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MEMORANDUM

To: Matthew Hayley, City of Ottawa
Laurel McCreight, City of Ottawa
cc: Joey Theberge, Theberge Homes Ltd.
Bill Holzman, Holzman Consulting

RE: 1158 Old Second Line Road, Addendum to 2013 Environmental Impact Assessment and Tree Conservation Report , File D07-16-18-0008

Date 4 March 2019

This memo provides supplementary information to an EIS and Tree Conservation Report developed in September 2013 by CJB Environnement toward a proposed subdivision development at 1158 Old Second Line Road, Ottawa, Ontario.

Background

The subject property in Kanata, Ontario, consists of two lots (Con 3 Part Lot 11 RP 5R-1715, parts 1& 2 and Con 3 Part Lot 11 RP 5R-2564 Parts 1& 2) that are under contract with Theberge Homes Ltd. The site is zoned General Urban - Development Reserve (DR) in current zoning bylaws. The mostly wooded property has not been included as Open Space or linkages within any existing Community Design Plans.

An EIS was completed in 2013 by CJB Environnement. This memo should be read in conjunction with the 2013 report. The 2013 EIS thoroughly described the existing conditions on the site including Vegetation cover, Ecological Land Classification, Surface Water and Fish Habitat, Wildlife Habitat and Species at Risk, as well as the proposed development, impacts, and mitigations.

Since the submission of the 2013 EIS, changes in policy and in the proposed project have led to a need for supplementary information and updates to the previous EIS. This memo provides information to be considered together with existing information in the 2013 CJB Environnement document, using the same organizational structure as the previous report:

- Vegetation Cover (2.4, p. 6-12)
- Habitat for Species at Risk (2.6, p. 15-17)
- Description of the Proposed Project (3.0, p. 17-18)
- Impact Assessment (4.1, p. 19)
- Mitigation (5.0, p 28)
- Monitoring (6.0, p, 30).

The following recent documents, referenced throughout, also support the original EIS and this Memo:

- Tree Conservation Report completed by IFS Associates (April 19, 2018), see File.
- i-Tree Ecosystem Analysis: 1158 Old Second Line Road, Urban Forest Effects and Values, February 2019, Appendix 1.
- Memo, Nick Stow (Senior Planner, City of Ottawa, 21 Feb 2019) re: 1158 Old Second Line Road, File No. D07016-18-0008, Appendix 2.
- Avoidance Alternatives Form (AAF) for activities that may require an overall benefit permit under clause 17(2)(c) of the *Endangered Species Act* (dated 30 Jan 2019), Appendix 3.
- Email from Aaron Foss (Kemptville MNRF, 5 Feb 2019) re: 1158 Old Second Line Road, File No. D07016-18-0008, Appendix 4.
- Information Gathering Form (IGF) for activities that may affect species or habitat protected under the *Endangered Species Act* (dated 10 Dec 2018), available via email.

2.0 Description of the Site and the Natural Environment

While the site itself is virtually unchanged since 2013, several changes to policies and procedures have led to the identification of additional impacts, as well as proposals for mitigation.

2.4 Vegetation Cover and Significant Woodlands

Within the 2013 EIS, the current vegetation cover is clearly described (2.4.1 to 2.4.3). Vegetation cover is unchanged since 2013. However, new policies around Significant Woodlands have resulted in the addition of the sections below to the EIS.

2.4.4. Tree Conservation Report (2018)

In April 2018, an updated Tree Conservation Report was completed in support of the EIS process (IFS Associates 2018a). In addition to the identification of five Butternut trees (see Section 2.6 below), the TCR provided additional information on the tree species, condition, size and status on the site. In response to a 2018 site plan proposal, IFS Associates recommended a 2m wide linear area to be protected adjacent to all property lines to allow for the retention of small trees (<10 cm diameter). The TCR also outlines tree preservation and protection measures to be undertaken during construction, outlined under 5.0 Mitigation (below).

2.4.5. Significant Woodlands: New 2019 Policy Context

Since 2013, a draft Significant Woodlands policy has been developed (City of Ottawa 2019), to provide consistency with Ontario's Provincial Policy Statement and supporting Natural Heritage Reference Manual (OMNR 2010).

In the draft 2019 policy, there are specific requirements to address Significant Woodlands that impact the proposed subdivision development at 1158 Old Second Line Road. Specifically, the EIS for the subject property must consider Significant Woodlands within the EIS because it is not within the urban boundary expansion area, it is not in a rural area, and it is not within an Urban Expansion Study Area or Developing Community (City of Ottawa Official Plan, Appendix A, p. 31). The property has not been identified as part of any existing natural heritage system, plan of subdivision, or community design plan. It was not included or assessed as an Urban Natural Feature (UNA) in Ottawa's Urban Natural Areas Study (Muncaster Environmental Planning and Brunton Consulting Services 2005).

However, the wooded area is considered as a Significant Woodland under the draft policy because it lies within the urban boundary, is more than 60 years old, is greater than 0.8 ha in size, and does not fall within an existing Secondary Plan, Community Design Plan, or Plan of Subdivision.

2.4.6. Significant Woodlands Screening Criteria

According to the draft Significant Woodlands policy (City of Ottawa 2019), areas of woodland that meet any of the criteria below should be screened out from development or negative impact (Table 2a (*new*)). As indicated below in the right column, the woodland at 1158 Old Second Line Road does not meet any of the Screening Criteria in the draft policy.

Table 2a Screening Criteria for Woodland at 1158 Old Second Line Road

Social Values	
Unusual recreational, educational or cultural opportunities	**None.** The subject area is private property with no public use supported.
Qualifying Cultural, Heritage, or Historical Features	**None.** No existing designations.
Indigenous values established through consultation	**None**. No values identified through CDP or other process.
Hazard lands	
Constrained areas	**None**. Subject area has no hazards (e.g. floodplain, meander belts, steep or unstable slopes, restrictive soils or karst).
Habitat and Landscape Connectivity	

Adjacency and connectivity	**None**. Not part of Natural Heritage System or identified greenspace. Although it is a woodland adjacent to the South March Highlands (an NEA), the intervening area is not natural landcover or greenspace, but a suburban road (see Draft guidelines, p . 37). To date, the property has not been identified in any natural heritage network.
Specialized habitat	**None.** There are no uncommon characteristics in the woodland (see OMNR 2010, Natural Heritage Reference Manual, Table 7.2: e.g. uncommon community types, important habitat of restricted species or woodlands dominated by large or old trees). The woodlands are not considered to provide habitat for an endangered or threatened species under the ESA 2007 (see below).

The screening criteria confirm that avoidance ("screening out") of the proposed development is not appropriate for this area under the draft Significant Woodlands policy.

2.4.7. Significant Woodlands Comparative Criteria

Comparative criteria identified in the draft policy identify attributes that can be replaced, substituted or adequately mitigated. The draft policy acknowledges that negative impacts on these functions and services of significant urban woodland may be necessary in order to achieve other policies and objectives of the Official Plan and PPS (City of Ottawa 2019).

Because 1158 Old Second Line Road represents the first proposal under the draft Significant Woodlands guidelines, City of Ottawa staff has evaluated the property with respect to the comparative criteria. This evaluation is appended (Memo dated 21 Feb, N. Stow, Senior Planner). It confirms that the woodland is subject to the following evaluation:

- Total canopy cover
- Social value
- iTree analysis
- Accessibility and Equity
- Low impact development

The following analyses were carried out by the City of Ottawa (2019b) for this evaluation:

- An iTree Canopy analysis of the urban tree canopy in Morgan's Grant (the community), based upon 100 sample points.
- An iTree Eco analysis of the woodland, based upon two sample plots, projecting 40 years into the future. The analysis used the default settings and assumed a natural regeneration of 15 trees per year. Note that the recommendations of the TCR (2 m buffer at north and south) and the landscaped trees were not accounted for in this analysis. For rationale, please see accompanying Memo.
- A GIS analysis of total, accessible greenspace and the percentage of the community with easy access to greenspace (defined as 250 m straight-line distance).

The modelling program iTree was developed by the USDA Forest Service. Ecosystem services offered by woodlands include removal of air pollution, reduction in surface run-off, carbon storage and sequestration, as well as structural value.

Note that a modest natural regeneration of 15 trees per year was assumed for the iTree analysis of 1158 Old Second Line Road. The planned retention of a 2 m treed buffer along north and south property lines, a wider area of tree retention along the hydro corridor, and trees proposed for planting in the landscaping plan were not included in the analysis. In the case of the latter, this is because the City determined that the soil volumes provided for the landscaped trees would be insufficient to allow for their long-term growth and development.

2.4.8. Results of City of Ottawa Assessment of Significant Woodlands Criteria

Results of the City's evaluation of the subject property with respect to Significant Woodlands are found in Table 2b (*new*, Memo from Nick Stow, 21 Feb 2019).

Table 1b Summary of Significant Woodlands Assessment (City of Ottawa)

Ecosystem Service	Change in local community (Morgan's Grant) as a result of proposed development	Comment
Total Canopy Cover	-1.7%	
Social Value	None known	
Accessible Greenspace	31 ha (15% of the community area)	No history of public access at 1158 Old Second Line Rd. (private)
Percent of the community within 250 m of accessible	95%	No history of public access at 1158 Old Second Line Rd. (private)

greenspace		
Percent of multi-unit housing within 250 m of accessible greenspace	100%	No history of public access at 1158 Old Second Line Rd. (private)
Carbon Storage	-0.26% (69 metric tons)	
Carbon Sequestration (net change)	-2%	
CO (kg)	-1.2%	
NO2 (kg)	-3.4%	
Ozone	-3.6%	
SO2 (kg)	-0.11%	
PM 2.5 (kg)	-2%	
Additional Runoff	184 m^3/a	

2.4.10. Significant Woodlands Conclusion

Based on the above analysis (Table 2b), City staff have concluded that the loss the wooded area on the subject property would result in a small decrease in ecosystem services provided to the local community. However the loss is considered limited in scope and magnitude when compared to the full community of Morgan's Grant.

The City of Ottawa acknowledges that the Significant Woodlands policy has not yet been approved by City Council and that the City "cannot reasonably ask the proponent to provide compensation in this case." The City Memo concluded that the negative impacts of the proposed development on the significant woodland should not prevent it from proceeding as planned. The proposed site plan is presented in Section 3.0 below, and impacts and proposed mitigations are discussed in Sections 4.0 and 5.0 respectively.

It should be noted that the proposed project is consistent with a variety of other policies with Ottawa's current Official Plan which affect natural systems planning for the City. For example:

- 2.1: Patterns of Growth: The proposed project is consistent with intensification targets in that population density is within an urban area and is directed towards key existing locations that are accessible to transit, walking, and cycling, and compact and efficient from a servicing point of view.

- 2.2: Managing Growth: The proposed project lies within Schedule B [Official Plan 2.2.1] where the City of Ottawa aims to accommodate approximately 90% of its growth. The project consists of a new development on … "land in designated growth areas that contributes to the completion of an existing community or builds a new community(ies)."

The ecological benefits of policies of growth and intensification in existing communities are well understood and include reduction in fossil fuel use due to reduced car travel, increased efficiency of land use, and protection of significant natural features in rural settings.

2.6 Habitat for Species at Risk

Since 2013, there has also been significant change to policies and procedures surrounding the identification of Species at Risk habitat, and mitigation. The information below is in addition to section 2.6, Habitat for Species at Risk (CJB Environnement 2013, p. 15-16). In 2013, CJB Environnement identified five potential SAR occurring on the subject property: Butternut (END), Blanding's Turtle (THR), Whip-poor-will (THR), Milksnake (SC at the time), and Snapping Turtle (SC). Since 2013, the Milksnake has been delisted as a Species at Risk under the provincial ESA.

2.6.1 Eastern Whip-poor-will

On 17 May 2013, CJB Environnement completed call playback surveys for Whip-poor-will on the subject property. No Whip-poor-wills were heard during the surveys, although again the surveys were completed prior to provision of a standard MNRF survey protocol. The property was visited by Holly Bickerton on November 22, 2018, to observe the structural habitat suitability for SAR, including Whip-poor-will. As summarized in documents to MNRF (appended), the site is not considered to provide suitable habitat for Whip-poor-will due to the closed nature of the canopy, the absence of suitable understory to provide nesting cover, the absence of foraging habitat, and the site's proximity to dense suburban settlement. A lack of documented observations in the nearby vicinity supports this assessment. In a January 2019 reply to the IGF, the MNRF concurred that although 2013 surveys did not follow the currently required survey protocol, "the rationale explaining the poor suitability of the site for species provides good support that no additional surveys are needed."

2.6.2 Blanding's Turtle

Between 16-18 May 2013, CJB Environnement completed active surveys for reptiles. Surveys were completed prior to a 2014 MNRF publication to standardize survey methods for Blanding's Turtles. No Blanding's Turtles were observed, and it was concluded that the site did not correspond to the habitat requirements of this species (p. 16). The site contains no wetland habitat, and there is also no wetland habitat or suitable nesting habitat in the adjacent hydro corridor.

Since 2013, MNRF has significantly altered the screening process for the identification of SAR habitat under the Ontario ESA 2007. In 2018 through communication with consultants at GHD and Holly Bickerton, MNRF identified the subject property as Category 3 Habitat for Blanding's Turtle as identified under the ESA, due to its proximity to known sites and recent observations of roadkill in the area (J. Devlin, pers. comm. 2018).

An Information Gathering Form (IGF, 11 Dec 2018) and Avoidance Alternative Form (AAF, 30 January 2019) were subsequently submitted to MNRF by Holly Bickerton on behalf of Theberge Homes (Bickerton 2019a and 2019b). In summary, the forms described the subject property and the surrounding area, and indicated several reasons why the area is unlikely to be used as Category 3 habitat of value to support Blanding's Turtle. In the AAF, activities were proposed during construction that would prevent all unlikely impact to Blanding's Turtle as a result of the proposed development. MNRF subsequently concurred via email that "the works, as proposed will not likely contravene the ESA with the mitigation described in the AAF." All agreed upon mitigations identified in the AAF are summarized in Table 1 (see Proposed Mitigation, below).

2.6.3 Butternut (NEW)

In April 2018, a Tree Conservation Report was completed by IFS Associates and five Butternut trees were identified on the subject property (Figure 2). A Butternut Health Assessment was completed by Andrew Boyd at IFS Associates on 14 June 2018 (see IFS Associates 2018b). Of the five trees, one was dead, and the remaining four were assessed as Category 1 ("non-retainable") under the BHA Tree analysis protocol, meaning that these four were affected by Butternut Canker to such an advanced degree that retaining the tree would not support the protection of the species. The BHA report summarizing this information was submitted by IFS Associates to MNRF on 27 June 2018.

