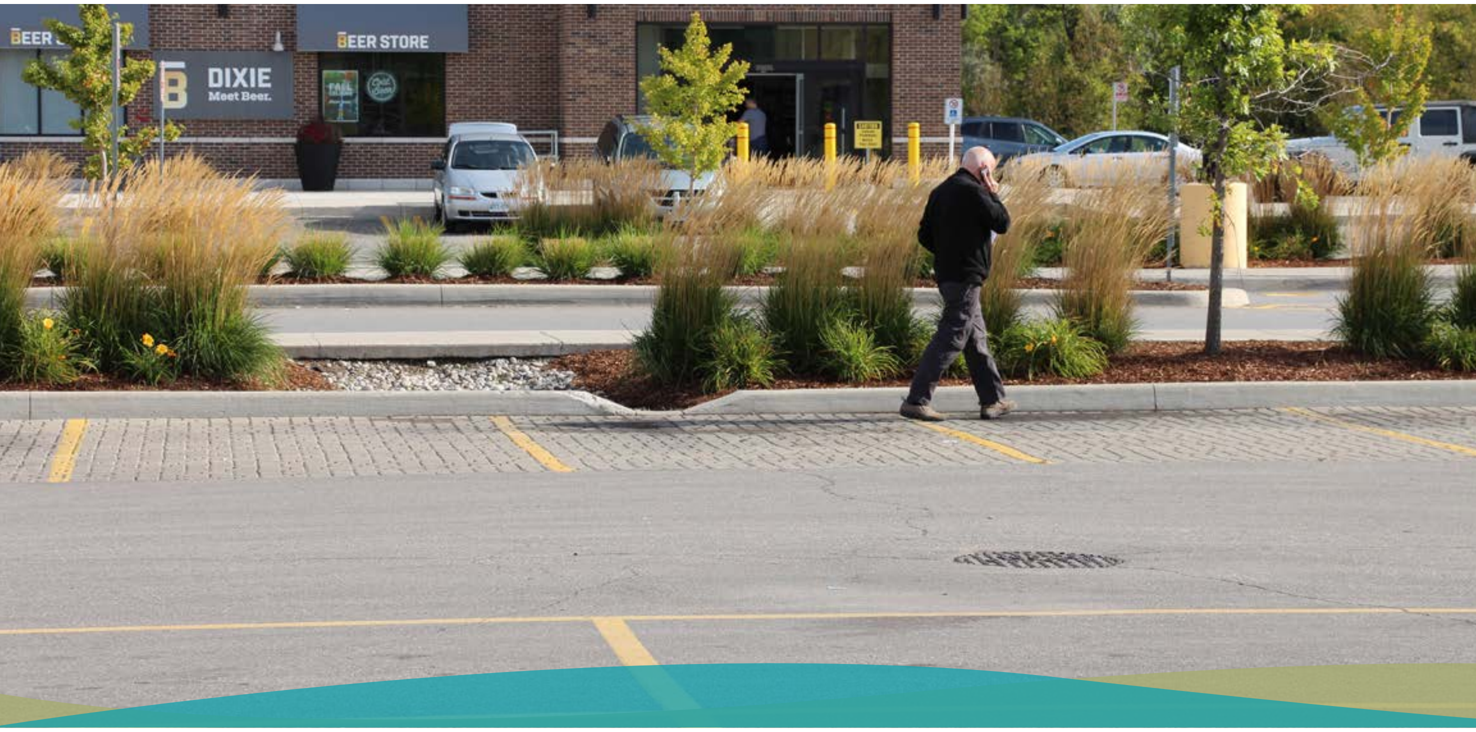
Fieldgate Commercial Property: Creekside Crossing

CASE STUDY

Low Impact Development Series



Featured practice:

- Bioretention
- Soakaways
- Permeable pavement

Groups involved:

- Fieldgate Commercial Inc.
- Fieldgate Development Inc.
- Smart Centres Inc.
- Schollen & Company Inc.
- Counterpoint Engineering Inc.
- Terraplan Landscape Architects

Completion data:

- Fall 2013

Creekside Crossing is a commercial centre located at 1500 Dundas Street East in Mississauga, Ontario. Situated in a heavily developed area, on the south side of Dundas Street east of Dixie Road, the site drains to Little Etobicoke Creek. Bounded by Canadian Pacific Railway to the south and commercial developments to the west, it was previously occupied by several industrial facilities and a golf driving range. Remediation of the site was needed including proper removal and disposal of contaminated soil, hazardous material and debris during construction. The change in land use significantly increased the amount of developed area, which would have resulted in more runoff and higher contaminant loads discharged into Little Etobicoke Creek. To offset these development impacts, several Low Impact Development (LID) practices were constructed on site.

