Waste Management of Canada Corporation

Environmental Impact Statement for Site Plan Stage of the West Carleton Environmental Centre Landfill Expansion

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1. Introduction

The City of Ottawa Official Plan (OP) requires that an Environmental Impact Statement (EIS) (City of Ottawa 2013a) be completed where development or site alteration may affect significant natural features and functions, which is consistent with Ontario's Provincial Policy Statement (PPS; MMAH, 2005). The PPS requires that it be demonstrated that no negative impacts will occur as a result of the development. Ottawa's OP supports the "the integrity of natural systems by directing land use and development in a way and to locations that maintain ecosystems functions over time," (Section 2.1). An EIS allows the City and the applicant to identify the potential environmental impacts of a proposed development or site alteration project and plan to avoid or minimise them before they occur, or provide mitigation where those are not possible. The main components of the EIS as stated by the City of Ottawa (2013a) are as follows:

- Property Information
- Description of the Site and Natural Environment
- Description of the Proposed Project
- Impact Assessment of the Project on the Environment
- Mitigation
- Monitoring of the Mitigations
- Summary and Recommendations

In addition, a Tree Conservation Report is required by the City of Ottawa (2013b). This entails documenting and assessing the vegetative cover on site prior to development. The report is required where trees greater than 10 cm diameter at breast height (DBH) need to be removed. The purpose of the assessment is to encourage retention of as much natural vegetation as possible within the proposed development. Since many components of the Tree Conservation Report are very similar as an EIS it can be included as part of an EIS as long as all of the required components are included. The Tree Conservation Report is part of this EIS.

The West Carleton Environmental Centre (WCEC) is located on the west side of Carp Road north of Highway 417 and owned by Waste Management of Canada Corporation. The property is legally described as part of Lots 2, 3 and 4, Concession II, and part of Lot 5, Concession III of the former Township of West Carleton (now City of Ottawa). The existing landfill is now closed.

An Environmental Assessment (EA) which identified the preferred landfill expansion alternative (AECOM 2012) following the requirements of the provincial Environmental Assessment Act, has already been prepared, submitted and approved by the Ontario Minister of the Environment. It was approved by the Minister in September 2013. The City of Ottawa participated in the review

and provided comments on the EA. The Existing Conditions Report (AECOM 2011) which described the existing terrestrial and aquatic natural environment conditions was prepared in the initial stages of the EA and it formed the basis for the impacts.

AECOM (2014a) prepared an EIS that was submitted to the City of Ottawa for proposed land use zoning change to allow for the development of a landfill on the lands adjacent to an existing landfill. That report primarily addressed land use issues and the impacts of the landfill development in a conceptual manner.

This EIS addresses the more detailed site plan stage and therefore looks at the specific details of the development, impacts and mitigations, prepared for the City of Ottawa. This EIS has been prepared to address the requirements of the City of Ottawa's development application review process.

2. Landfill Study Area

The On-Site and Site-Vicinity study areas for the proposed landfill expansion at the WCEC are listed below.

On-Site .....the lands owned or optioned by WM and required for the landfill expansion. The Site is bounded by Highway 417, Carp Road and Richardson Sideroad;

Adjacent Lands ...the lands in the vicinity of the site extending about 120 metres surrounding the proposed landfill expansion.

The following report provides an assessment of site conditions contained On-Site, as identified in **Figure 1**. The study area for the purposes of vegetation and wildlife was primarily On-Site. The study area for potential fish habitat extended off-site to include the downstream extent of the South Huntley Creek to where it joins the Huntley Creek. The landscape connectivity analysis covered the On-Site area including the subject property and extended to include land several kilometres away.

3. Methods

Information on existing natural environmental conditions of the WM Ottawa landfill site and vicinity was gathered from a combination of field investigations, research of existing documents and agency consultation. Site specific field investigations were conducted primarily in 2005, 2006 and 2011 as discussed in this report. Note that the initial study for the EA (AECOM 2012) considered several landfill alternatives including on lands on the west side of William Mooney Road. As a result the natural features were mapped and described in that area. The proposed and approved landfill alternative will not intrude onto areas west of William Mooney Road.