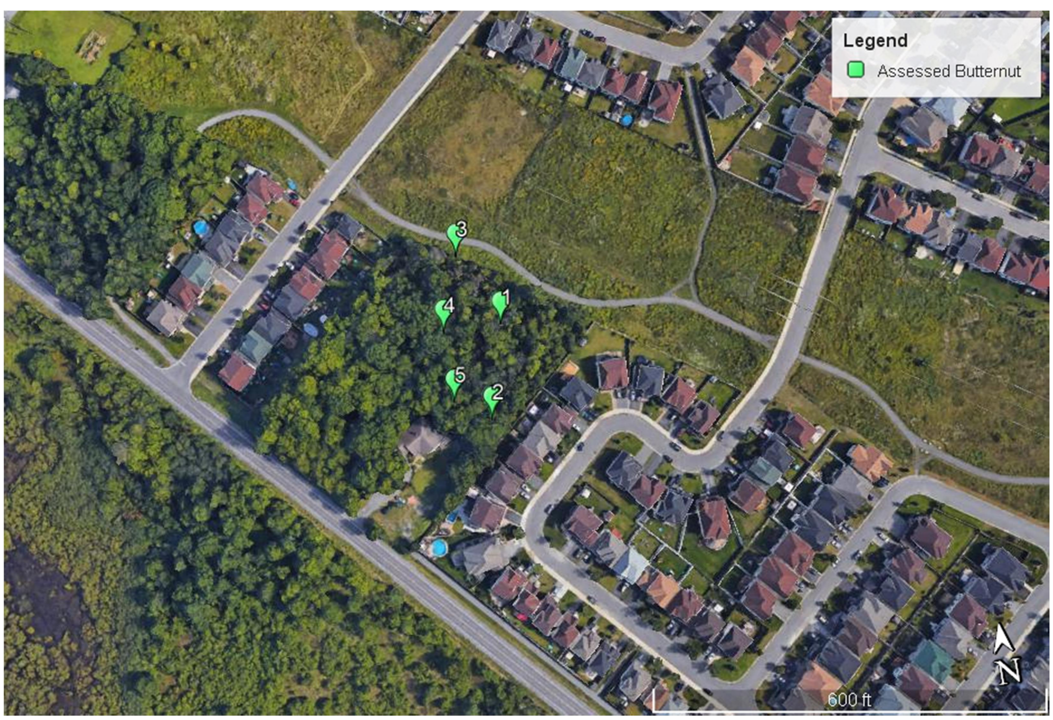

Figure 2 Location of 5 assessed Butternut trees. 1=Dead, 2-5=Category 1 (non-retainable).

3.0 Description of the Proposed Project

At the time of the 2013 EIS, no development plans were available. The former proponent was seeking rezoning and site approval.

Theberge Homes and Holzman Consultants Inc. have developed site plans for the subject property and have submitted an application for a Plan of Subdivision and Zoning Bylaw Amendment based on a detailed Site Plan, Landscape Plan, Site Servicing and Grading Plans, and other supporting materials. A residential development of 47 units is planned, arranged in townhouse blocks (see Site Plan for reference in Figure 3; note that the most recent full site plan is included in Dec 28 submission). Each has an internal single car garage and additional legal parking space in the driveway, with 18 visitor parking spaces. Urban infrastructure servicing is proposed along with a stormwater management facility (dry pond) adjacent to the hydro line, to control the quality and quantity of the stormwater runoff.

A Landscape Plan completed by G.J. Aiello Associates is similarly presented for reference in Figure 4; note that the full Landscape plan is included in Dec 28 submission.

4.0 Impact Assessment

Given that a detailed site plan for the proposed subdivision has been developed, impacts to the woodland can be more clearly identified than in 2013.

4.1 General

The 2013 EIS states that there are no environmental features of note present on the site. However, five Endangered Butternut trees have been identified on the site since that time, and consultation with the MNRF identified that Category 3 Blanding's Turtle habitat is present (see 2.6.2 above). Additionally, the City of Ottawa has identified that the proposed project will result in decreases in ecosystem services provided to the local community.

4.2 Impact Assessment Matrix

Additional impacts described above are now included in the updated Table 6a (below, based on Table 6 completed by CJB Environnement in 2013).

Figure 3 Site Plan, 1158 Old Second Line Road (Partial for reference only; for full plan please see 21 December 2018 SP-1, Rev. 3)

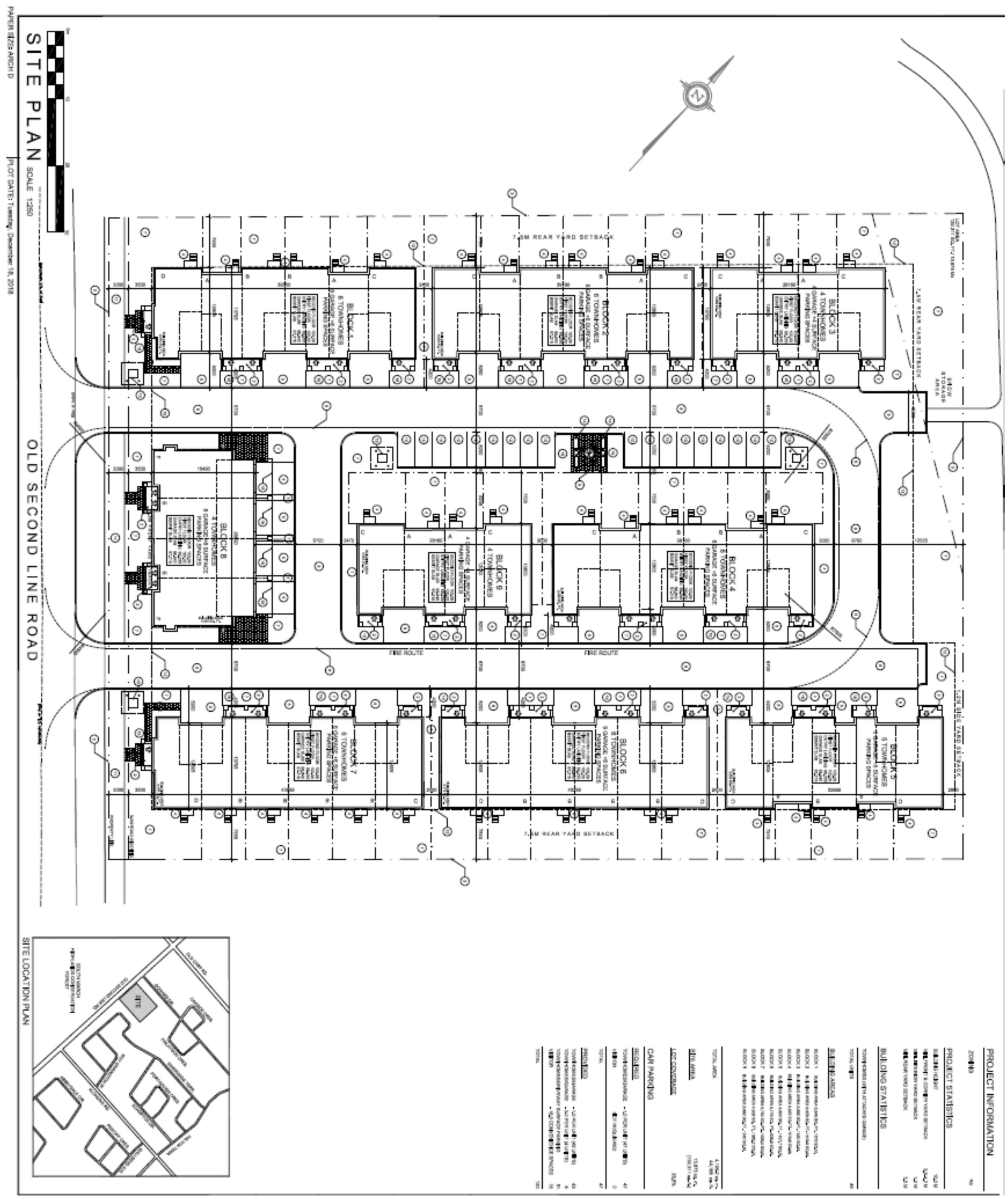

Figure 4 Landscape Plan, 1158 Old Second Line Road (Partial for reference only; for full plan please see 18 December 2018 L-1, Rev. 3)

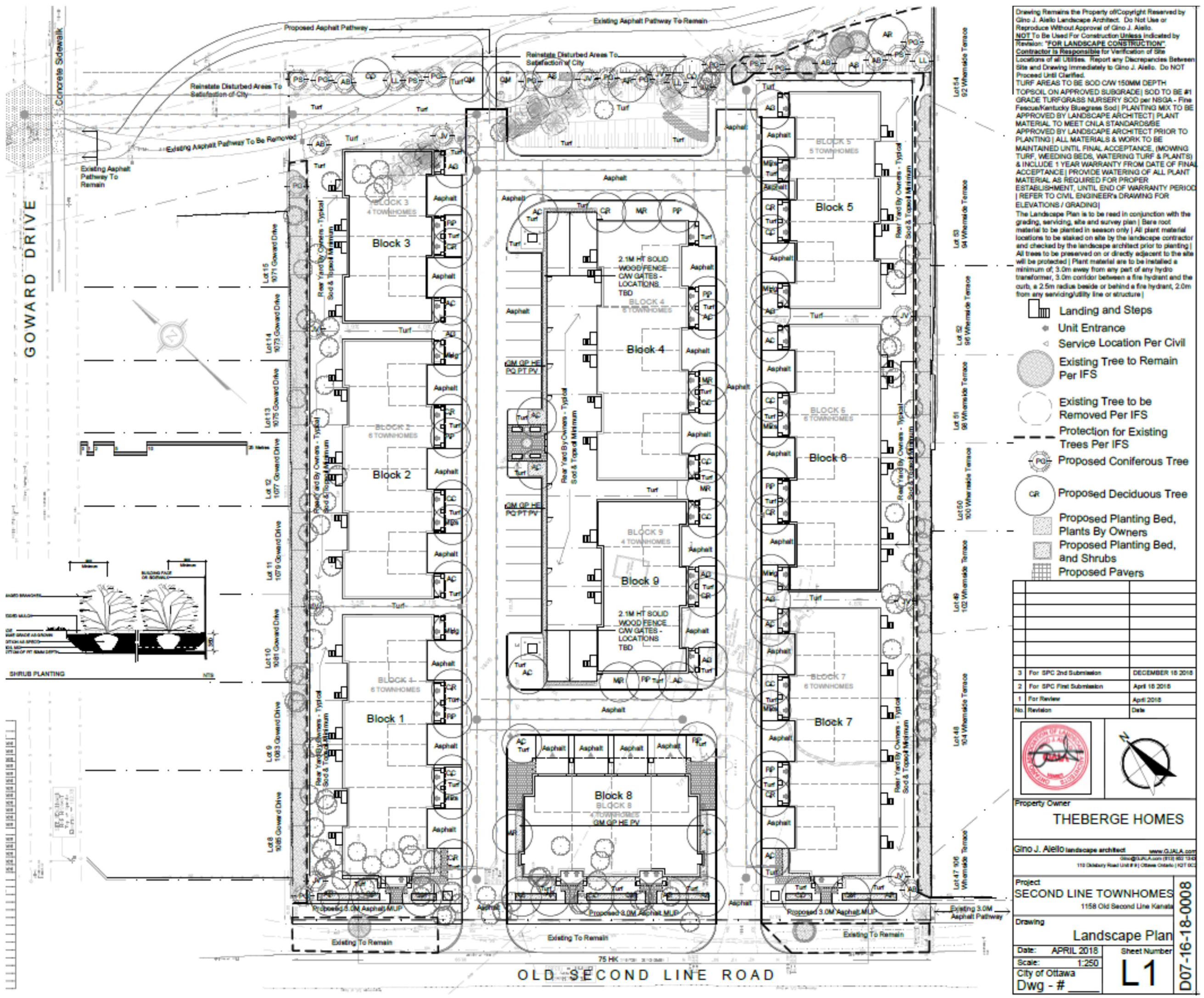

Table 6a Matrix to identify environmental impacts (revised)

DIMENSIONS	PHYSICAL							BIOLOGICAL						
	AIR		SOL			Water		Habitat		Fauna		Veg.		
						Ground	Surface							
	Quality	Sound env.	Quality	Drainage	Erosion	Quality	Quality	Terrestrial	Aquatic	Terrestrial	Aquatic	Terrestrial	Aquatic	Landscape
SITE PREPARATION														
1. Delineating protective zones			X											
2. Vegetation clearing	X		X	X			X	X		X		X		X
3. Demolition of the existing house		X	X											
CONSTRUCTION														
4. Soil excavation	X	X	X			X	X							
5. Street and buildings construction	X	X	X				X							
6. Waste management and residual material			X				X							
7. Machinery	X	X	X				X							
OPERATION														
8. Traffic	X	X												
9. Residential development								X		X		X		X

A combined impacts and mitigation summary table is presented in Table 7 of the 2013 EIS (CJB Environnement 2013). Additions to this table, including all mitigations developed as a result of discussions with MNRF and the City of Ottawa, are included as agreed through consultation, below in Table 7a.

Table 7a. Impacts and Mitigations Summary Table

Activity	Natural Feature/Function	Potential Effect	Proposed Mitigation	Residual Effect
1. Delineating protective zones	SAR habitat (Blanding's Turtle)	Turtles from South March Highlands may risk harm wandering through site in search of unsuitable nesting habitat in hydro corridor (potential habitat sink).	Temporary exclusion fencing installed around the perimeter of the property before April 1, 2019 and maintained and monitored until construction is complete.	Fencing before and during construction will prevent Blanding's Turtles from accessing the construction site. Turtle movement will be excluded well in advance of the start of the active season.
2. Vegetation Clearing	SAR habitat (Butternut)	Five non-retainable Endangered Butternut to be removed (killed).	None. Permit in place (IFS Associates BHA, June 2018).	Non-retainable Butternut trees removed as per permit.
	Soil Quality, Air Quality, Surface Water	Small decreases in stored carbon, long-term carbon sequestration, air quality, urban heat island, and increase in storm water runoff.	As per 2018 TCR: Retention of 2 m linear buffer at north and south boundaries of property, with retention of small-diameter (<10 cm) trees to maximize survivorship (see Figure 4, Landscape Plan). Erosion & Sediment Control Plan will be prepared requiring excavated water to be directed east toward the Hydro Easement, where sediment controls will be installed. Prior to site clearing, a fence will be erected as close as possible to the Critical Root Zone (CRZ) of trees to be retained, with appropriate signage as per TCR.	Modest mitigation of soil quality, air quality and surface water within the existing planning context. Small potential for carbon sequestration as retained trees, providing small offset of woodland loss. Erosion and sediment runoff will be mitigated during vegetation clearance with standard controls.

			No material or equipment is to be placed within CRZ.	
3. Demolition of the existing house	Soil Quality, Air Quality, Surface Water	Possible loss of retained trees if soils are compacted within CRZ.	No material or equipment is to be placed within CRZ.	Appropriate measures will be taken to prevent accidental loss of or damage to trees to be retained.
4. Soil excavation	SAR habitat (Blanding's Turtle)	Turtles from South March Highlands may cross Old Second Line Road and attempt to nest in loose fill on site during excavation.	No loose fill to be stockpiled on site. Site monitored regularly during key times of turtle movement (late May-late June) by a qualified professional Construction workers instructed to identify Blanding's Turtles and to contact a qualified professional immediately if one is identified on or near the site.	Preventing loose fill at site will eliminate any potential nesting opportunities for Blanding's and other turtles. Monitoring and awareness will ensure any turtles near the site will not be harmed. Erosion and sediment runoff will be mitigated during soil excavation.
	Soil Quality, Air Quality, Surface Water	Possible loss of retained trees if soils are compacted within CRZ.	No material or equipment is to be placed within CRZ. Tunnelling or boring is to be used instead of digging or trenching, as per TCR.	Appropriate measures will be taken to prevent accidental loss of or damage to trees to be retained.
5. Street and building construction	SAR habitat (Blanding's Turtle)	Surface water within SMH may be negatively impacted if overland flows are directed to the west.	Overland flow will be directed to a dry basin catchment at the east boundary of the site, and directed via storm sewer to an existing municipal drain to the north along Goward Rd (See AAF for additional information).	Any overland flow that may contain sediment, nutrients, and/or pollutants will be directed to municipal stormwater drains. All adverse impacts on known Blanding's Turtle habitat in SMH will be avoided in that the water chemistry of

				adjacent wetland and local natural areas will remain intact.
6. Waste management and residual material	No change			
7. Machinery	No change			
8. Traffic	No change			
9. Residential development	No change			

5.0 Mitigation

Proposed mitigation was summarized in 2013 in Table 7 and remains in place. Additional mitigation is proposed within Table 7a above.