The stormwater biofilters used on this site differ from the design of most bioretention areas in that they consist of stone inlets and clear stone trenches below the plantings.

All combined, the LIDs fulfill the requirement of the Toronto and Region Conservation Authority's (TRCA) water balance objective of retaining runoff from a 10 mm rain event onsite. While the TRCA's water balance objective during development is usually the retention of 5 mm of runoff onsite, the objective was raised to 10 mm for this site due to the rehabilitation work required in the floodplain. The LIDs, which include bioretention areas, soakaways/infiltration galleries, and permeable pavement, achieve the water balance objective through attenuation/infiltration and evapotranspiration. They have also been designed specifically to optimize their function within the site environment. . The majority of the runoff that is not dealt with on site discharges through the sewer to Little Etobicoke Creek. Smaller portions will flow to Dundas Street or to a ditch bordering the site south side, which ultimately drains into Little Etobicoke Creek.

STUDY SITE

The 164,000-square-metre commercial property contains well-known retail stores, restaurants, and banks. Approximately 83% of the site is hardscaped, with the remainder of the site kept as open space enhanced with additional landscaping, which includes approximately 330 new trees. The soil conditions do not meet the minimum infiltration rate stated in the LID Stormwater Management Planning and Design Guide (TRCA and CVC, 2010), therefore the LID practices on site are designed to attenuate/infiltrate runoff and release it over a minimum of 48 hours. The total storage volume of 1457 m3 provided by the LID features exceeds the TRCA's water balance objective.

Figure 1. Study site location

Project Objectives

• Restore the stream corridor through: (i) expansion of the breadth of the corridor, (ii) removal of dumped debris, (iii) removal of invasive non-native vegetation and (iv) restoration and enhancement of the vegetation community.

• Reduce the urban heat island effect through the use of high reflectivity roofing material and the provision of shade over parking areas.

• Heighten public awareness and promote the application of LID and sustainable living options through implementation of LID practices as amenities in the landscape.

• Improve infiltration potential and enhance base flow contribution to Little Etobicoke Creek

• Remediate the site as part of the brownfield redevelopment process.

PLANNING AND REGULATION

Schollen & Company Inc. prepared the report entitled "Environmental Overview and Enhancement Strategy" for the site in January 2010. In it they proposed the concept of using a suite of LID practices to achieve the water balance objectives. The City of Mississauga and TRCA were satisfied in principle with the plan.

An LID report was prepared by Counterpoint Engineering Inc. in accordance with the LID Stormwater Management Planning and Design Guide . The proposed LID designs were discussed with the City of Mississauga and TRCA, and by May 2011 the proponent was granted site plan approval and issued a TRCApermit under Ontario Regulation 166/06. Minor revisions to the permit and site plan were required through the remainder of 2011 and 2012.

DESIGN

The system was designed such that the LIDs would allow the site to meet its stormwater requirements, and also exceed the water balance objective by 90 m3. The LID practices attenuate, filter, and infiltrate stormwater runoff, contributing to shallow groundwater recharge. This ultimately helps to sustain and improve the health of the vegetation community within the Little Etobicoke Creek corridor.

In selecting the LIDs to install, the owners stayed on the conservative side, choosing to put in LIDs with a proven history of success, and those that continue to function effectively in the long term without excessive maintenance requirements . This was largely done in order to keep maintenance costs low and predictable, so as to avoid the need to increase rental rates above that which is standard for shopping centres. The design team worked with Schollen & Company to ensure that the LIDs were installed in places that wouldn't impact customer experience, since installing LIDs in commercial areas can require additional considerations due to the varied use at the site. For example, some people may find it difficult to push shopping carts over permeable pavement, and therefore permeable pavement installations should be located away from the front of stores.

For specific information on individual LID practices please refer to the LID Stormwater Management Planning and Design Guide (TRCA and CVC, 2010).

Figure 2. Permeable pavement section in parking lot away from store fronts

Stormwater biofilter

There were seven stormwater biofilters installed on the site, making up a total area of approximately 2,000 m2 and providing 388 m3 of storage volume. This LID practice will help to reduce peak flows and improve the quality of the runoff entering Little Etobicoke Creek. They are situated as obvious elements within the landscape, showcasing both functional and aesthetic value. To maximize the contributing drainage areas they are located in low points of the site grading. The stormwater biofilters located in the parking area have catchbasins allowing for ponding depths of 0.15 m.

Figure 3. Native plants in a stormwater biofilter

Native plantings

Restored areas are planted with TRCA approved native species in a configuration which establishes a graduated transition. Closer to Etobicoke Creek there is more natural vegetation, while the vegetation becomes more resilient in the vicinity of the parking area and buildings.