3.1 Available Secondary Source Information Collection and Review

Available secondary sources of information were queried and all received information was reviewed to determine aquatic, vegetation community and wildlife conditions within the study area. The natural environment component has the sub-components aquatic ecosystems and terrestrial ecosystems. The following tasks and secondary information are relevant to the characterization of the natural environment and information from these sources were collected and reviewed to characterize existing environmental conditions:

- Ongoing terrestrial and aquatic surveys;
- Published information from Ministry of Natural Resources and Forestry (MNRF), DFO and Conservation Authority, including potential Species at Risk (SAR); and Aerial photos and topographic and drainage mapping.
- Natural Heritage Information Centre Database (Ontario Ministry of Natural Resources);
- Ministry of Natural Resources Fisheries Database;
- Species at Risk (Fisheries and Oceans Canada) and Endangered Species (MNRF) Databases;
- Ontario Breeding Bird Atlas
- City of Ottawa Official Plan;
- Original baseline study of site (Gartner Lee 2006) which characterized terrestrial and aquatic environment baseline conditions

3.2 Field Investigations

Natural environment investigations were undertaken by conducting on site field surveys during appropriate seasonal periods to document the existing environmental site conditions including

features and functions. The data collected from field surveys is integrated with background information then evaluated to identify significant features.

Note that when field investigations were conducted in 2011 for the EA, lands west of William Mooney Road were also assessed in order to consider other landfill expansion alternatives.

All field investigation dates and the tasks completed on those dates are shown in **Table 1** and described in Sections 3.2.1 and 3.2.2. This includes the baseline studies that were conducted by Gartner Lee (2006).

Table 1. Field Investigations

Date of Field Visit	Field Investigation Details
October 26, 2004	• Vegetation and Animal Survey
October 27, 2004	• Vegetation and Animal Survey
June 2, 2005	• Partial Amphibian and Animal Survey
June 3, 2005	• Breeding Bird Survey, Vegetation and Animal Survey
June 27, 2005	• Amphibian and Animal Survey
May 26, 2006	• Aquatic Survey
July 26, 2006	• Aquatic Survey
September 28, 2006	• Aquatic Survey
October 24, 2006	• Aquatic Survey
June 13, 2007	• Vegetation and Animal Survey
May 3, 2011	• Vegetation and Amphibian Survey
May 4, 2011	• Vegetation Survey
June 1, 2011	• Vegetation and Amphibian Survey
June 3, 2011	• Vegetation and Breeding Bird Survey
June 16, 2011	• Breeding Bird Survey
August 2, 2011	• Aquatic Survey
August 3, 2011	• Aquatic Survey
September 26, 2013	• Species at Risk Surveys and investigate vegetation enhancement opportunities

3.2.1 Aquatic Surveys

The existing WM Ottawa landfill and proposed expansion lies within the watershed of the Carp River. The Carp River watershed flows through the northwest portion of the City of Ottawa in the former municipalities of West Carleton, Kanata and Goulbourn. It drains an area of approximately 306 km² and discharges to the Ottawa River at Fitzroy Harbour. For most of its length, the Carp River flows through poorly drained clay soils in a relict glaciofluvial channel of

the Ottawa River. The Carp River has four major tributaries draining into it: Corkery Creek, Huntley Creek, Feedmill Creek and Poole Creek (Robinson, 2004).

Surveys in 2005 and 2006 (Gartner Lee 2006) determined that an ephemeral pool and agricultural drainage ditch lying on the west side of the WM facility currently provide seasonal and wet-weather surface water flow into an unnamed tributary of Huntley Creek, hereafter referred to as South Huntley Creek. The entire Huntley Creek sub-watershed is 4900 ha including the area drained by South Huntley Creek. South Huntley Creek has not been assigned a thermal designation (i.e., warm/coldwater) from the Ontario Ministry of Natural Resources but the Carp River Watershed/Subwatershed Study (Robinson, 2004) designates the South Huntley Creek as containing a degraded warmwater fish community. South Huntley Creek eventually flows into Huntley Creek, which has been designated by the Carp River Watershed/Subwatershed study as a coldwater stream (Robinson, 2004). Temperature and stream flow data were collected to confirm the thermal designation and presence of fish community.

A desktop analysis was completed for the project limits using aerial photography and topographic maps. Existing fisheries and aquatic information was obtained from the Ontario Ministry of Natural Resources and Forestry (MNRF) Kemptville District Office. A field assessment of identified surface aquatic features within the study area was conducted on May 26, July 26, September 28 and October 24, 2006.

To confirm and supplement this earlier work, AECOM completed an on-site review of watercourses to confirm their existence and overall condition. This work was undertaken between May 3rd and 4th, 2011 and is the first of three stages of work to be completed. During this time, an aquatic biologist visited each watercourse within the project footprint study area and examined characteristics such as:

- Presence or absence;
- Overall channel condition;
- Riparian (shoreline) features;
- Water depth, flow and visual quality (i.e., clear, muddy);
- Adjacent impacts or factors affecting the watercourse, such as agriculture, forestry development, etc.; and,
- Potential for fish or fish habitat.