5.1 Tree Conservation Report

As described above, a 2018 Tree Conservation Report (IFS Associates) replaces the TCR included in Section 5.1 of the 2013 EIS by CJB Environnement. Mitigations recommended in this report are incorporated into Table 7a and also into the most recent (December 2018) proposed Site Plan. These mitigations take precedence over those described in the 2013 EIS.

6.0 Monitoring

As identified in Table 7a, monitoring is required to ensure the effectiveness of mitigation measures. Below is a summary of proposed monitoring, timing, and responsibility (Table 8). Contingency discussions are embedded in Tables 7 and 7a.

Table 8 Proposed monitoring schedule for 1158 Old Second Line Road

Monitoring activity	Duration	Frequency	Responsibility
Check for Blanding's Turtle, ensure fencing is intact and other mitigation measures in place	April 1-late June	Weekly	Environmental consultant
Monitor for turtle activity on or near site	Throughout construction	Daily	Construction staff

7.0 Summary and Recommendations

Since 2013, the site conditions on the subject property are unchanged. However, plans for a 47 dwelling unit residential development have been identified that will require the removal of most of the vegetation on the site. In this Memo, the impacts of the proposed development have been identified in light of changes to the site plan as well as policy changes since 2013.

In summary:

- The wooded area of the site is considered a Significant Woodland under a draft City policy on Significant Woodlands, due to its age, size and location within the urban boundary. No other criteria for Significant Woodlands are met, and identified impacts under City policy and the PPS are limited to ecosystem services.
- The loss of approximately 1.0 ha of wooded area will result in a small loss to the local community of a number of ecosystem services, including air quality, heat

island benefits, carbon sequestration, releases in stored carbon and increases in stormwater run-off.

- To reduce loss of tree cover, a 2 m vegetated buffer (trees <10 cm diameter) will be retained on the north and south boundaries, and a small area of trees adjacent the hydro line, as per a 2018 Tree Conservation Report. Street tree plantings are also identified in a Landscape Plan.
- Overall, losses in ecosystem services are considered limited in scope and magnitude when compared to the full community of Morgan’s Grant, and the proposed development is consistent with other environmental policies on infill and densification in existing development areas.
- Five Endangered Butternut trees on the property have been assessed via a Butternut Health Assessment (2018) as non-retainable (Category 1) and will be removed subject to a permit under the Ontario ESA 2007.
- Current procedures to identify potential impacts to Species at Risk have been completed for the subject property, and a low potential for impact to Blanding’s Turtle was identified.
- Avoidance activities including fencing of the property and regular monitoring will be undertaken to eliminate any risk to Blanding’s Turtles.

A monitoring plan has been developed to ensure that proposed mitigation is both timely and effective.

Please feel free to contact me for further information or clarification.

Kind regards

Holly J. Bickerton
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Consulting Ecologist

References

Bickerton, H. 2018a. Information Gathering Form (IGF) for activities that may affect species or habitat protected under the *Endangered Species Act* (dated 10 Dec 2018).

Bickerton, H. 2018b. Avoidance Alternatives Form (AAF) for activities that may require an overall benefit permit under clause 17(2)(c) of the *Endangered Species Act* (dated 30 Jan 2019).

City of Ottawa. 2019a. Draft Significant Woodlands: Guidelines for Identification, Evaluation and Impact Assessment.

City of Ottawa. 2019b. iTree Ecosystem Analysis: 1158 Old Second Line Road. Urban Forest Effects and Values. February 2019. 36 pp.

CJB Environnement Inc. 2013. 1158 Second Line Road, Ottawa, Ontario: Environmental Impact Assessment and Tree Conservation Report. September 2013, 32 pp. + appendices.

IFS Associates. 2018a. Letter re: Environmental Impact Statement and Tree Conservation Report – 1158 Old Second Line Road. 19 April 2018.

IFS Associates. 2018b. Memo re: Butternut trees at Old 1158 Old Second Line Road. 25 June 2018.

Muncaster Environmental Planning and Brunton Consulting Services 2005. Urban Natural Areas: Environmental Evaluation Study. March 2005. Report to City of Ottawa.

Ontario Ministry of Natural Resources (OMNR). 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queen's Printer for Ontario. 248 pp.

Appendix 1: iTree Ecosystem Analysis

i-Tree Ecosystem Analysis

1158 Old Second Line

Urban Forest Effects and Values
February 2019

Summary

Understanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the 1158 Old Second Line urban forest was conducted during 2019. Data from 2 field plots located throughout 1158 Old Second Line were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station.

- Number of trees: 1,292
- Tree Cover: 100.0 %
- Most common species of trees: Sugar maple, Eastern hophornbeam, American beech
- Percentage of trees less than 6" (15.2 cm) diameter: 62.8 %
- Pollution Removal: 36.87 kilograms/year (Can$147/year)
- Carbon Storage: 82.52 metric tons (Can$9.48 thousand)
- Carbon Sequestration: 3.331 metric tons (Can$383/year)
- Oxygen Production: 6.794 metric tons/year
- Avoided Runoff: 183.5 cubic meters/year (Can$427/year)
- Building energy savings: N/A – data not collected
- Avoided carbon emissions: N/A – data not collected
- Structural values: Can$611 thousand

Tonne: 1000 kilograms
Monetary values Can$ are reported in Canadian Dollars throughout the report except where noted.
Ecosystem service estimates are reported for trees.

For an overview of i-Tree Eco methodology, see Appendix I. Data collection quality is determined by the local data collectors, over which i-Tree has no control. Additionally, some of the plot and tree information may not have been collected, so not all of the analyses may have been conducted for this report.

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I. Tree Characteristics of the Urban Forest

The urban forest of 1158 Old Second Line has an estimated 1,292 trees with a tree cover of 100.0 percent. The three most common species are Sugar maple (38.2 percent), Eastern hophornbeam (34.6 percent), and American beech (10.0 percent).

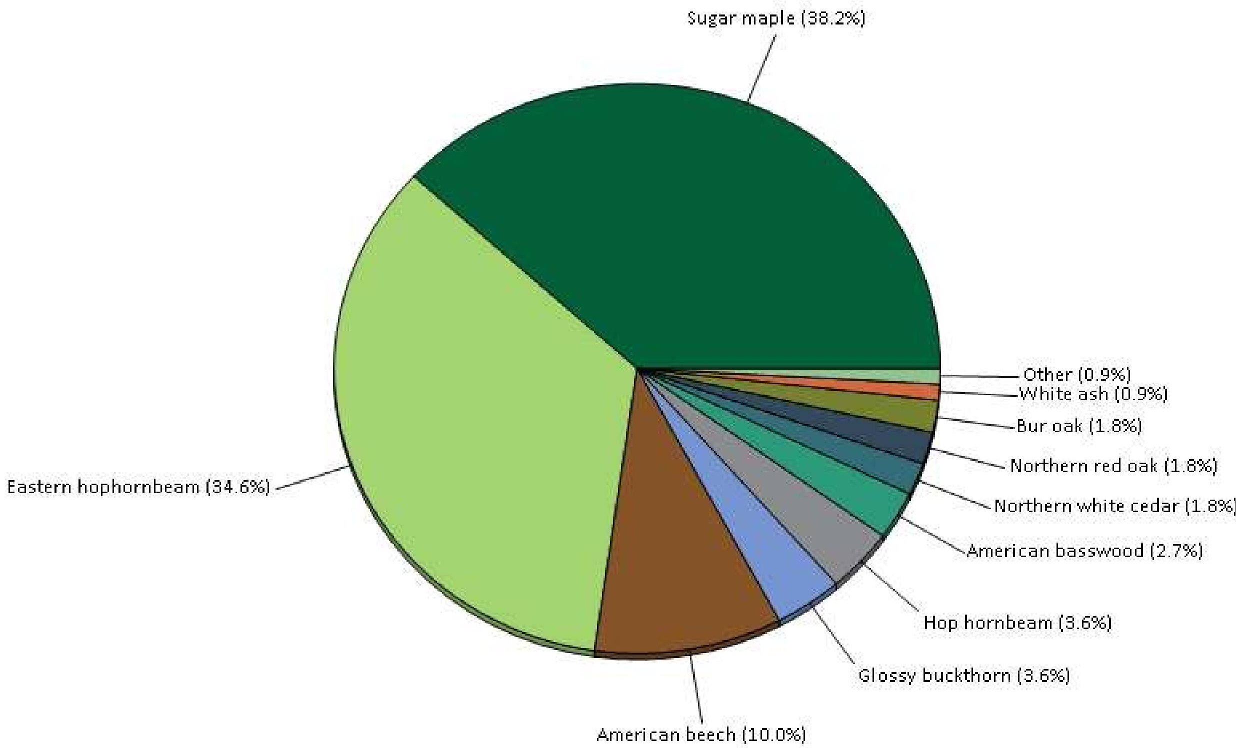

Figure 1. Tree species composition in 1158 Old Second Line

The overall tree density in 1158 Old Second Line is 1,359 trees/hectare (see Appendix III for comparable values from other cities).

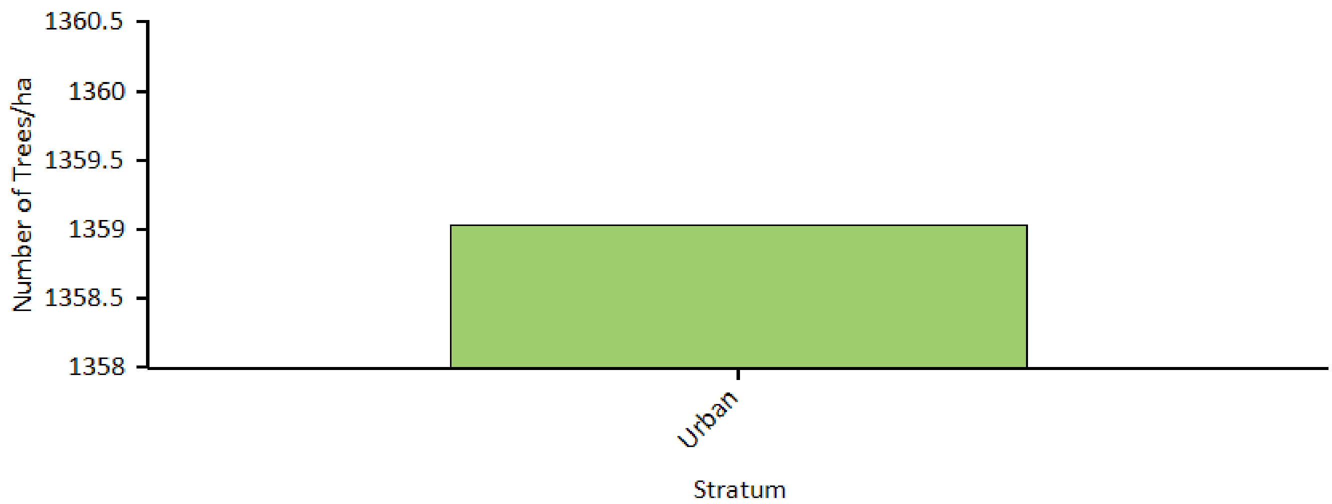

Figure 2. Number of trees/ha in 1158 Old Second Line by stratum

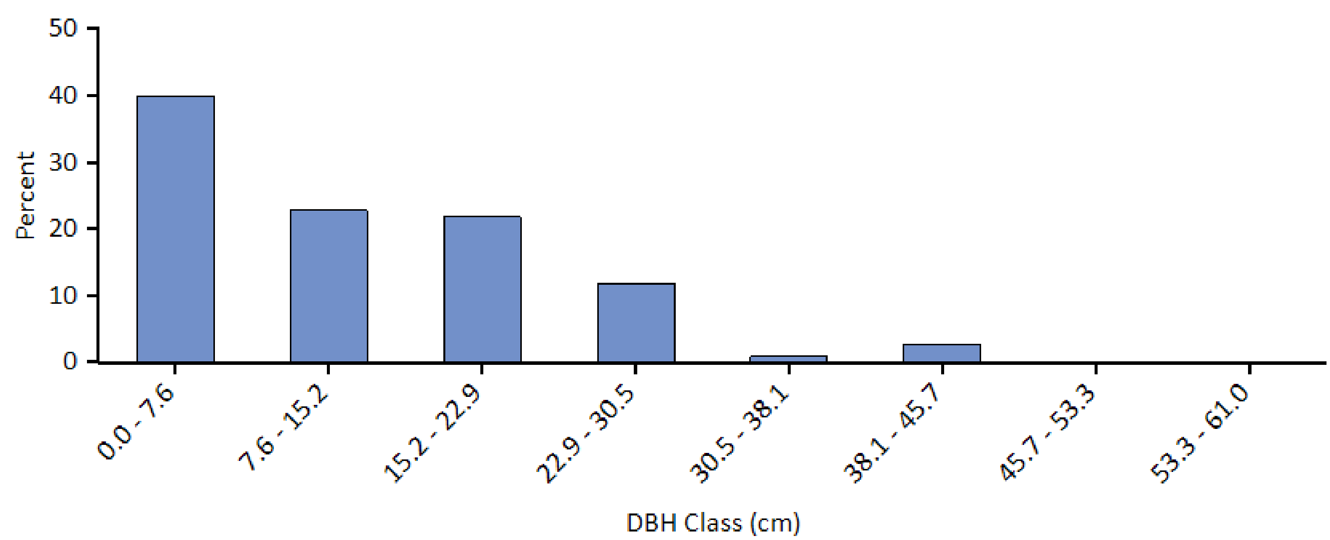

Figure 3. Percent of tree population by diameter class (DBH - stem diameter at 1.37 meters)

Urban forests are composed of a mix of native and exotic tree species. Thus, urban forests often have a tree diversity that is higher than surrounding native landscapes. Increased tree diversity can minimize the overall impact or destruction by a species-specific insect or disease, but it can also pose a risk to native plants if some of the exotic species are invasive plants that can potentially out-compete and displace native species. In 1158 Old Second Line, about 93 percent of the trees are species native to North America. Most trees have an origin from Europe & Asia (4 percent of the trees).

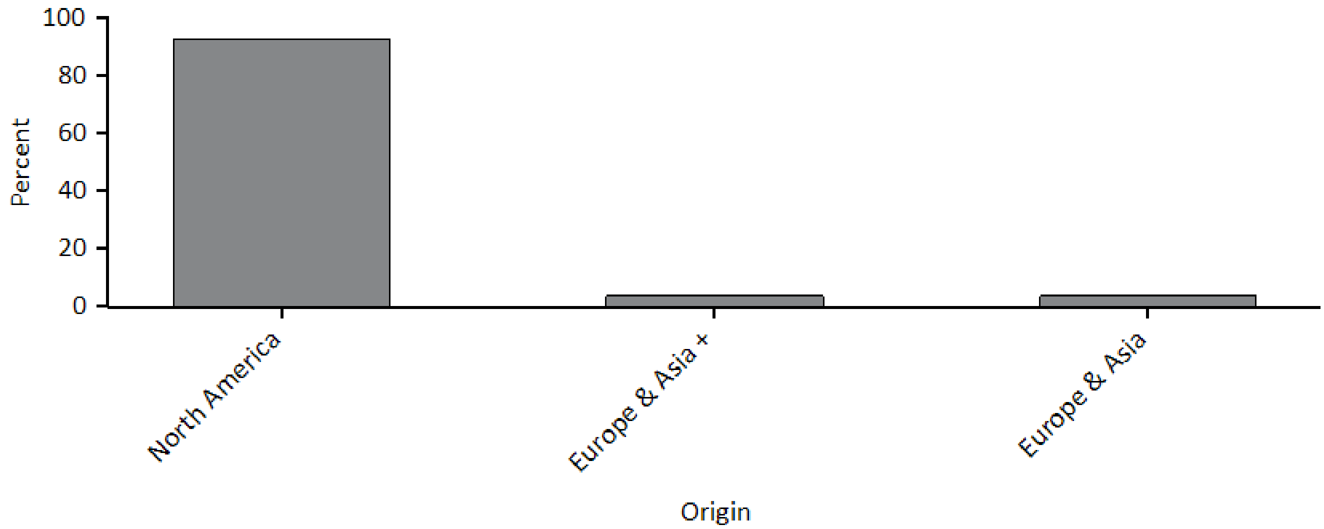

Figure 4. Percent of live tree population by area of native origin, 1158 Old Second Line

The plus sign (+) indicates the tree species is native to another continent other than the ones listed in the grouping.