Soakaways

Four soakaways constructed on the site provide peak flow attenuation and infiltration of runoff from adjacent parking areas and building rooftops. In total, they provide 613 m3 of storage, and can accommodate all flows form a 2-year storm event. To promote attenuation and infiltration of runoff, parallel sections of perforated pipe are installed within an underground granular trench between two control manholes. The gallery that receives water from the parking area has an oil-grit separator to pre-treat the water before it enters the trench. The footprints of the soakaways are designed to optimize the distribution of water through the granular trenches from the perforated pipes.

Permeable pavement

The permeable pavement was installed in multiple sections of the parking lot, and the east side of the site was avoided since it contains areas where the fill is deep, which could result in differential settlement of the pavers. A 0.6-metre-deep clear stone trench constructed under the permeable pavement ensures minimal settlement of the parking structure. The total surface area covered by permeable pavement is approximately 2,000 m2, spread through 15 sections. The permeable pavement provides a total of 414 m3 of stormwater storage.

Figure 4. Permeable pavement strip with stormwater biofilter inlets

Vegetated filter strip

Stormwater flows in excess of the capacity of the onsite LIDs described above (biofilters, soakaways, permeable pavement) are passed through a vegetated filter strip and then conveyed for discharge into Little Etobicoke Creek's low flow channel. The vegetated filter strip helps to minimize flow velocities and filter out contaminants.

Figure 5. Stormwater fountain feature powered by solar panels

CONSTRUCTION AND COMMISSIONING

Standard erosion and sediment control (ESC) measures were installed prior to the start of construction and maintained until the site was stabilized and restored along the site boundary at the downstream end of overland flow. Silt fence was installed to intercept surface flows along the perimeter of the site prior to grading. Temporary sediment ponds were constructed and conveyance swales and construction access mud mats were installed as necessary. Any future grassed areas were seeded as soon as possible. In April 2012 an ESC permit amendment was required. At the time, 8.05 ha had already been constructed, and 5.62 ha remained that required ESC controls. This remaining land was divided into two drainage areas, with a 4.22 ha area to be drained into a new ESC pond and a 1.4 ha to a proposed sediment trap.

ECONOMICS

The cost to construct the LIDs was as follows:

- Bioswales - $335,000 (does not include plantings)
- Infiltration/Attenuation Facilities - $105,000
- Permeable Pavement - $120,000

OPERATION AND MAINTENANCE

Proper maintenance of LID practices is crucial for optimizing performance, cost effectiveness, and aesthetics over their full life cycle. Maintenance is especially important during the initial establishment of vegetative practices. At this site property managers are educated on what needs to be done with the LIDs, though the maintenance requirements aren't particularly onerous and don't diverge too much from the types of activities required for a non-LID site. Removal of trash and debris is one example of a relatively frequent maintenance activity that would be required on both LID and non-LID sites.

For specific information on maintenance of individual LID practices, please refer to the LID Stormwater Management Practice Inspection and Maintenance Guide (TRCA, 2016).

ACHEIVEMENTS

Functional design. The Fieldgate site encourages and supports multi-modal transportation by providing bicycle racks, direct linkages to transit on Dundas Street East, and a connection with the neighbouring GO train station.

Aesthetic value. Stormwater biofilters provide green space on site, increasing visual appeal and contributing to an improved visitor experience.

Stormwater management benefits. Incorporation of LID principles results in more sustainable stormwater management.

Figure 6. Sediment build-up and clogging in the permeable pavement

LESSONS LEARNED

- Detailed design drawings must specify the use, type and placement of special fill required for the LIDs with information on where it can be sourced, particularly if the material is not commonly available.
- Design drawings should specify the ideal timing for the installation of the permeable pavement relative to the other construction activities that are taking place. They should also provide information on the measures that should be taken to prevent construction activities from clogging the pavement voids.
- When the owner's desires or expectations for the site design are in conflict with design features that are most functional for LIDS, it is important to find a compromise. Whenever possible work to find solutions to satisfy both, either through placement of LIDs or modifications to the LID design.
- Educate the owners and maintenance groups regarding snow clearance and piles. Due to the sand, salt and debris that collects in the snow piles, LIDs can become clogged and their function impaired after the snow has melted.

REFERENCES

Credit Valley Conservation and Toronto and Region Conservation (CVC & TRCA) (2010) Low Impact Development Stormwater Management Planning and Design Guide. Version 1.0. Toronto, Ontario.

Toronto and Region Conservation (TRCA) (2016) Low Impact Development Stormwater Management Practice Inspection and Maintenance Guide. Toronto, Ontario.

For more information on STEP's other Low Impact Development initiative visit us online at www.sustainabletechnologies.ca

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