The third and final step in the aquatic survey work is to undertake a sensitivity analysis for each watercourse based on background information, field collections and observations and thermal information about the watercourse. Sensitivity rankings will be used to determine the potential risk of future project elements to harm fish or fish habitat.

3.2.2 Vegetation and Wildlife Surveys

Vegetation communities both on-site and in the site vicinity were interpreted from aerial orthophotographic images taken in 2005 and 2010 to delineate preliminary vegetation polygons prior to field surveys. Stereo aerial photographs using images taken in May 2001 (scale 1:16,000) were examined to better define vegetation types. Field investigations were conducted on October 26th and 27th, 2004, June 3rd, 2005, June 13th, 2007, May 3rd and 4th, and June 1st and 3rd, 2011 by an AECOM ecologist. All encountered vascular plant species were documented.

Vegetation communities were described in terms of vegetation structure, stand characteristics and soil description, which provided guidance for detailed ecological classification. The classification of these communities followed Ecological Land Classification (ELC), as per Lee *et al*. (1998). The ELC system adopts a structured approach that incorporates both biological elements (such as dominant plant species and relative cover characteristics) and physical conditions within a hierarchical framework. In this regard, vegetation communities were classified to the finest level of definition: Vegetation Type.

Breeding Birds – Field Investigations

Breeding bird surveys were conducted on June 3rd, 2005, June 3rd, 2011 and June 16th, 2011 in the early morning period (approximately between 05:30 and 10:30). The site was walked such that it was possible to detect most singing territorial birds. Breeding birds were counted, using the "assumed pair" as the counting unit (i.e., one of: a singing male, a pair seen, or single adult birds in suitable nesting habitat). Observed bird territories were recorded on filed maps.

Amphibians – Field Investigations

Field surveys for calling frogs were conducted during evenings (between 9:00 and 11:30 p.m.) on June 2nd and June 27th, 2005 and May 3rd and June 2nd, 2011. On the second survey date, amphibians were surveyed at wetland locations on site that had potential to provide habitat for breeding amphibians. At each location the numbers of each calling species were recorded using a scale from Code 1 – Code 3, adapted from the Canadian Wildlife Service Marsh Monitoring Program. This survey method provides an indication of amphibian abundance during the breeding season using the following scale:

Code 1:..... calls heard without overlapping of calls, possible to count number of individuals calling;

Code 2:..... call overlapping, but possible to estimate numbers; and,

Code 3:..... a large chorus where it is not possible to provide a reasonable estimate of numbers.

Other Wildlife

Incidental observations of non-breeding birds, mammals and reptiles contribute to the overall picture of wildlife use of the area and these were recorded if seen or heard while conducting any of the field surveys.

Landscape Connectivity

Pathways of landscape connectivity and core areas were taken from The Big Picture 2002 (Ontario Natural Heritage Information Centre 2003) and interpreted based upon local knowledge of the area.

3.2.3 Tree Conservation Report

The information collected for the Tree Conservation Report component was completed as part of, and in conjunction with the ELC vegetation surveys as described above. Overall conditions of the vegetation community such as size of trees, structure and health of the vegetation community were recorded. The report is required where trees greater than 10 cm diameter at breast height will need to be removed. Given the size of this project and the area of tree cover that will need to be removed, there are a vast number of trees in this size range. As a result an individual tree by tree assessment was not conducted, instead tree conditions were described by vegetation community and the area of vegetation was measured as opposed to individual trees. In this case the ELC classification of vegetation is the means used to describe the tree cover on site.

The Tree Conservation Report was completed by **James Kamstra, B.Sc., M.E.S.**, *Senior Terrestrial Ecologist*, with AECOM. He has twenty-five years of experience conducting environmental impact studies, bio-physical inventories, tree assessments, and ecological restoration projects. Through his extensive field experience Mr. Kamstra has become a recognized expert in identifying flora and fauna, assessing ecological significance and understanding the ecological relationships. He has completed numerous studies on the impact of a wide variety of developments on natural heritage features including residential housing, wind turbines, landfills, gravel pits, mines, golf courses, highways, pipelines and hydro-electric dams both in Ontario and B.C. His CV is included in Appendix D

4. Existing Natural Environment Conditions

4.1 Aquatic Survey Results

The following is a summary of more detailed information included in the EA (AECOM 2012). The dominant watercourse within the project limits is South Huntley Creek (**Figure 2**). South Huntley Creek is a permanent warmwater system that has been significantly impacted historically by surrounding agricultural land use; and linear developments such as roadways which have bisected its length into smaller reaches, separated generally by culverts.