Invasive plant species are often characterized by their vigor, ability to adapt, reproductive capacity, and general lack of natural enemies. These abilities enable them to displace native plants and make them a threat to natural areas.

II. Urban Forest Cover and Leaf Area

Many tree benefits equate directly to the amount of healthy leaf surface area of the plant. Trees cover about 100 percent of 1158 Old Second Line and provide 9.89 hectares of leaf area. Total leaf area is greatest in Urban.

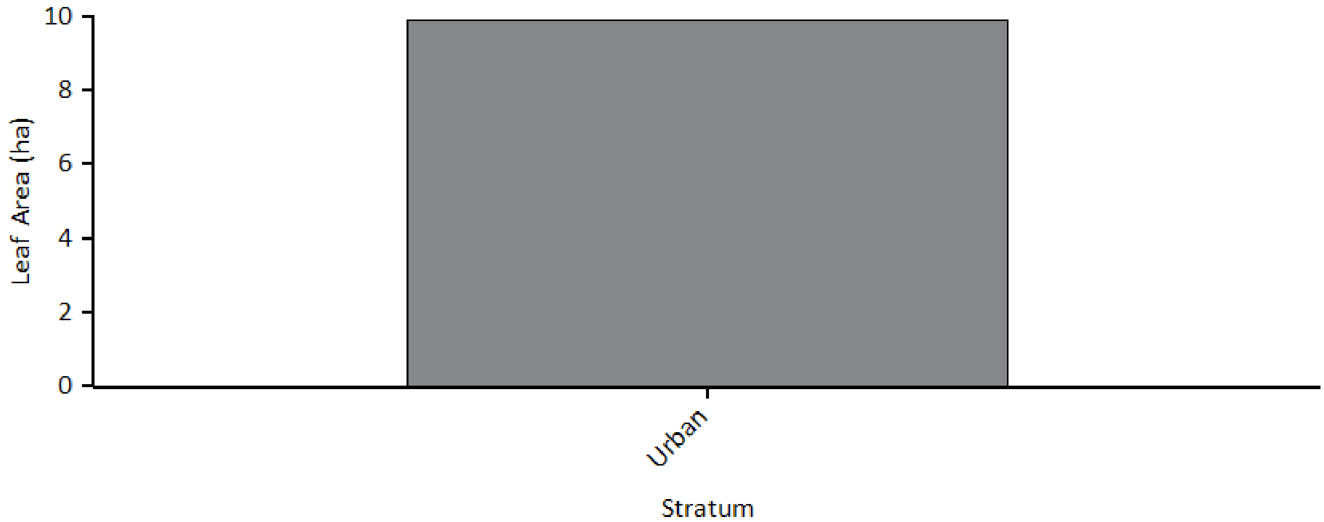

Figure 5. Leaf area by stratum, 1158 Old Second Line

In 1158 Old Second Line, the most dominant species in terms of leaf area are Sugar maple, Eastern hophornbeam, and American beech. The 10 species with the greatest importance values are listed in Table 1. Importance values (IV) are calculated as the sum of percent population and percent leaf area. High importance values do not mean that these trees should necessarily be encouraged in the future; rather these species currently dominate the urban forest structure.

Table 1. Most important species in 1158 Old Second Line

Species Name	*Percent Population*	*Percent Leaf Area*	*IV*
Sugar maple	38.2	39.3	77.5
Eastern hophornbeam	34.5	27.4	61.9
American beech	10.0	10.3	20.3
American basswood	2.7	7.9	10.6
Northern red oak	1.8	4.0	5.8
Hop hornbeam	3.6	1.4	5.0
Bur oak	1.8	3.2	5.0
White ash	0.9	3.5	4.4
Glossy buckthorn	3.6	0.3	3.9
Bitternut hickory	0.9	1.8	2.7

Common ground cover classes (including cover types beneath trees and shrubs) in 1158 Old Second Line are not available since they are configured not to be collected.

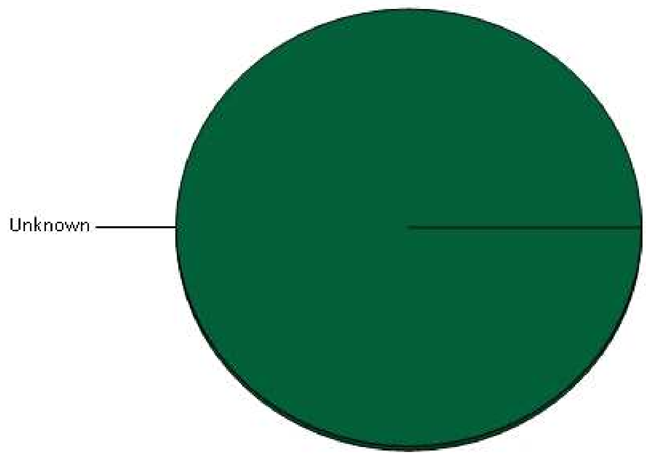

Figure 6. Percent of land by ground cover classes, 1158 Old Second Line

III. Air Pollution Removal by Urban Trees

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power sources. Trees also emit volatile organic compounds that can contribute to ozone formation. However, integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (Nowak and Dwyer 2000).

Pollution removal[1] by trees in 1158 Old Second Line was estimated using field data and recent available pollution and weather data available. Pollution removal was greatest for ozone (Figure 7). It is estimated that trees remove 36.87 kilograms of air pollution (ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 2.5 microns (PM2.5)[2], and sulfur dioxide (SO2)) per year with an associated value of Can$147 (see Appendix I for more details).

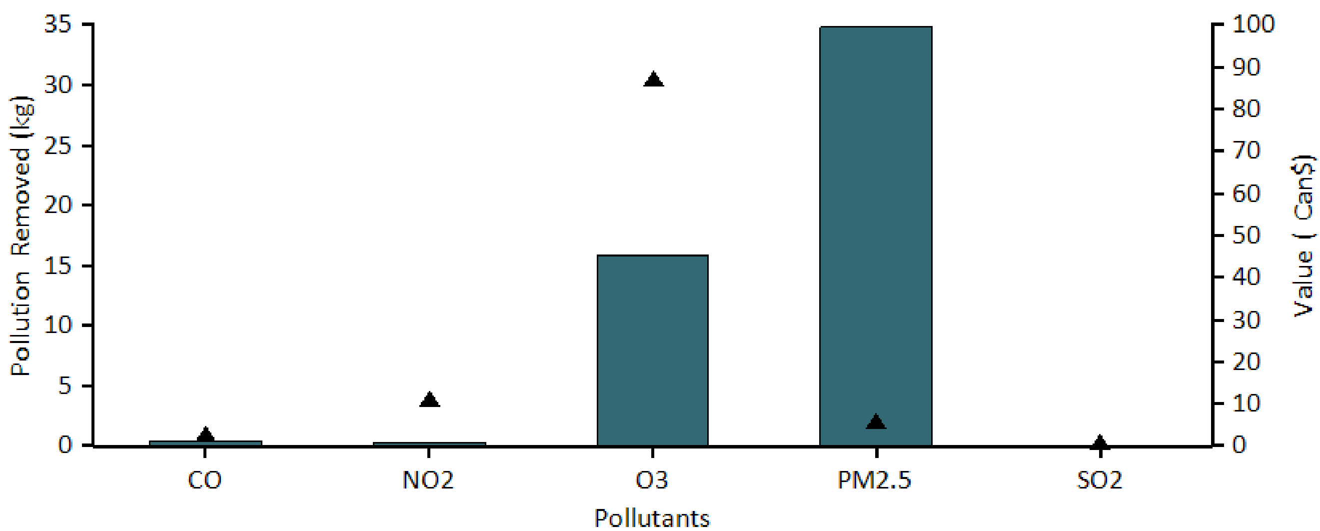

Figure 7. Annual pollution removal (points) and value (bars) by urban trees, 1158 Old Second Line

[1] Particulate matter less than 10 microns is a significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

[2] Trees remove PM2.5 when particulate matter is deposited on leaf surfaces. This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors (see Appendix I for more details).

In 2019, trees in 1158 Old Second Line emitted an estimated 13.71 kilograms of volatile organic compounds (VOCs) (6.522 kilograms of isoprene and 7.184 kilograms of monoterpenes). Emissions vary among species based on species characteristics (e.g. some genera such as oaks are high isoprene emitters) and amount of leaf biomass. Sixty- eight percent of the urban forest's VOC emissions were from Sugar maple and Northern red oak. These VOCs are precursor chemicals to ozone formation.[3]

General recommendations for improving air quality with trees are given in Appendix VIII.

[3] Some economic studies have estimated VOC emission costs. These costs are not included here as there is a tendency to add positive dollar estimates of ozone removal effects with negative dollar values of VOC emission effects to determine whether tree effects are positive or negative in relation to ozone. This combining of dollar values to determine tree effects should not be done, rather estimates of VOC effects on ozone formation (e.g., via photochemical models) should be conducted and directly contrasted with ozone removal by trees (i.e., ozone effects should be directly compared, not dollar estimates). In addition, air temperature reductions by trees have been shown to significantly reduce ozone concentrations (Cardelino and Chameides 1990; Nowak et al 2000), but are not considered in this analysis. Photochemical modeling that integrates tree effects on air temperature, pollution removal, VOC emissions, and emissions from power plants can be used to determine the overall effect of trees on ozone concentrations.

IV. Carbon Storage and Sequestration

Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Abdollahi et al 2000).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of 1158 Old Second Line trees is about 3.331 metric tons of carbon per year with an associated value of Can$383. Net carbon sequestration in the urban forest is about 2.548 metric tons. See Appendix I for more details on methods.

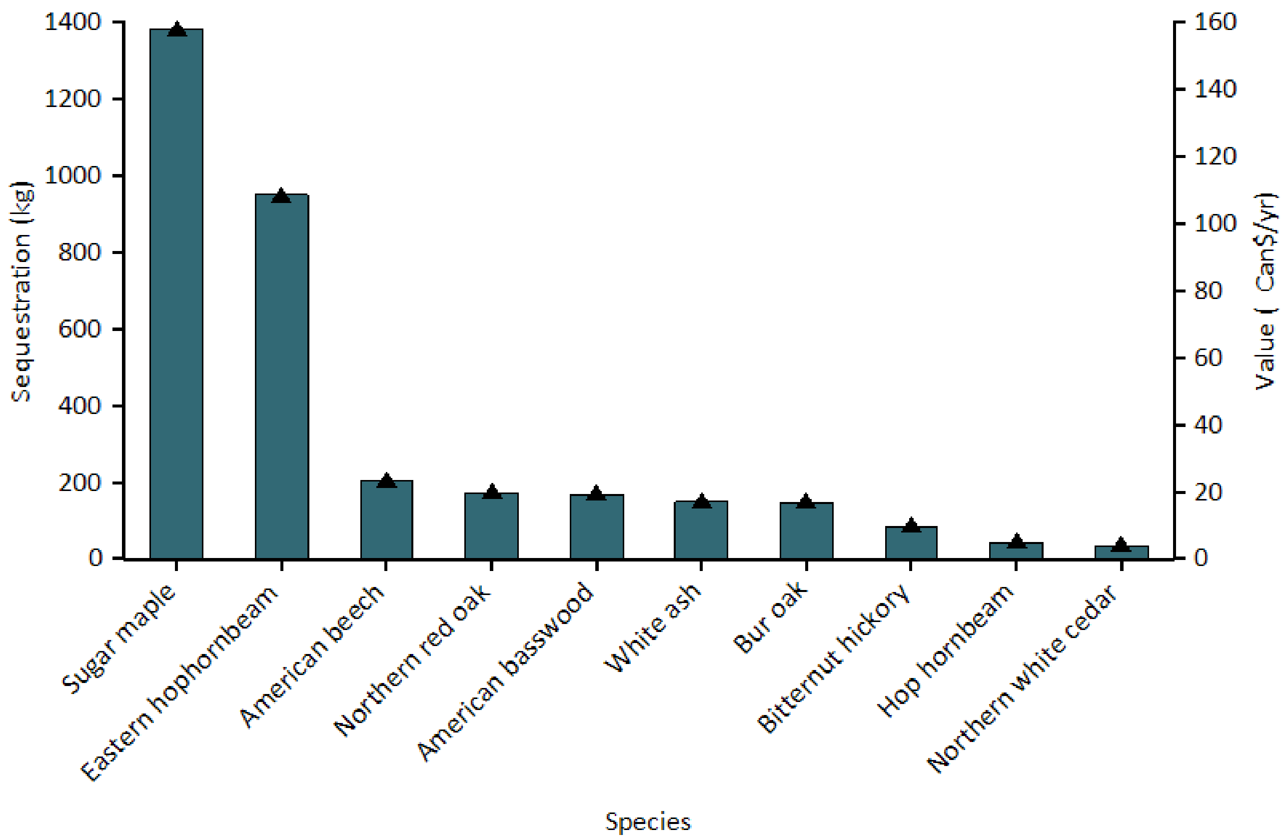

Figure 8. Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration, 1158 Old Second Line

Carbon storage is another way trees can influence global climate change. As a tree grows, it stores more carbon by holding it in its accumulated tissue. As a tree dies and decays, it releases much of the stored carbon back into the atmosphere. Thus, carbon storage is an indication of the amount of carbon that can be released if trees are allowed to die and decompose. Maintaining healthy trees will keep the carbon stored in trees, but tree maintenance can contribute to carbon emissions (Nowak et al 2002c). When a tree dies, using the wood in long-term wood products, to heat buildings, or to produce energy will help reduce carbon emissions from wood decomposition or from fossil-fuel or wood-based power plants.

Trees in 1158 Old Second Line are estimated to store 82.5 metric tons of carbon (Can$9.48 thousand). Of the species sampled, Sugar maple stores and sequesters the most carbon (approximately 38.3% of the total carbon stored and 41.4% of all sequestered carbon.)

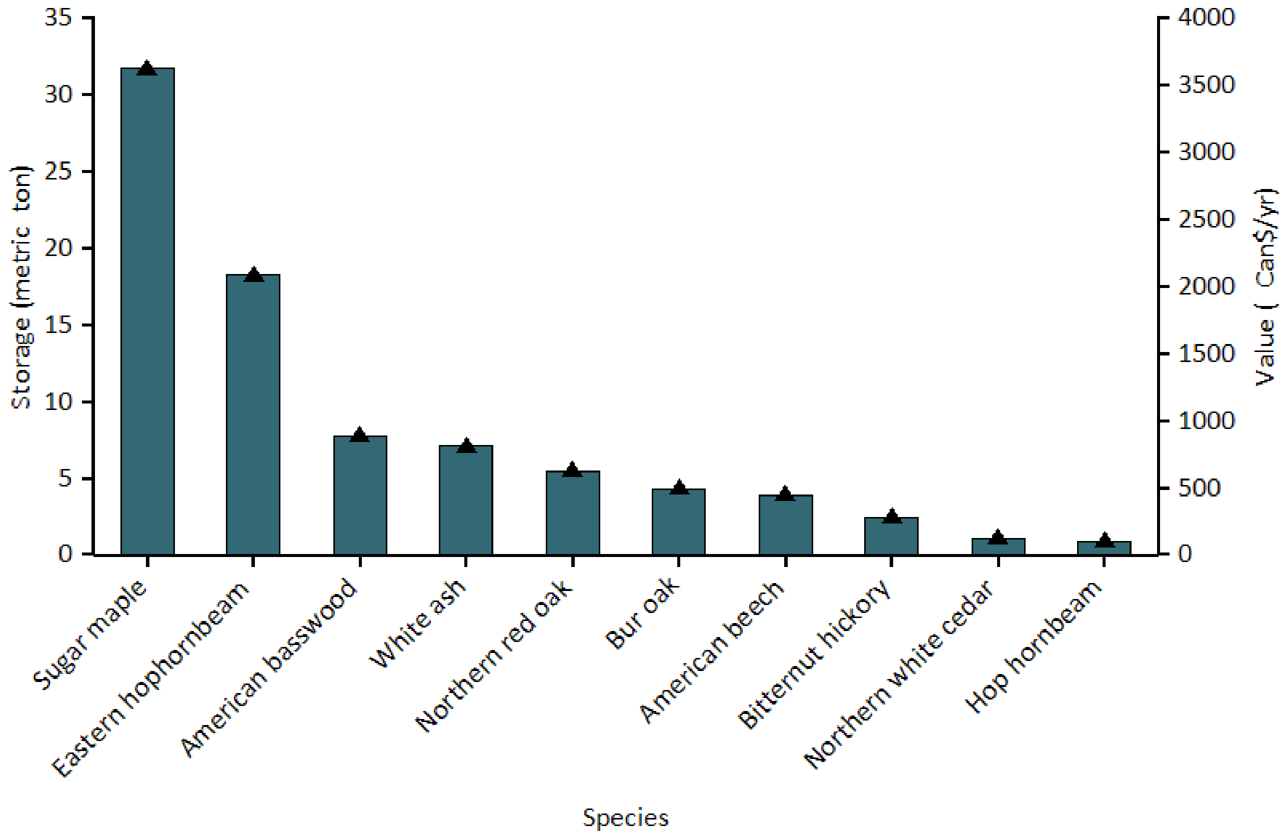

Figure 9. Estimated carbon storage (points) and values (bars) for urban tree species with the greatest storage, 1158 Old Second Line

V. Oxygen Production

Oxygen production is one of the most commonly cited benefits of urban trees. The net annual oxygen production of a tree is directly related to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass.

Trees in 1158 Old Second Line are estimated to produce 6.794 metric tons of oxygen per year.[4] However, this tree benefit is relatively insignificant because of the large and relatively stable amount of oxygen in the atmosphere and extensive production by aquatic systems. Our atmosphere has an enormous reserve of oxygen. If all fossil fuel reserves, all trees, and all organic matter in soils were burned, atmospheric oxygen would only drop a few percent (Broecker 1970).

Table 2. The top 20 oxygen production species.

Species	*Oxygen (kilogram)*	*Net Carbon Sequestration (kilogram/yr)*	*Number of Trees*	*Leaf Area (hectare)*
Sugar maple	2,871.22	1,076.71	493	3.89
Eastern hophornbeam	2,057.26	771.47	446	2.71
American beech	439.54	164.83	129	1.02
Northern red oak	320.45	120.17	23	0.39
Bur oak	279.57	104.84	23	0.32
American basswood	252.94	94.85	35	0.78
White ash	219.15	82.18	12	0.34
Bitternut hickory	162.26	60.85	12	0.18
Hop hornbeam	89.91	33.72	47	0.14
Northern white cedar	62.40	23.40	23	0.08
Glossy buckthorn	38.92	14.59	47	0.03

[4] A negative estimate, or oxygen deficit, indicates that trees are decomposing faster than they are producing oxygen. This would be the case in an area that has a large proportion of dead trees.

VI. Avoided Runoff

Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, lakes, and oceans. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012). In urban areas, the large extent of impervious surfaces increases the amount of surface runoff.

Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. The trees and shrubs of 1158 Old Second Line help to reduce runoff by an estimated 183 cubic meters a year with an associated value of Can$430 (see Appendix I for more details). Avoided runoff is estimated based on local weather from the user-designated weather station. In 1158 Old Second Line, the total annual precipitation in 2010 was 92.1 centimeters.

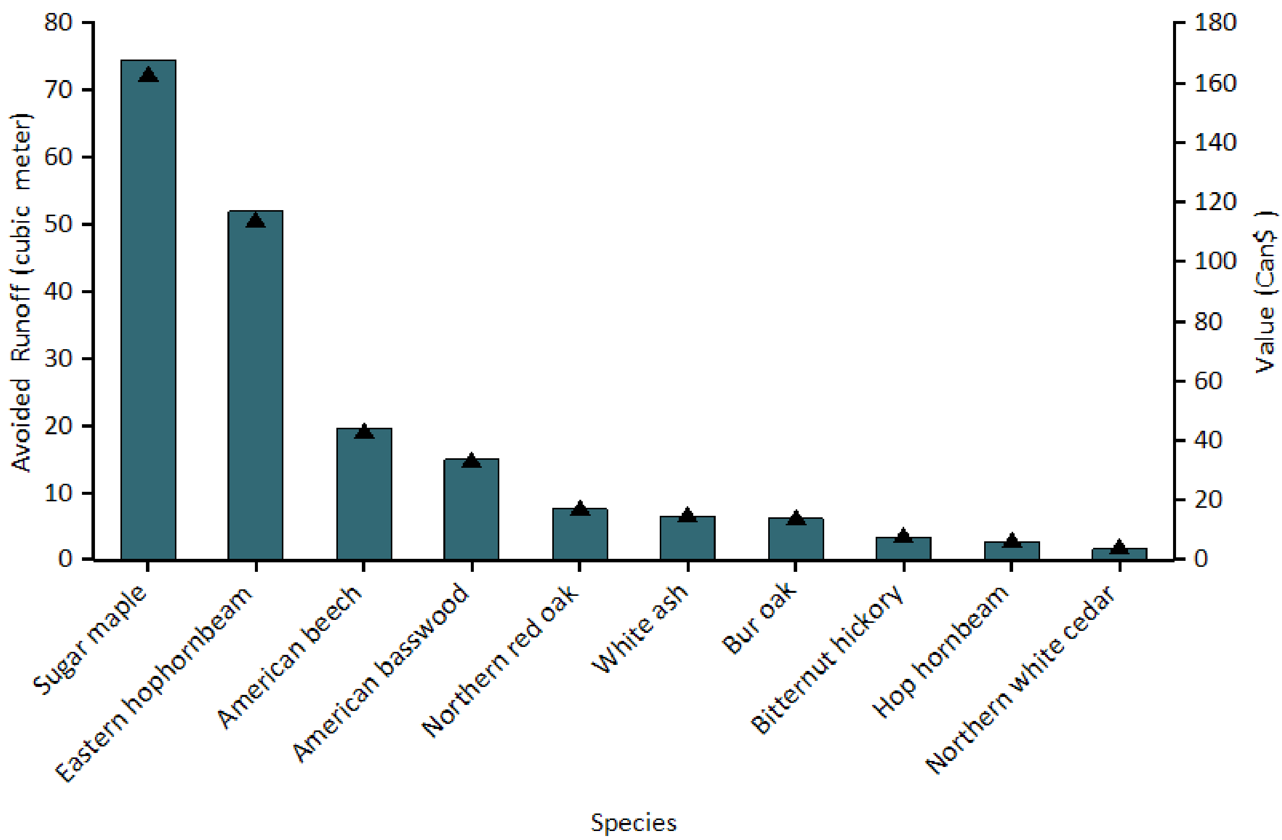

Figure 10. Avoided runoff (points) and value (bars) for species with greatest overall impact on runoff, 1158 Old Second Line

VII. Trees and Building Energy Use

Trees affect energy consumption by shading buildings, providing evaporative cooling, and blocking winter winds. Trees tend to reduce building energy consumption in the summer months and can either increase or decrease building energy use in the winter months, depending on the location of trees around the building. Estimates of tree effects on energy use are based on field measurements of tree distance and direction to space conditioned residential buildings (McPherson and Simpson 1999).

Because energy-related data were not collected, energy savings and carbon avoided cannot be calculated.

Table 3. Annual energy savings due to trees near residential buildings, 1158 Old Second Line

	Heating	*Cooling*	*Total*
MBTU[a]	0	N/A	0
MWH[b]	0	0	0
Carbon Avoided (kilograms)	0	0	0

[a]MBTU - one million British Thermal Units

[b]MWH - megawatt-hour

Table 4. Annual savings [a](Can$) in residential energy expenditure during heating and cooling seasons, 1158 Old Second Line

	Heating	*Cooling*	*Total*
MBTU[b]	0	N/A	0
MWH[c]	0	0	0
Carbon Avoided	0	0	0

[b]Based on the prices of Can$75 per MWH and Can$10.4544285106757 per MBTU (see Appendix I for more details)

[c]MBTU - one million British Thermal Units

[c]MWH - megawatt-hour

[5] Trees modify climate, produce shade, and reduce wind speeds. Increased energy use or costs are likely due to these tree-building interactions creating a cooling effect during the winter season. For example, a tree (particularly evergreen species) located on the southern side of a residential building may produce a shading effect that causes increases in heating requirements.

VIII. Structural and Functional Values

Urban forests have a structural value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree); they also have functional values (either positive or negative) based on the functions the trees perform.

The structural value of an urban forest tends to increase with a rise in the number and size of healthy trees (Nowak et al 2002a). Annual functional values also tend to increase with increased number and size of healthy trees. Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines.

Urban trees in 1158 Old Second Line have the following structural values:

- Structural value: Can$611 thousand
- Carbon storage: Can$9.48 thousand

Urban trees in 1158 Old Second Line have the following annual functional values:

- Carbon sequestration: Can$383
- Avoided runoff: Can$427
- Pollution removal: Can$147
- Energy costs and carbon emission values: Can$0

(Note: negative value indicates increased energy cost and carbon emission value)

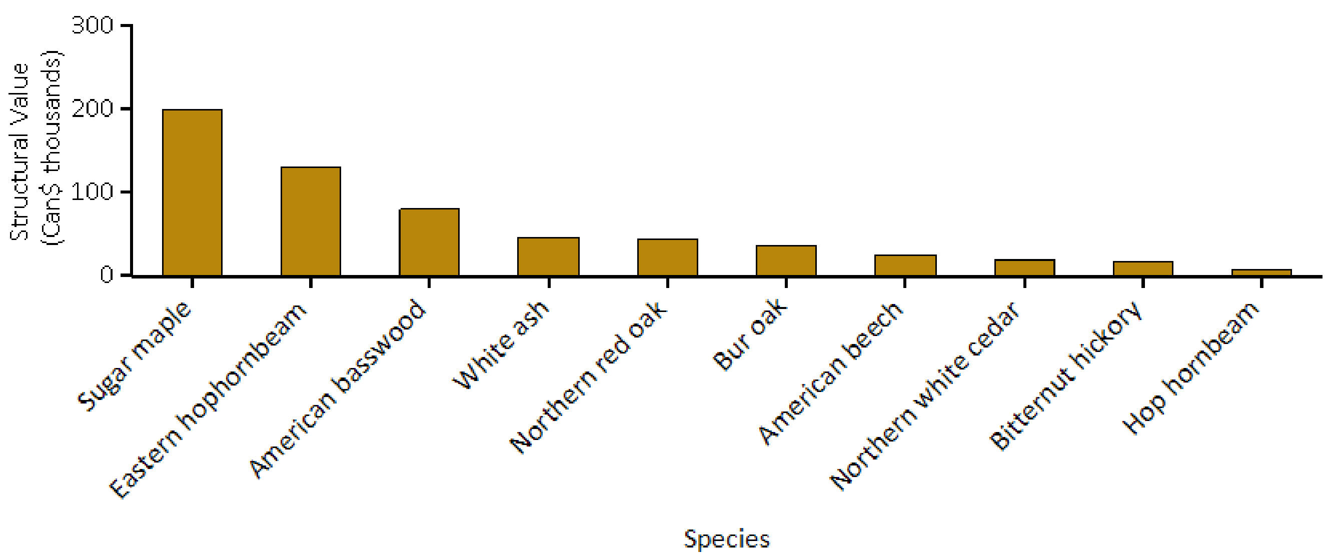

Figure 11. Tree species with the greatest structural value, 1158 Old Second Line

[1] Structural value in Canada is calculated using the same procedure as the U.S. (Nowak et al 2002a). Base costs and species values are derived from the International Society of Arboriculture Ontario Chapter and applied to all Canadian provinces and territories.

IX. Potential Pest Impacts

Various insects and diseases can infest urban forests, potentially killing trees and reducing the health, structural value and sustainability of the urban forest. As pests tend to have differing tree hosts, the potential damage or risk of each pest will differ among cities.Thirty-six pests were analyzed for their potential impact.

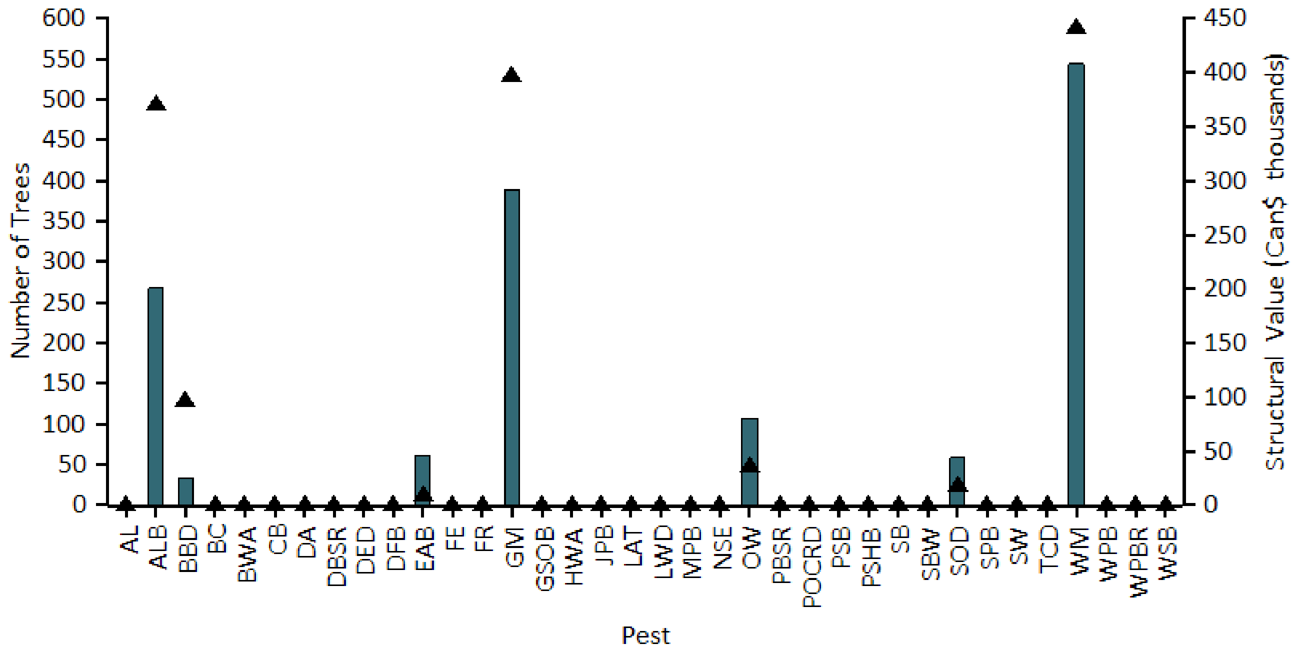

Figure 12. Number of trees at risk (points) and associated compensatory value (bars) by potential pests, 1158 Old Second Line

Aspen leafminer (AL) (Kruse et al 2007) is an insect that causes damage primarily to trembling or small tooth aspen by larval feeding of leaf tissue. AL has the potential to affect 0.0 percent of the population (Can$0 in structural value).