The most unaltered and natural portion of South Huntley Creek occurs in the upper watershed southwest of William Mooney Road (Tributaries A and B). A smaller series of intermittent reaches occur just north of the proposed landfill expansion envelope (Tributary D), east of William Mooney Road and just south Richardson Sideroad.

Small drainages to the creek were historically located within the current landfill property limits, however these historical reaches have been realigned or buried within culverts and no longer occur as open creek channels (Tributary E). No watercourses occur within the area of the proposed landfill application or the area subject to re-zoning.

AECOM identified three different tributaries of South Huntley Creek (**Figure 2**).

Tributary A originates south of Highway 417 and flows northwesterly through the Goulbourn Wetland. This tributary possesses a relatively natural channel form typically 1.0-1.5 m wide with 10 to 15 mm of flowing water on average over much of its length (**Plates 1 and 2**). It is generally situated within woodlands although portions pass through areas of open and active agricultural use. Specifically, cattle grazing and pasture lands. Tributary A provides habitat suitable for supporting a bait and forage fish population, although AECOM did not observe fish during their field reconnaissance. Bottom substrates were largely clay and sand/gravel within the reach. The channel also contained instream structure such as gravel areas, boulders and woody debris; features important to fish for feeding, rearing and cover. Flows at the time of assessment were abnormally elevated, however its hydraulic connection to wetlands likely provides sufficient baseflow to sustain water year round and even in low water years, there are adequate refuge pools to sustain small fish groupings.

Plate 1. Natural channel within Tributary A showing pool/glide habitats within wooded area

Plate 2. Tributary A passing from wooded area into pasture lands.

Tributary B originates in the Goulbourn Wetland and flows southeasterly. This tributary has been highly altered by historical and current agricultural activities, including recent evidence of cattle access and crossing. There was no discernable channel for about half of its length due to flooding and significant channel degradation. Flows were not measureable due to the absence of a defined channel and flooded condition. Detailed habitat mapping will be undertaken during the July 2011 sampling and provide additional detail of the typical conditions within this reach of South Huntley Creek.

Tributary B lacks habitat suitable for supporting a permanent fish community. It is also considered that ongoing disturbance will further impair creek function and deter fish from re-colonizing the reach, even though its hydraulic connection to wetlands may provide some flow on a year round basis.

Tributary C of South Huntley Creek is an agricultural drain that runs parallel to William Mooney Road. It flows northwest and is intercepted by the first and second tributaries discussed approximately 400 m south of Richardson Sideroad. This tributary has been highly altered by historical agricultural land use and is subject to current impacts resulting from adjacent crop farming. It is a linear channel dominated by shoreline grasses and some sedges (**Plates 3 and 4**). Trees occur randomly along the channel but provide very little shading to the watercourse. There are no pool or riffle habitats present in this tributary. South of the inflow of Tributaries A and B, Tributary C had no discernable flow during AECOM's investigations, despite an abnormally wet period preceding the site visit. The channel north of that point contained flow, largely originating from tributaries A and B.

Plate 3. Tributary C displaying agricultural channel, south of property laneway upstream **from** the confluence with Tributary A and B.

Plate 4. Tributary C displaying agricultural channel, northwest of property laneway, downstream of the confluence with Tributary A and B.

Based on these preliminary investigations, it appears that the tributary functions solely as an agricultural drain and does not provide fish habitat. Ongoing agriculture, including crop planting up to top of bank will further impair the tributary and its water quality. This observation is consistent with the fisheries resources work completed in 2006 and documented in Section 4.1.3 of this report.

The area immediately north of the landfill expansion area project envelope contains properties that were not accessible for survey during the EA. Roadside surveys of Tributary D confirmed the existing condition to be typical of an ephemeral or intermittent watercourse, as the channel contained little or no discernable flow. Bifurcation of the creek and distribution through culverts beneath Richardson Sideroad have likely caused the creek to acquire its current condition. It is unlikely Tributary D can support a resident fish population, and its likely function is the provision of indirect fish habitat for warmwater baitfish species in downstream reaches.

4.1.1 South Huntley Creek Fisheries Resources

To confirm the watercourse conditions and presence of fisheries resources, temperature, stream flow and electrofishing work was undertaken in 2006 (Gartner Lee 2006). This information is summarized below.

4.1.1.1 Temperature

Three continuous Onset Tidbit temperature loggers were installed in South Huntley Creek. Two loggers were installed along William Mooney Road (Sites 1 and 2, see **Figure 2**) and the third logger was installed at Richardson Sideroad (Site 4). Loggers were installed on April 13, 2006 and removed on September 28, 2006.