Asian longhorned beetle (ALB) (Animal and Plant Health Inspection Service 2010) is an insect that bores into and kills a wide range of hardwood species. ALB poses a threat to 38.2 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$201 thousand in structural value.

Beech bark disease (BBD) (Houston and O'Brien 1983) is an insect-disease complex that primarily impacts American beech. This disease threatens 10.0 percent of the population, which represents a potential loss of Can$25.1 thousand in structural value.

Butternut canker (BC) (Ostry et al 1996) is caused by a fungus that infects butternut trees. The disease has since caused significant declines in butternut populations in the United States. Potential loss of trees from BC is 0.0 percent (Can$0 in structural value).

Balsam woolly adelgid (BWA) (Ragenovich and Mitchell 2006) is an insect that has caused significant damage to the true firs of North America. 1158 Old Second Line could possibly lose 0.0 percent of its trees to this pest (Can$0 in structural value).

The most common hosts of the fungus that cause chestnut blight (CB) (Diller 1965) are American and European chestnut. CB has the potential to affect 0.0 percent of the population (Can$0 in structural value).

Dogwood anthracnose (DA) (Mielke and Daughtrey) is a disease that affects dogwood species, specifically flowering and Pacific dogwood. This disease threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

Douglas-fir black stain root disease (DBSR) (Hessburg et al 1995) is a variety of the black stain fungus that attacks Douglas-firs. 1158 Old Second Line could possibly lose 0.0 percent of its trees to this pest (Can$0 in structural value).

American elm, one of the most important street trees in the twentieth century, has been devastated by the Dutch elm disease (DED) (Northeastern Area State and Private Forestry 1998). Since first reported in the 1930s, it has killed over 50 percent of the native elm population in the United States. Although some elm species have shown varying degrees of resistance, 1158 Old Second Line could possibly lose 0.0 percent of its trees to this pest (Can$0 in structural value).

Douglas-fir beetle (DFB) (Schmitz and Gibson 1996) is a bark beetle that infests Douglas-fir trees throughout the western United States, British Columbia, and Mexico. Potential loss of trees from DFB is 0.0 percent (Can$0 in structural value).

Emerald ash borer (EAB) (Michigan State University 2010) has killed thousands of ash trees in parts of the United States. EAB has the potential to affect 0.9 percent of the population (Can$46.5 thousand in structural value).

One common pest of white fir, grand fir, and red fir trees is the fir engraver (FE) (Ferrell 1986). FE poses a threat to 0.0 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$0 in structural value.

Fusiform rust (FR) (Phelps and Czabator 1978) is a fungal disease that is distributed in the southern United States. It is particularly damaging to slash pine and loblolly pine. FR has the potential to affect 0.0 percent of the population (Can$0 in structural value).

The gypsy moth (GM) (Northeastern Area State and Private Forestry 2005) is a defoliator that feeds on many species causing widespread defoliation and tree death if outbreak conditions last several years. This pest threatens 40.9 percent of the population, which represents a potential loss of Can$292 thousand in structural value.

Infestations of the goldspotted oak borer (GSOB) (Society of American Foresters 2011) have been a growing problem in southern California. Potential loss of trees from GSOB is 0.0 percent (Can$0 in structural value).

As one of the most damaging pests to eastern hemlock and Carolina hemlock, hemlock woolly adelgid (HWA) (U.S. Forest Service 2005) has played a large role in hemlock mortality in the United States. HWA has the potential to affect 0.0 percent of the population (Can$0 in structural value).

The Jeffrey pine beetle (JPB) (Smith et al 2009) is native to North America and is distributed across California, Nevada, and Oregon where its only host, Jeffrey pine, also occurs. This pest threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

Quaking aspen is a principal host for the defoliator, large aspen tortrix (LAT) (Ciesla and Kruse 2009). LAT poses a threat to 0.0 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$0 in structural value.

Laurel wilt (LWD) (U.S. Forest Service 2011) is a fungal disease that is introduced to host trees by the redbay ambrosia beetle. This pest threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

Mountain pine beetle (MPB) (Gibson et al 2009) is a bark beetle that primarily attacks pine species in the western United States. MPB has the potential to affect 0.0 percent of the population (Can$0 in structural value).

The northern spruce engraver (NSE) (Burnside et al 2011) has had a significant impact on the boreal and sub-boreal forests of North America where the pest's distribution overlaps with the range of its major hosts. Potential loss of trees from NSE is 0.0 percent (Can$0 in structural value).

Oak wilt (OW) (Rexrode and Brown 1983), which is caused by a fungus, is a prominent disease among oak trees. OW poses a threat to 3.6 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$80.4 thousand in structural value.

Pine black stain root disease (PBSR) (Hessburg et al 1995) is a variety of the black stain fungus that attacks hard pines, including lodgepole pine, Jeffrey pine, and ponderosa pine. 1158 Old Second Line could possibly lose 0.0 percent of its trees to this pest (Can$0 in structural value).

Port-Orford-cedar root disease (POCRD) (Liebhold 2010) is a root disease that is caused by a fungus. POCRD threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

The pine shoot beetle (PSB) (Ciesla 2001) is a wood borer that attacks various pine species, though Scotch pine is the preferred host in North America. PSB has the potential to affect 0.0 percent of the population (Can$0 in structural value).

Polyphagous shot hole borer (PSHB) (University of California 2014) is a boring beetle that was first detected in California. 1158 Old Second Line could possibly lose 0.0 percent of its trees to this pest (Can$0 in structural value).

Spruce beetle (SB) (Holsten et al 1999) is a bark beetle that causes significant mortality to spruce species within its range. Potential loss of trees from SB is 0.0 percent (Can$0 in structural value).

Spruce budworm (SBW) (Kucera and Orr 1981) is an insect that causes severe damage to balsam fir. SBW poses a threat to 0.0 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$0 in structural value.

Sudden oak death (SOD) (Kliejunas 2005) is a disease that is caused by a fungus. Potential loss of trees from SOD is 1.8 percent (Can$43.9 thousand in structural value).

Although the southern pine beetle (SPB) (Clarke and Nowak 2009) will attack most pine species, its preferred hosts are loblolly, Virginia, pond, spruce, shortleaf, and sand pines. This pest threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

The sirex woodwasp (SW) (Haugen and Hoebeke 2005) is a wood borer that primarily attacks pine species. SW poses a threat to 0.0 percent of the 1158 Old Second Line urban forest, which represents a potential loss of Can$0 in structural value.

Thousand canker disease (TCD) (Cranshaw and Tisserat 2009; Seybold et al 2010) is an insect-disease complex that kills several species of walnuts, including black walnut. Potential loss of trees from TCD is 0.0 percent (Can$0 in structural value).

Winter moth (WM) (Childs 2011) is a pest with a wide range of host species. WM causes the highest levels of injury to its hosts when it is in its caterpillar stage. 1158 Old Second Line could possibly lose 45.5 percent of its trees to this pest (Can$408 thousand in structural value).

The western pine beetle (WPB) (DeMars and Roettgering 1982) is a bark beetle and aggressive attacker of ponderosa and Coulter pines. This pest threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

Since its introduction to the United States in 1900, white pine blister rust (Eastern U.S.) (WPBR) (Nicholls and Anderson 1977) has had a detrimental effect on white pines, particularly in the Lake States. WPBR has the potential to affect 0.0

percent of the population (Can$0 in structural value).

Western spruce budworm (WSB) (Fellin and Dewey 1986) is an insect that causes defoliation in western conifers. This pest threatens 0.0 percent of the population, which represents a potential loss of Can$0 in structural value.

Appendix I. i-Tree Eco Model and Field Measurements

i-Tree Eco is designed to use standardized field data from randomly located plots and local hourly air pollution and meteorological data to quantify urban forest structure and its numerous effects (Nowak and Crane 2000), including:

- Urban forest structure (e.g., species composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power sources.
- Structural value of the forest, as well as the value for air pollution removal and carbon storage and sequestration.
- Potential impact of infestations by pests, such as Asian longhorned beetle, emerald ash borer, gypsy moth, and Dutch elm disease.

Typically, all field data are collected during the leaf-on season to properly assess tree canopies. Typical data collection (actual data collection may vary depending upon the user) includes land use, ground and tree cover, individual tree attributes of species, stem diameter, height, crown width, crown canopy missing and dieback, and distance and direction to residential buildings (Nowak et al 2005; Nowak et al 2008).

During data collection, trees are identified to the most specific taxonomic classification possible. Trees that are not classified to the species level may be classified by genus (e.g., ash) or species groups (e.g., hardwood). In this report, tree species, genera, or species groups are collectively referred to as tree species.

<u>Tree Characteristics:</u>

Leaf area of trees was assessed using measurements of crown dimensions and percentage of crown canopy missing. In the event that these data variables were not collected, they are estimated by the model.

An analysis of invasive species is not available for studies outside of the United States. For the U.S., invasive species are identified using an invasive species list for the state in which the urban forest is located. These lists are not exhaustive and they cover invasive species of varying degrees of invasiveness and distribution. In instances where a state did not have an invasive species list, a list was created based on the lists of the adjacent states. Tree species that are identified as invasive by the state invasive species list are cross-referenced with native range data. This helps eliminate species that are on the state invasive species list, but are native to the study area.

<u>Air Pollution Removal:</u>

Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter less than 2.5 microns. Particulate matter less than 10 microns (PM10) is another significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

Air pollution removal estimates are derived from calculated hourly tree-canopy resistances for ozone, and sulfur and nitrogen dioxides based on a hybrid of big-leaf and multi-layer canopy deposition models (Baldocchi 1988; Baldocchi et al 1987). As the removal of carbon monoxide and particulate matter by vegetation is not directly related to transpiration, removal rates (deposition velocities) for these pollutants were based on average measured values from the literature (Bidwell and Fraser 1972; Lovett 1994) that were adjusted depending on leaf phenology and leaf area. Particulate removal incorporated a 50 percent resuspension rate of particles back to the atmosphere (Zinke 1967). Recent updates (2011) to air quality modeling are based on improved leaf area index simulations, weather and pollution processing and interpolation, and updated pollutant monetary values (Hirabayashi et al 2011; Hirabayashi et al 2012; Hirabayashi 2011).

Trees remove PM2.5 when particulate matter is deposited on leaf surfaces (Nowak et al 2013). This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors. Generally, PM2.5 removal is positive with positive benefits. However, there are some cases when net removal is negative or resuspended particles lead to increased pollution concentrations and negative values. During some months (e.g., with no rain), trees resuspend more particles than they remove. Resuspension can also lead to increased overall PM2.5 concentrations if the boundary layer conditions are lower during net resuspension periods than during net removal periods. Since the pollution removal value is based on the change in pollution concentration, it is possible to have situations when trees remove PM2.5 but increase concentrations and thus have negative values during periods of positive overall removal. These events are not common, but can happen.

For reports in the United States, default air pollution removal value is calculated based on local incidence of adverse health effects and national median externality costs. The number of adverse health effects and associated economic value is calculated for ozone, sulfur dioxide, nitrogen dioxide, and particulate matter less than 2.5 microns using data from the U.S. Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP) (Nowak et al 2014). The model uses a damage-function approach that is based on the local change in pollution concentration and population. National median externality costs were used to calculate the value of carbon monoxide removal (Murray et al 1994).

For international reports, user-defined local pollution values are used. For international reports that do not have local values, estimates are based on either European median externality values (van Essen et al 2011) or BenMAP regression equations (Nowak et al 2014) that incorporate user-defined population estimates. Values are then converted to local currency with user-defined exchange rates.

For this analysis, pollution removal value is calculated based on the prices of Can$1,486 per metric ton (carbon monoxide), Can$1,490 per metric ton (ozone), Can$222 per metric ton (nitrogen dioxide), Can$81 per metric ton (sulfur dioxide), Can$51,860 per metric ton (particulate matter less than 2.5 microns).

<u>Carbon Storage and Sequestration:</u>

Carbon storage is the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. To calculate current carbon storage, biomass for each tree was calculated using equations from the literature and measured tree data. Open-grown, maintained trees tend to have less biomass than predicted by forest-derived biomass equations (Nowak 1994). To adjust for this difference, biomass results for open-grown urban trees were multiplied by 0.8. No adjustment was made for trees found in natural stand conditions. Tree dry-weight biomass was converted to stored carbon by multiplying by 0.5.

Carbon sequestration is the removal of carbon dioxide from the air by plants. To estimate the gross amount of carbon sequestered annually, average diameter growth from the appropriate genera and diameter class and tree condition was added to the existing tree diameter (year x) to estimate tree diameter and carbon storage in year x+1.

Carbon storage and carbon sequestration values are based on estimated or customized local carbon values. For international reports that do not have local values, estimates are based on the carbon value for the United States (U.S. Environmental Protection Agency 2015, Interagency Working Group on Social Cost of Carbon 2015) and converted to local currency with user-defined exchange rates.

For this analysis, carbon storage and carbon sequestration values are calculated based on Can$115 per metric ton.

<u>Oxygen Production:</u>

The amount of oxygen produced is estimated from carbon sequestration based on atomic weights: net O2 release (kg/yr) = net C sequestration (kg/yr) × 32/12. To estimate the net carbon sequestration rate, the amount of carbon sequestered as a result of tree growth is reduced by the amount lost resulting from tree mortality. Thus, net carbon sequestration and net annual oxygen production of the urban forest account for decomposition (Nowak et al 2007). For complete inventory projects, oxygen production is estimated from gross carbon sequestration and does not account for decomposition.

Avoided Runoff:

Annual avoided surface runoff is calculated based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis.

The value of avoided runoff is based on estimated or user-defined local values. For international reports that do not have local values, the national average value for the United States is utilized and converted to local currency with user-defined exchange rates. The U.S. value of avoided runoff is based on the U.S. Forest Service's Community Tree Guide Series (McPherson et al 1999; 2000; 2001; 2002; 2003; 2004; 2006a; 2006b; 2006c; 2007; 2010; Peper et al 2009; 2010; Vargas et al 2007a; 2007b; 2008).

For this analysis, avoided runoff value is calculated based on the price of Can$2.32 per m^3.

Building Energy Use:

If appropriate field data were collected, seasonal effects of trees on residential building energy use were calculated based on procedures described in the literature (McPherson and Simpson 1999) using distance and direction of trees from residential structures, tree height and tree condition data. To calculate the monetary value of energy savings, local or custom prices per MWH or MBTU are utilized.

For this analysis, energy saving value is calculated based on the prices of Can$75.00 per MWH and Can$10.45 per MBTU.

Structural Values:

Structural value is the value of a tree based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree). Structural values were based on valuation procedures of the Council of Tree and Landscape Appraisers, which uses tree species, diameter, condition, and location information (Nowak et al 2002a; 2002b). Structural value may not be included for international projects if there is insufficient local data to complete the valuation procedures.

Potential Pest Impacts:

The complete potential pest risk analysis is not available for studies outside of the United States. The number of trees at risk to the pests analyzed is reported, though the list of pests is based on known insects and disease in the United States.

For the U.S., potential pest risk is based on pest range maps and the known pest host species that are likely to experience mortality. Pest range maps for 2012 from the Forest Health Technology Enterprise Team (FHTET) (Forest Health Technology Enterprise Team 2014) were used to determine the proximity of each pest to the county in which the urban forest is located. For the county, it was established whether the insect/disease occurs within the county, is within 400 kilometers of the county edge, is between 400 and 1210 kilometers away, or is greater than 1210 kilometers away. FHTET did not have pest range maps for Dutch elm disease and chestnut blight. The range of these pests was based on known occurrence and the host range, respectively (Eastern Forest Environmental Threat Assessment Center; Worrall 2007).