Site 1, located adjacent to the existing landfill on William Mooney Road, was dry for the majority of the summer. During the May sampling event, there was a shallow pool of water on the northeast side of William Mooney Road. Mapping of surficial geology indicates the presence of a clay lens in this area. The pool is fed by surface water from a wooded swale running east under the fence of the existing landfill facility. It contained water during the spring and fall, and for brief periods following several very large summer storm events. The stream temperature graph reflects the same water and air temperatures for the end of July through September, 2006 indicating that it was dry. When water was present, the average summer (July and August) water temperature was 20.1 ºC. This system is ephemeral and is considered warmwater when flowing.

Water temperatures at Site 2 also reflected the air temperature indicating that it is a warmwater system with little to no groundwater influence. The average summer (July and August, 2006) water temperature was 19.7 ºC, similar to the average summer air temperature of 20.9 ºC. The slightly cooler water temperatures are most likely the result of inputs from wetlands southwest of the monitoring station.

Site 4 is located approximately 3.5 km downstream from Site 1, on the north side of Richardson Sideroad. Summer water temperatures at this site were, on average, 3 ºC cooler than air temperatures. The average summer (July and August, 2006) water temperature was 17.9 ºC. The water temperatures at this site indicate that the thermal regime for this portion of the stream is coolwater. Coolwater systems are defined as having average daily maximum water temperatures of approximately 18 ºC (Stoneman and Jones, 1996).

4.1.2 Stream Flow

Stream flow was measured using a Marsh McBernie flow meter on several occasions. Flow was recorded only at Sites 1, 5 and 6 during the July site visit due to technical difficulties. The flow measurements were used in conjunction with stream depths to produce discharge information. Discharge information along with staff gauge readings are presented in **Table 2**.

Table 2. Discharge and Staff Gauge Readings

Date	Precipitation[1] (mm)	Staff Gauge Reading (m)				Discharge (L/s)					
		CARP1 S. Huntley	*CARP2 S. Huntley*	*CARP4 S. Huntley*	*CARP5 S. Huntley*	*CARP1 S. Huntley*	*CARP2 S. Huntley*	*CARP3 S. Huntley*	*CARP4 S. Huntley*	*CARP5 S. Huntley*	*CARP6 S. Huntley*
11-Apr-06	0.0	0.12	0.29	0.44	0.36	0	56	114	109	159	870
18-May-06	28.2	0.28	0.39	-	-	-	-	-	-	-	-
26-Jul-06	32.0	0.00	0.08	0.44	0.01	dry	-	-	-	3.2	164.0
19-Sep-06	4.6	0.00	-	-	-	dry	-	-	-	-	-
28-Sep-06	4.0	0.00	0.10	0.42	0.05	dry	0.7	1.4	12.0	13.7	-
24-Oct-06	13.0	0.15	0.31	-	-	-	-	-	-	-	-

Note: 1. Precipitation for 48 hours prior to sampling.

4.1.3 Fisheries Resources

4.1.3.1 Fish Habitat

Fish habitat was assessed at five sites along South Huntley Creek (Sites 1-5) as well as at one site on Huntley Creek (Site 6). Fish habitat was evaluated three times (May, July and September, 2006) in order to evaluate seasonal availability. Staff gauges were installed at four sites (Sites 1- 2 and Sites 4-5) and flow measurements were made at least twice in 2006.

The fish habitat characteristics and quality of the sites were classified into four categories (no fish habitat, poor, moderate, good) according to the habitat conditions described **Table 3**.

Table 3. Fish Habitat Classification

Assessment	Stream Attributes
No Fish Habitat	▪ Swale ▪ Not defined to poorly defined channel ▪ Dry at time of site visit
Poor	▪ Poorly defined stream channel (i.e., wetland area) ▪ Some vegetation in channel ▪ Possibly permanent flow ▪ Soft substrates
Moderate	▪ Well defined channel ▪ Permanent flow ▪ Poor riffle / pool morphology ▪ Some instream cover ▪ Sand / fine gravel substrates
Good	▪ Well defined channel ▪ Permanent flow ▪ Well defined riffle / pool morphology ▪ Abundant instream cover (i.e., large woody debris, undercut banks) ▪ Gravel / cobble substrates

4.1.3.2 Fish Community

Historical fisheries information for South Huntley Creek was extremely limited. South Huntley Creek was sampled once near Carp Road in July 2001. Six species of fish were captured: central mudminnow (*Umbra limi*), blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), redbelly/finescale dace (*Phoxinus* sp.) and brook stickleback (*Culaea inconstans*). All six species are common, tolerant species typical of urban systems.

Electrofishing and habitat survey at three sites (Sites 1, 3 and 4) on South Huntley Creek (**Figure 2**) in May 2006.

4.1.3.3 Site 1 – South Huntley Creek

This site is located on Tributary C adjacent to the landfill (**Figure 2**). On the northeast side of William Mooney Road, there is a pool of water, which steadily decreased during the summer. The water temperature in the pool was 21.2º C on April 12, 2006, significantly higher than the other sites on the same date. The May, July and October site visits were conducted after rain events, during which a small amount of water was flowing in the ditch. During the August site visit, the ditch was dry indicating that the ditch is ephemeral. Approximately 150 m downstream, water flows in from another tributary from the southwest substantially increasing stream flow.

The pool of standing water on the northeast side of the road was electrofished during the May site visit. No fish were caught at Site 1. This site does not provide direct fish habitat due to its ephemeral nature. This site may contribute to downstream fish habitat during periods of high flow (i.e., spring freshet).

4.1.3.4 Site 2 – South Huntley Creek

Site 2 is located on William Mooney Road, near Richardson Sideroad and this is located approximately 40 m from the edge of the proposed landfill expansion (**Figure 2**). This section of the stream is permanent and ranged from 0.75 to 1.25 m wide and 0.04 to 0.3 m deep during the site visits. On the north side of the road, the stream flows through agricultural and livestock (cow) fields before flowing under William Mooney Road through a concrete box culvert. For approximately 100 m downstream of the road, the stream is unaltered before becoming straightened along the edge of a farm field. Water then flows in a ditch along Richardson Side Road for approximately 250 m. Water draining from various fields collects in this ditch, increasing stream flow. Electrofishing was not conducted at Site 2 as WM did not have access to this property. This site is considered poor fish habitat due to the upstream farm, low summer water levels and beaver dam preventing upstream fish migration.

4.1.3.5 Site 3 – South Huntley Creek

This site is located at Carp Road (**Figure 2**). This section of the stream is permanent and ranged from 0.12 to 0.27 m deep and 1.2 to 1.9 m wide during the site visits. On the west side of Carp Road, the stream is channelized for approximately 50 m by concrete (~1 m high) walls. Large patches of vegetation grow in channel causing braiding. East of Carp Road, the stream bottom is hardened with sediment (gravel, sand) on top. The hardened bottom is an impervious surface that limits the burrowing depth of fish and benthic invertebrate habitat. Two small watercress plants were found near the culvert indicating the potential for groundwater seepage in the area. Riparian vegetation consists only of mown grass on either side of Carp Road. After passing Carp Road, South Huntley Creek enters the M-Con Products Inc. quarry property.

The stream on the east side of Carp Road was electrofished from the quarry fence to the culvert. Two creek chub (*Semotilus atromaculatus*) were caught at this site. Creek chub are common, tolerant fish that prefer coolwater (Eakins, 2006).

This site is considered moderate fish habitat because of its permanent flow, well defined channel, low to moderate in-stream cover and lack of riparian vegetation.

4.1.3.6 Site 4 – South Huntley Creek

Site 4 is located on Richardson Sideroad, near Oak Creek Road (**Figure 2**), downstream of M-Con Products Inc. Riparian vegetation and canopy cover at this site is fair (~40%). Recent beaver activity was seen along the stream banks. The average stream width was 3 m and the depth ranged from 0.2 to 0.5 m. Bottom sediment was mainly sand with some gravel and rock. Orange staining, possibly indicating groundwater, was noted on the left bank (when facing upstream) on the downstream (north) side of the culvert.

The stream on the southeast side of Richardson Sideroad was electrofished. Seven species of fish were caught at this site: white sucker (*Catostomus commersonii*), blacknose dace (*Rhinichthys atratulus*), brook stickleback (*Culaea inconstans*), fathead minnow (*Pimephales promelas*), creek chub (*Semotilus atromaculatus*), central mudminnow (*Umbra limi*) and mottled sculpin (*Cottus bairdii*). This community is indicative of a cool to coldwater fish community and is similar to the community found in Huntley Creek (~500 m downstream).

This site is considered good fish habitat because of its cool temperature, gravel substrates, moderate in-stream cover and fair riparian vegetation.