Relative Tree Effects:

The relative value of tree benefits reported in Appendix II is calculated to show what carbon storage and sequestration, and air pollutant removal equate to in amounts of municipal carbon emissions, passenger automobile emissions, and house emissions.

Municipal carbon emissions are based on 2010 U.S. per capita carbon emissions (Carbon Dioxide Information Analysis Center 2010). Per capita emissions were multiplied by city population to estimate total city carbon emissions.

Light duty vehicle emission rates (g/mi) for CO, NO_x, VOCs, PM_{10}, SO_2 for 2010 (Bureau of Transportation Statistics 2010; Heirigs et al 2004), $PM_{2.5}$ for 2011-2015 (California Air Resources Board 2013), and CO_2 for 2011 (U.S. Environmental Protection Agency 2010) were multiplied by average miles driven per vehicle in 2011 (Federal Highway Administration 2013) to determine average emissions per vehicle.

Household emissions are based on average electricity kWh usage, natural gas Btu usage, fuel oil Btu usage, kerosene Btu usage, LPG Btu usage, and wood Btu usage per household in 2009 (Energy Information Administration 2013; Energy Information Administration 2014)

- CO_2, SO_2, and NO_x power plant emission per KWh are from Leonardo Academy 2011. CO emission per kWh assumes 1/3 of one percent of C emissions is CO based on Energy Information Administration 1994. PM_{10} emission per kWh from Layton 2004.
- CO_2, NO_x, SO_2, and CO emission per Btu for natural gas, propane and butane (average used to represent LPG), Fuel #4 and #6 (average used to represent fuel oil and kerosene) from Leonardo Academy 2011.
- CO_2 emissions per Btu of wood from Energy Information Administration 2014.
- CO, NO_x and SO_x emission per Btu based on total emissions and wood burning (tons) from (British Columbia Ministry 2005; Georgia Forestry Commission 2009).

Appendix II. Relative Tree Effects

The urban forest in 1158 Old Second Line provides benefits that include carbon storage and sequestration, and air pollutant removal. To estimate the relative value of these benefits, tree benefits were compared to estimates of average municipal carbon emissions, average passenger automobile emissions, and average household emissions. See Appendix I for methodology.

Carbon storage is equivalent to:

- Amount of carbon emitted in 1158 Old Second Line in 0 days
- Annual carbon (C) emissions from 64 automobiles
- Annual C emissions from 26 single-family houses

Carbon monoxide removal is equivalent to:

- Annual carbon monoxide emissions from 0 automobiles
- Annual carbon monoxide emissions from 0 single-family houses

Nitrogen dioxide removal is equivalent to:

- Annual nitrogen dioxide emissions from 1 automobiles
- Annual nitrogen dioxide emissions from 0 single-family houses

Sulfur dioxide removal is equivalent to:

- Annual sulfur dioxide emissions from 2 automobiles
- Annual sulfur dioxide emissions from 0 single-family houses

Annual carbon sequestration is equivalent to:

- Amount of carbon emitted in 1158 Old Second Line in 0.0 days
- Annual C emissions from 0 automobiles
- Annual C emissions from 0 single-family houses

Appendix III. Comparison of Urban Forests

A common question asked is, "How does this city compare to other cities?" Although comparison among cities should be made with caution as there are many attributes of a city that affect urban forest structure and functions, summary data are provided from other cities analyzed using the i-Tree Eco model.

I. City totals for trees

City	*% Tree Cover*	*Number of Trees*	*Carbon Storage (metric tons)*	*Carbon Sequestration (metric tons/yr)*	*Pollution Removal (metric tons/yr)*
Toronto, ON, Canada	26.6	10,220,000	1,108,000	46,700	1,905
Atlanta, GA	36.7	9,415,000	1,220,000	42,100	1,509
Los Angeles, CA	11.1	5,993,000	1,151,000	69,800	1,792
New York, NY	20.9	5,212,000	1,225,000	38,400	1,521
London, ON, Canada	24.7	4,376,000	360,000	12,500	370
Chicago, IL	17.2	3,585,000	649,000	22,800	806
Baltimore, MD	21.0	2,479,000	517,000	16,700	390
Philadelphia, PA	15.7	2,113,000	481,000	14,600	522
Washington, DC	28.6	1,928,000	477,000	14,700	379
Oakville, ON , Canada	29.1	1,908,000	133,000	6,000	172
Boston, MA	22.3	1,183,000	290,000	9,500	257
Syracuse, NY	26.9	1,088,000	166,000	5,300	99
Woodbridge, NJ	29.5	986,000	145,000	5,000	191
Minneapolis, MN	26.4	979,000	227,000	8,100	277
San Francisco, CA	11.9	668,000	176,000	4,600	128
Morgantown, WV	35.5	658,000	84,000	2,600	65
Moorestown, NJ	28.0	583,000	106,000	3,400	107
Hartford, CT	25.9	568,000	130,000	3,900	52
Jersey City, NJ	11.5	136,000	19,000	800	37
Casper, WY	8.9	123,000	34,000	1,100	34
Freehold, NJ	34.4	48,000	18,000	500	20

II. Totals per hectare of land area

City	*Number of Trees/ha*	*Carbon Storage (metric tons/ha)*	*Carbon Sequestration (metric tons/ha/yr)*	*Pollution Removal (kg/ha/yr)*
Toronto, ON, Canada	160.4	17.4	0.73	29.9
Atlanta, GA	275.8	35.7	1.23	44.2
Los Angeles, CA	48.4	9.4	0.36	14.7
New York, NY	65.2	15.3	0.48	19.0
London, ON, Canada	185.5	15.3	0.53	15.7
Chicago, IL	59.9	10.9	0.38	13.5
Baltimore, MD	118.5	25.0	0.80	18.6
Philadelphia, PA	61.9	14.1	0.43	15.3
Washington, DC	121.1	29.8	0.92	23.8
Oakville, ON , Canada	192.9	13.4	0.61	12.4
Boston, MA	82.9	20.3	0.67	18.0
Syracuse, NY	167.4	23.1	0.77	15.2
Woodbridge, NJ	164.4	24.2	0.84	31.9
Minneapolis, MN	64.8	15.0	0.53	18.3
San Francisco, CA	55.7	14.7	0.39	10.7
Morgantown, WV	294.5	37.7	1.17	29.2
Moorestown, NJ	153.4	27.9	0.90	28.1
Hartford, CT	124.6	28.5	0.86	11.5
Jersey City, NJ	35.5	5.0	0.21	9.6

City	*Number of Trees/ha*	*Carbon Storage (metric tons/ha)*	*Carbon Sequestration (metric tons/ha/yr)*	*Pollution Removal (kg/ha/yr)*
Casper, WY	22.5	6.2	0.20	6.2
Freehold, NJ	94.6	35.9	0.98	39.6

Appendix IV. General Recommendations for Air Quality Improvement

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmosphere environment. Four main ways that urban trees affect air quality are (Nowak 1995):

- Temperature reduction and other microclimate effects
- Removal of air pollutants
- Emission of volatile organic compounds (VOC) and tree maintenance emissions
- Energy effects on buildings

The cumulative and interactive effects of trees on climate, pollution removal, and VOC and power plant emissions determine the impact of trees on air pollution. Cumulative studies involving urban tree impacts on ozone have revealed that increased urban canopy cover, particularly with low VOC emitting species, leads to reduced ozone concentrations in cities (Nowak 2000). Local urban management decisions also can help improve air quality.

Urban forest management strategies to help improve air quality include (Nowak 2000):

Strategy	*Result*
Increase the number of healthy trees	Increase pollution removal
Sustain existing tree cover	Maintain pollution removal levels
Maximize use of low VOC-emitting trees	Reduces ozone and carbon monoxide formation
Sustain large, healthy trees	Large trees have greatest per-tree effects
Use long-lived trees	Reduce long-term pollutant emissions from planting and removal
Use low maintenance trees	Reduce pollutants emissions from maintenance activities
Reduce fossil fuel use in maintaining vegetation	Reduce pollutant emissions
Plant trees in energy conserving locations	Reduce pollutant emissions from power plants
Plant trees to shade parked cars	Reduce vehicular VOC emissions
Supply ample water to vegetation	Enhance pollution removal and temperature reduction
Plant trees in polluted or heavily populated areas	Maximizes tree air quality benefits
Avoid pollutant-sensitive species	Improve tree health
Utilize evergreen trees for particulate matter	Year-round removal of particles

Appendix V. Invasive Species of the Urban Forest

Invasive species data is only available for the United States. This analysis cannot be completed for international studies because of a lack of necessary data.

Appendix VI. Potential Risk of Pests

Pest range data is only available for the United States. This analysis cannot be completed for international studies because of a lack of necessary data.

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Appendix 2: Memo, Nick Stow (Senior Planner, City of Ottawa, 21 Feb 2019) re: 1158 Old Second Line Road, File No. D07016-18-0008, Appendix 2.

M E M O / N O T E D E S E R V I C E

To / Destinataire	Holly Bickerton Laurel McCreight Matthew Hayley	File/N° de fichier: D07-16-18-0008
From / Expéditeur	Nick Stow Senior Planner Planning Services	
Subject / Objet	1158 Old Second Line Road : Significant Woodland Evaluation	Date: 21 February 2019

Background

The proposed subdivision development at 1158 Old Second Line Road would require the removal of a forested area meeting the City of Ottawa definition of a significant woodland. Consequently, the Environmental Impact Statement for the development requires an evaluation of the impacts upon the woodland.

This proposal provides the first case of development of a significant woodland in the established urban area under the City's new significant woodland policies. It is also the first development subject to the draft Significant Woodlands Guidelines (scheduled for consideration by City Council on March 6, 2019). In this instance, City staff from the Natural Systems and Rural Affairs Unit have carried out the analysis of the proposal under the Significant Woodlands Guidelines, as a practical test of the utility and practicality of those guidelines. On future development applications affecting significant woodlands, proponents will be responsible for carrying out the analysis as part of their Environmental Impact Statement requirements.

Mitigation Hierarchy

Based upon past planning decisions, the proponent appears to have a reasonable expectation of development of 1158 Old Second Line Road for residential use. Neither the property nor the surrounding community (Morgan's Grant) is governed by an existing secondary plan or community design plan. However, the land uses within the Morgan's Grant community have been well-established, including the locations of park and open space blocks. For example, the similar woodlot at 1190 Old Second Line Road has been acquired by the City and preserved as an open space block. In contrast, 1158 Old Second Line Road has been zoned DR – Development Reserve. The purpose of the DR zone is to, "recognize lands intended for future urban development", and to, "limit the range of permitted uses to those which will not preclude future development options". In this case, the planning context clearly establishes an intent by the City to see residential development of the property.

Preservation of the forest cover on site is not consistent with the designation and intended use of the land in the Official Plan and Zoning By-law. Consequently, avoidance and mitigation are not viable options for this significant woodland. Compensation for the loss of the ecosystem services provided by the woodland is the preferred option, if feasible.

Evaluation

According to the information provided by the proponent's consultants, the woodland meets the Official Plan definition of a significant woodland in the urban area: *i.e.* it is older than 60 years, and it is larger than 0.8 hectares. Accordingly, it is considered significant within the urban area for its social, economic, and cultural values. It does not appear significant with respect to any other of the criteria in the Province's Natural Heritage Reference Manual. Based upon Table 4 of the draft Significant Woodlands Guidelines, the woodland is subject to the following evaluation measures and indicators:

- Total canopy cover;
- Social value: unusual recreational, education or cultural opportunities; cultural, heritage, or historical features; Indigenous values; existing public use;
- iTree analysis: removal of pollutants; run-off averted; carbon sequestration; structural value;
- Accessibility and Equity: residents within 250 m by housing type and quality of access, total accessible greenspace, sensitive populations within 250 m;
- Low-impact development: run-off captured.

The planning area chosen for the analysis is the community of Morgan's Grant, lying within the boundaries of March Road, Terry Fox Drive, Old Second Line Road, and Old Carp Road. This community has an approximate area of 210 hectares. Residential development in the community consists predominantly of street-oriented housing, with some small areas of multi-unit housing.

The woodlot does not currently provide public access. Consequently, an analysis of change in greenspace access for the community is not necessary. However, a summary of accessible greenspace within the surrounding community has been provided.

An evaluation should consider the net change in ecosystem services resulting from development of the woodland. It should identify:

- The ecosystem services provided by the urban forest within the community;
- The loss of ecosystem services through impacts on the woodland;
- The gain in ecosystem services through compensation within the development, especially the planting of trees.

The following analyses were carried out for this evaluation:

- An iTree Canopy analysis of the urban tree canopy in Morgan's Grant (the community), based upon 100 sample points.
- An iTree Eco analysis of the woodland, based upon two sample plots, projecting 40 years into the future. The analysis used the default settings and assumed a natural regeneration of 15 trees per year.
- A GIS analysis of total, accessible greenspace and the percentage of the community with easy access to greenspace (defined as 250 m straight-line distance).

Ideally, iTree Eco would have been used instead of iTree Canopy for the analysis of the full urban tree canopy, using City of Ottawa inventory data. However, due to time constraints, staff employed the simpler and quicker iTree Canopy analysis. In addition, due to time constraints, staff limited the iTree Canopy analysis to 100 samples points, resulting in a relatively high standard error in the tree cover estimate.

Staff did not credit the development plan for any compensation through tree planting. A review of the landscaping plan and tree planting details suggests that most trees proposed for planting on site would lack sufficient soil volume for healthy growth. The City's draft Street Tree Manual recommends 20 cubic meters of native or good quality topsoil for a single small tree or 12 cubic meters of soil for a small tree planted in a shared space. The landscaping plan suggests that most of the trees proposed on site would have less than half these soil volumes. Consequently, healthy growth appears unlikely, especially for medium or large tree species.

Results

Total Canopy Cover

Morgan's Grant: 59 hectares (27.3% +/- 4.5)
Woodlot at 1158 Old Second Line: 1 hectare.

Change in urban tree cover: -1.7%.

Social Value

There are no known social values on the site.

Accessible Greenspace

Total accessible greenspace: 31 hectares (15% of the community area).
Percent of the community within 250 of accessible greenspace: 95%
Percent of multi-unit housing within 250 m of accessible greenspace: 100%

Change in accessible greenspace: not applicable.

iTree Analysis – Air Quality and Climate Change

Carbon released through tree removal: 83 metric tons

Net Air Quality and Climate Benefit (Forty Years)

	Carbon	Pollutants Removed				
	Carbon Sequestration (metric tons)	CO (kg)	NO_2 (kg)	Ozone (kg)	SO_2 (kg)	PM 2.5 (kg)
Morgan's Grant	26460	2222	3940	28732	3452	3624
1158 Old Second Line Road (loss)	69	26	136	1050	4	73
Net Change in Community Ecosystem Services	-0.26%	-1.2%	-3.4%	-3.6%	-0.11%	-2%

iTree Analysis - Stormwater

Additional run-off due to loss of trees: 184 cubic meters *per* year.

Low impact development: no LID measures appear planned for the site.

Conclusions

The proposed development would result in a small decrease in ecosystem services provided to the community, primarily as a direct result of tree cover loss. These losses are:

- A small release of stored carbon;
- A small decline in long-term carbon sequestration;
- Small declines in long-term air quality benefits;
- A small decline in urban heat island benefit;
- A small increase in stormwater run-off.

The development plan provides few compensating benefits on site, because of inadequate soil volumes for planted trees and lack of LID measures.

There is no change in accessibility to greenspace for the community. Community greenspace is currently below the Official Plan target of 16 – 20% of gross area. However, access to greenspace remains high and equitable in the community, in part because of the presence of a large City-owned Hydro corridor through the community.