4.1.4 Fisheries Resources Summary

Site 1 does not provide direct fish habitat due to its lack of water for the majority of the year. Site 2 is considered poor fish habitat due to the upstream farm, low summer water levels and a beaver dam downstream (near Cardevco Road) which prevents upstream fish movement. The channel along Richardson Sideroad is used mainly for agricultural drainage. Although there is water present year-round, terrestrial plants have grown in many portions of the ditch making it unfavourable for fish habitat. Tolerant fish (i.e., creek chub, brook stickleback) are likely present in this channel as a result of upstream movement in spring when water levels are high. This fish then become trapped in the drainage channel until higher flows return in the fall. The channelized portion of the stream north of Carp Road, is also unfavourable for fish habitat. Because of the width of the channel, the stream becomes braided and water levels are often very low. Downstream of Carp Road, the entire stream is considered moderate to good fish habitat. The fisheries resources observed are classified and summarized in **Figure 2**.

4.2 Terrestrial

4.2.1 Vegetation Communities

The vegetation descriptions and classifications follow the ELC system (Lee et al. 1998). Vegetation polygons are mapped on **Figure 3** within the landfill property and on the 120 m adjacent lands around the proposed landfill expansion**.**

The existing, now closed landfill consists of buried refuse material that has been covered by a sufficiently thick layer soil that has been allowed to become colonized (or seeded) with grasses and some broad-leaved forbs. In some more disturbed areas the landfill consists of exposed fill where vegetation cover is not well established. The existing landfill is periodically mowed for maintenance reasons and to prevent colonization by woody plants.

Mature deciduous woodlot and some deciduous swamp fringes are located on the south and west sides of the existing landfill mound. Man-made ponds and marsh are fed by surface water that flows from the surrounding operations, including the landfill.

Active agriculture covers about 25 ha of the land within the proposed landfill expansion. Other cropland and some livestock pasture occurs in the site vicinity west of William Mooney Road. Some former cultivated land or pasture has been abandoned in the last decade or so and is regenerating to cultural meadow and thicket. For areas within the proposed landfill expansion along Carp Road, a former farmstead and several houses have been removed and are now regenerating to meadow or cultural woodland. Former gravel pits occur on the northwest and south sides of the Laurysen building which are regenerating to sparse dry cultural meadow.

The lower portion of the pit is seasonally flooded meadow marsh. A deeper permanent pond and cattail marsh is present in the south side of the pit. A portion of deciduous swamp extends onto the north side of the site.

The Natural Heritage Information Centre (NHIC, a branch of the Ministry of Natural Resources) provides a provincial status ranking for the Ecological Land Classification (ELC) vegetation communities of Ontario. None of the vegetation communities recorded on site is considered provincially rare (S1 through S3) by the NHIC.

The various ELC communities are described under the broad vegetation classes in the following section.

4.2.1.1 Forest

Five forest communities were identified consisting of coniferous, mixed and deciduous types and are described below.

Fresh-moist White Cedar Coniferous Forest (FOC4-1) has a canopy greater than 75% White Cedar (*Thuja occidentalis*) with occasional other species in the canopy such as Balsam Fir (*Abies balsamea*), Paper Birch (*Betula papyrifera*) and Trembling Aspen (*Populus tremuloides*). The ground cover is sparse where the canopy is dense but contains Poison Ivy (*Rhus radicans*) and Wild Sarsaparilla (*Aralia nudicaulis*) where more open.

Fresh-moist Cedar – hardwood Mixed Forest (FOM7-2) occupies much of the study area. White Cedar is frequently the most abundant tree sometimes approaching 75% of the canopy. Paper Birch, Trembling Aspen and Green Ash (*Fraxinus pennsylvanica*) are typically co-dominants but other trees may be well represented including Balsam Fir and Red Maple (*Acer rubrum*). Sometimes there is a dense understorey of White Cedar and Balsam Fir, while at other locations, mostly deciduous saplings. The forest is mature, appears to be approximately 80 years in age. Dominant tree size is in the 25 to 40 cm DBH range, and there are many in the 10 to 25 cm DBH range. Trees were found to be mostly healthy with only occasional snags. Fallen logs are frequent on the ground.

Both Glossy Buckthorn (*Frangula alnus*) and Common Buckthorn (*R. cathartica*) may be common in the shrub layer of the mixed forest. Glossy Buckthorn was found to be particularly abundant in some parts of the forest. Poison Ivy, Wild Sarsaparilla, Lady Fern (*Athyrium felis-femina*), Bracken Fern (*Pteridium aquilinum*) and sedges (*Carex* spp.) are common ground flora.

Dry-fresh-Paper Birch Deciduous Forest (FOD3-2), is a relatively young forest found in three units south of the existing landfill. Paper Birch dominates the canopy with a component of Balsam Poplar and American Elm (*Ulmus americana*).