Recommendations

The negative impacts of the project on the significant woodland should not prevent it from proceeding as planned.

If this proposal had been submitted after approval of the Significant Woodlands Guidelines by City Council, then Natural Systems and Rural Affairs would recommend against its approval. The Landscaping and Tree Conservation Plan does not appear to provide the necessary volumes of quality soil for the growth of healthy, mature trees. Additional soil volume could be provided using Silva cells or their equivalent under driveways. Although this would add to the cost of the development, the City would be justified in asking for their use as compensation for loss of the woodland.

However, given that the Significant Woodlands Guidelines have not yet been approved by City Council, it follows that Council has not yet endorsed the principle of compensation for loss of ecosystem services that they propose. Consequently, the City cannot reasonably ask the proponent to provide that compensation in this case.

Overall, removal of the significant woodland will result in a small decrease in ecosystem services provided to the community. However, the limited scope and magnitude of these services appears small in the context of the full community of Morgan's Grant. Given previous planning decisions by City Council, the reasonable expectation of development by the proponent, and the lack of approved Significant Woodlands Guidelines, this negative impact appears defensible under the Official Plan and the Provincial Policy Statement.

Nick Stow
NS / NS

cc: Geraldine Wildman
Mark Richardson

Appendix 3: Avoidance Alternatives Form (AAF) for activities that may require an overall benefit permit under clause 17(2)(c) of the *Endangered Species Act* (dated 30 Jan 2019), Ontario Ministry of Natural Resources

For Internal Use Only

Tracking Number	Lead District

Avoidance Alternatives Form for activities that may require an overall benefit permit under clause 17(2)(c) of the *Endangered Species Act*

Note: It is anticipated that the completion of this form will take multiple extended sessions. It is recommended that proponents download and save the form and the associated guide to their local hard drive in order to more easily facilitate this task. Adobe Reader 10 is required to save, view and add data to the form. If you require this version of Adobe, select download to download it for free. To review the entire form, select view. It is strongly recommended that while completing the form, proponents read all associated tabs and help buttons to ensure the information requirements are clearly understood.

Personal information in this form is collected under the authority of Section 53 of the *Endangered Species Act*, *2007*. The information provided will be used for the purposes of administering the Act and its Regulations. Questions about the use of this information should be directed to the species at risk representative at the local MNR office (http://www.mnr. gov.on.ca/en/ContactUs/2ColumnSubPage/STEL02_179002.html) for the location where the proposed activity will take place.

Fields marked with an asterisk (*) are mandatory.

1. Contact Information

Proponent Contact Information ☐ check this box if the proponent is a private individual

Legal Last Name*	Legal First Name*	Legal Middle Initial(s)
Theberge Homes Ltd.	None	

Full Mailing Address

Unit No.	Street No.*	Street Name*	P.O. Box
	904	Lady Ellen Place	

Rural Route	Postal Station	Lot No.	Concession

City/Town*	Province*	Postal Code*
Ottawa	Ontario	K1X 5L5

Telephone No.*	Fax No.	Email (if available)
613 421-1515 ext.		joeytheberge@thebergehomes.com

Primary Contact for Proponent

Is the proponent the primary contact for this form?*

☐ Yes ☑ No

Last Name*	First Name*	Middle Initial(s)
Bickerton	Holly	

Position/Title
Consulting Ecologist

Legal Name of Organization/Company
Holly Bickerton

Full Business Mailing Address

Unit No.	Street No.*	Street Name*	P.O. Box
	143	Aylmer Ave	

Rural Route	Postal Station	Lot No.	Concession

City/Town*	Province*	Postal Code*
Ottawa	ON	K1S 2Y1

Business Telephone No.*	Business Fax No.	Business Email (if available)
613 730-7725 ext.		holly.bickerton@rogers.com

Authorization*

☑ I, Joey Theberge (Theberge Homes Ltd.) (proponent's name), authorize

Holly Bickerton (primary contact's name)

to disclose information required by the Ministry of Natural Resources for the purpose of administering the *Endangered Species Act*, *2007* and its Regulations in accordance with the *Freedom of Information and Protection of Privacy Act*, *1990*.

2. Consideration of reasonable alternatives that would not adversely affect protected species at risk or habitat (i.e., avoidance alternatives)

In Table 1, please describe the alternative approaches to the activity that would not adversely affect the protected species at risk or habitat(s) for MNR's consideration. For multiple species, add additional rows. For each alternative listed, provide the rationale for how it would completely avoid adverse effects on 1) the protected species (**avoidance of all adverse effects on species**) or 2) the protected habitat (**avoidance of all adverse effects on protected habitat**).

Note: MNR will consider the information provided and assess whether or not the activity avoidance alternatives completely avoid adverse effects on protected species and habitat.

If proponents do not elect to proceed with avoidance alternatives that completely avoid adverse effects to species at risk or their habitat, then they will be advised to complete the Application for an overall benefit permit under clause 17(2)(c) of the *Endangered Species Act*, and the information presented in this form will be used to assist MNR to assess the permit application and determine whether it meets the legislated requirements of clause 17(2)(c) of the ESA.

2. Consideration of reasonable alternatives that would not adversely affect protected species at risk or habitat (i.e., avoidance alternatives)

Table 1. Alternative approaches considered to avoid potential adverse effects on protected species or habitat (e.g., alternative locations) and any contravention of subsection 9(1) or 10(1) of the ESA**.** If this information is available in an existing report, proponents can copy and paste the relevant information into the appropriate spaces below and reference the title, author and date of the report(s) from which the copy and paste sections originate.

Description of Avoidance Alternative	Explanation of how all adverse effects on species will be avoided	Explanation of how all adverse effects on habitat will be avoided	Effectiveness in meeting the main purpose of the activity	Potential limitations (e.g., biological, technical and economic feasibility)
1. Project does not proceed at 1158 Old Second Line Road. No development will occur.	All potential adverse effects on Blanding's Turtles will be avoided because the project would not occur.	All potential adverse effects on habitat will be avoided because the project would not occur.	Completely ineffective. The fundamental objects of the proposed projects would not be met.	This alternative is economically infeasible. It is also infeasible on a policy basis, in that the area would no longer contribute to the City of Ottawa's stated goal of increasing density within appropriate zoning within the urban boundary.
2. Project proceeds with an altered site plan and potentially reduced footprint, e.g. by designing a "travel corridor" for Blanding's Turtle through the subject property to the Hydro Line	Adverse impacts to Blanding's Turtles are unlikely to be avoided. Potential impacts may increase. The identification of the subject property by MNRF as Category 3 habitat is entirely based on proximity to known Blanding's Turtle habitat, and does not consider other factors. The property at 1158 Old Second Line Road does not represent Category 3 habitat of any value to Blanding's Turtles. On the contrary, it may function as a habitat sink, as turtles in the South March Highlands may potentially be drawn across busy Old Second Line Road (risking mortality), through a	Adverse effects on habitat may not be avoided. Subject property does not provide habitat of value and may be habitat sink. Addition of corridor is unlikely to provide effective habitat, but if effective, it could increase function as a habitat sink by drawing turtles across the road	Ineffective. The project may not proceed due to economic in-feasibility of reduced footprint. It is unlikely there would be any benefit to Blanding's Turtle.	Biologically ineffective. Encouraging wildlife to undertake this behavior via a travel corridor to a habitat sink may increase mortality. Technically limiting and possibly infeasible because there are many inflexible planning and engineering-related factors influencing the site plan, including grading and tree retention requirements.

Description of Avoidance Alternative	Explanation of how all adverse effects on species will be avoided	Explanation of how all adverse effects on habitat will be avoided	Effectiveness in meeting the main purpose of the activity	Potential limitations (e.g., biological, technical and economic feasibility)
	high density housing development, into a meadow corridor where no nesting habitat exists. To survive, they would then need to return through the subject property and across the road once more to return safely to nesting habitat. Encouraging wildlife to travel to a habitat sink may increase mortality. There is also little research to suggest this type of corridor would be effective.	to an area where no nesting habitat exists.		Economically infeasible because significantly altering the site plan may result in the project not being economically viable.
3. Project proceeds with permanent exclusion fencing according to MNRF guidelines (July 2013 and April 2016) was considered along the west of Old Second Line Road as suggested in MNRF's reply to the IGF	Reduced road mortality to individual turtles could result as turtles would prevented from accessing Old Second Line Road, and therefore both the subject property and the Hydro Line. It is unlikely there will be any change in direct mortality of Blanding's Turtles on the subject property itself, because although this area has been identified as Category 3 habitat, it is of very low value to Blanding's Turtle, which are probably not present on the site.	All potential adverse effects on habitat would be avoided. Blanding's Turtles will be prevented from low likelihood of entering property, which may function as a habitat sink.	Effective in that development could as planned, while avoiding some road mortality impacts to Blanding's Turtles (ie. Impacts not related to the proposed project itself). It is unlikely there will be any change in adverse effects on Blanding's Turtle on the subject property because it is unlikely any are present in this area with no observed habitat value, but decreases in road mortality may result.	May be technically infeasible. The west side of Old Second Line road is private property. Permanent fencing may not be supported by the City of Ottawa because it restricts access to a privately owned lot (M. Hayley, pers.comm. approve this could involve significant delay, meaning this option may also not be economically feasible.

4. Project proceeds with permanent exclusion fencing according to MNRF guidelines (July 2013 and April 2016) along the east side of Old Second Line Road as suggested in MNRF's reply to the IGF, or along the Hydro Line.	Fencing along the frontage of 1158 Old Second Line Road (east side) has been considered but offers no substantial conservation gains because it does not prevent Blanding's Turtles from crossing Old Second Line Road (the primary threat, which is not a result of the proposed project). Based on the Site Plan, the lot frontage will be interrupted by two new streets in order to provide access to residents so fencing would be interrupted.. Fencing at the rear of the property adjacent to the hydro line was also considered but has limited conservation value, in that turtles are not anticipated in this area, and iIt offers no nesting habitat and is surrounded by high-density residential neighbourhoods.If turtles are there, it would not be desirable to create more barriers to escape. Potential fencing along the Hydro Line would also be interrupted by two pedestrian access points to the recreational path on the Hydro Line, and therefore would probably be an ineffective barrier.	All potential adverse effects on habitat will be avoided. Blanding's Turtles will be prevented from low likelihood of entering property, which may function as a habitat sink.	Moderately effective in that development could proceed as planned with existing site plan.	Biologically not feasible - ineffective. Benefits to Blanding's Turtles are low to nil, because road mortality is not reduced and fencing would not prevent Blanding's Turtle from habitat sink. Hydro Line fencing may be technically infeasible because it may limit HydroOne access, contrary to easement requirements (B. Holzman, pers. comm. 28 Jan 2019). The process to negotiate this could involve significant delay, making the project not economically feasible.

5. Project proceeds as proposed, with the following activities: -Temporary exclusion fencing installed around the perimeter of the property before April 1, 2019 and maintained and regularly monitored until construction is complete. -No loose fill to be stockpiled on site. -Site monitored regularly during key times of turtle movement (late May-late June) by a qualified professional - Construction workers instructed to identify Blanding's Turtles and to contact a qualified professional immediately if one is identified on or near the site. -Erosion & Sediment Control Plan will be prepared requiring excavated water to be directed east toward the Hydro Easement, where sediment controls will be installed. - Post-development, overland flow will be directed to a dry basin catchment at the east boundary of the site, and directed via storm sewer to an existing municipal drain to the north along Goward Rd. See attached Figure.	Fencing before and during construction will prevent Blanding's Turtles from accessing the construction site. Turtle movement will be excluded well in advance of the start of the active season. Preventing loose fill at site will eliminate any potential nesting opportunities. Site will be regularly monitored to ensure harm and staff trained. Should a turtle (Blanding's or otherwise) be identified on or near the site, a qualified professional will ensure all adverse impacts are avoided. No water or sediment will reach Blanding's Turtles or cause direct impact, either during construction or in future.	Adverse potential effects of the habitat sink (Hydro line) will be avoided with exclusion fencing to ensure that Blanding's Turtles do not access any areas likely to function as a habitat sink. Any overland flow that may contain sediment, nutrients, and/ or pollutants will be directed to municipal stormwater drains. All adverse impacts on known Blanding's Turtle habitat in SMH will be avoided in that the water chemistry of adjacent wetland and local natural areas will remain intact.	Fully effective in that this alternative allows development to proceed, while protecting Blanding's Turtle and habitat.	No potential limitations. All activities occur on property owned and managed by proponent and within management purview.

3. Expression of Interest to Apply for a Permit

Does the proponent elect to proceed with the avoidance alternative(s) that MNR has determined to be sufficient to avoid contravention of subsection 9(1) or 10(1) of the ESA?

☑ **Yes**. The proponent wishes to apply the fifth avoidance alternative described in Table 1 alternative(s) as identified by MNR to avoid contravention of the ESA and will NOT be proceeding with a 17(2)(c) overall benefit permit application at this time.

☐ **No**. The proponent wishes to proceed with the application for an overall benefit permit under clause 17(2)(c) of the ESA.

4. Submission Information

Date this form was submitted to the local MNR office (yyyy-mm-dd)*
2019-01-30

Please note: the email function will not work if you do not have your automatic email settings established. In these cases, please save a copy of your form, access your email account and attach a copy of the form for email submission to your local MNR. The list of MNR office email addresses is below for your reference.

Email Client Option *

☑ Default Email Application (e.g., MS Outlook)

☐ Internet Email (e.g., Yahoo or Hotmail. Save the form and send it manually to the MNR office by using internet email service.)

Local MNR office this form is being submitted to*	MNR Email Address for reference
Kemptville	sar.kemptville@ontario.ca

Proposal title (same as title used in the Information Gathering Form (IGF))*
1158 Old Second Line Road, Ottawa

Authorization*

☑ I, Joey Theberge (Theberge Homes Ltd.), (insert "proponent" name) confirm that the information provided in this form is accurate and complete to the best of my knowledge. I grant permission for a summary of my proposed activity to be posted on the Ministry of Natural Resources Species at Risk website and the Environmental Registry for the purpose of administering the *Endangered Species Act, 2007* and its Regulations and in accordance with the *Freedom of Information and Protection of Privacy Act, 1990*.

Appendix 4: Email from Aaron Foss (Kemptville MNRF, 5 Feb 2019) re: 1158 Old Second Line Road, File No. D07016-18-0008

Holly Bickerton

From: Foss, Aaron (MNRF) <Aaron.Foss@ontario.ca>
Sent: Tuesday, February 5, 2019 12:25 PM
To: Holly Bickerton
Subject: RE: AAF - 1158 Old Second Line Rd.

Good morning Holly,
Thanks for completing the AAF for works related to 1158 Second Line Rd and providing it for review.
The MNRF is of the opinion that the works, as proposed, will likely not contravene the ESA with the mitigation described in the AAF
If details of the proposal change, I would advise further review by the Ministry.

Any questions, please let me know

Aaron Foss

Sr. Fish and Wildlife Technical Specialist
Ministry of Natural Resources and Forestry
Kemptville District
10-1 Campus Drive
Kemptville, ON K0G 1J0
Ph: 613-258-8386

From: Holly Bickerton <holly.bickerton@rogers.com>
Sent: January 30, 2019 3:05 PM
To: SAR Kemptville District (MNRF) <sar.kemptville@ontario.ca>
Cc: joeytheberge@thebergehomes.com
Subject: AAF - 1158 Old Second Line Rd.

Hi Aaron,
Attached is a revised AAF for the above property.
Many thanks for your help with guiding this application quickly through the process – it is much appreciated.

Please feel free to contact me if you need any additional information.

Holly

Holly Bickerton
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Consulting Ecologist
143 Aylmer Ave.
Ottawa, Ontario K1S 2Y1
Tel: 613 730 7725
Cell: 613 720 7725