Dry-fresh Sugar Maple – Birch – Poplar Deciduous Forest (FOD5-10) is a mature unit of forest on the south side of the existing landfill. Sugar Maple (*Acer saccharum*) is co-dominated with Trembling Aspen and Paper Birch. It contains a rich ground layer that contains Trout Lily (*Erythronium americanum*), White Trillium (*Trillium grandiflorum*) and woodland sedges. This forest is at least 100 years old. Dominant tree size is in the 25 to 40 cm DBH range. Occasional snags and fallen logs are present.

Fresh-moist Poplar Deciduous Forest (FOD8-1) dominated by Trembling Aspen occurs on the east side of the mixed forest and also as a narrow fringe along the edge of deciduous swamp on the north side of the proposed landfill expansion. It also contains some Balsam Poplar (*Populus balsamifera*), Green Ash and Paper Birch. The ground layer is a mix of species that may include Wild Lily-of-the-valley (*Maianthemum canadense*), violets (*Viola* spp.) and sedges.

4.2.1.2 Cultural Vegetation

Cultural communities are those where human land uses have significantly influenced the structure and species composition of the vegetation. Cultural designation includes the following: Cultural coniferous plantation consists of White Pine (*Pinus strobus*) and White Cedar, which was planted, occurs in the northeast corner of the subject property. A young deciduous plantation of hybrid poplar (*Populus* sp.) was planted south of the existing landfill that is irrigated with treated leachate.

Cultural Meadow (CUM1) consists of areas that were previously cultivated, grazed or mowed and have since been abandoned and are now dominated by non-native grasses such as Smooth Brome (*Bromus inermis*) and Kentucky Bluegrass (*Poa pratensis*). A variety of forbs such as Tall Goldenrod (*Solidago altissima*), asters and Common Milkweed (*Asclepias syriaca*) may also be abundant. Meadow on the existing landfill is periodically mowed and consists primarily of grasses.

Dry Cultural Meadow (CUM1a) is on poor well drained soils of an abandoned gravel pit. Dominants include Canada Bluegrass (*Poa compressa*), White Sweet Clover (*Melilotus alba*) and Chickory (*Cichorium intybus*). The ground is 30% bare in those areas.

Cultural thickets (CUT1) are at a later stage of succession and have developed from cultural meadow. Here shrub cover comprises at least 25% and may be as high as 100%. Willows, in

particular Slender Willow (*Salix petiolaris*) dominate on moister sites while Glossy Buckthorn and Red-osier Dogwood (*Cornus stolonifera*) are also frequent. Although the shrub layer suggests wetland, the ground cover does not which is dominated by species such as Kentucky Bluegrass, Birdfoot Trefoil (*Lotus corniculatus*) and Red Clover (*Trifolium pratense*).

Cultural woodlands (CUW1) are tree communities similar to forests but they are disturbed by human activities resulting in a canopy cover of between 35 and 60% (Lee *et al.* 1998). Forests have a canopy cover greater than 60%. Species composition is variable consisting of a combination of native and non-native tree species that may include: Sugar Maple, Norway Maple (*Acer platanoides*), Paper Birch, Trembling Aspen and Black Locust (*Robinia pseudo-acacia*). Shrub thickets and cultural meadow ground cover are present.

Cultural Hedgerows (CUH) are linear groves of trees and shrubs that typically succeeded along fence lines between agricultural fields. Tree species include Sugar Maple, American Basswood (*Tilia americana*), American Elm and Green Ash. Shrubs include variable dense thickets of dogwood, Common Buckthorn and Choke Cherry (*Prunus virginiana*).

4.2.1.3 Swamp

Swamps are areas with a seasonal or permanent high water table that are dominated by woody vegetation, either trees or shrubs. Five swamp types were identified on the landfill property and are described below.

Green Ash – Glossy Buckthorn Mineral Deciduous Swamp (SWD2-2a) occurs on the north property boundary. This is a seasonally flooded swamp that shows considerable ephemeral pooling. Green Ash dominates the canopy while Glossy Buckthorn and ash saplings are abundant in the shrub layer. The ground layer is dominated by Fowl Manna Grass (*Glyceria striata*) and Sensitive Fern (*Onoclea sensibilis*). The organic layer is about 20 cm deep.

Swamp Maple Mineral Deciduous Swamp (SWD3-3) occurs in the south edge of the landfill property consisting of a tall canopy almost entirely comprised of Swamp Maple (*Acer X freemannii*). The subcanopy contains American Elm, Green Ash and Black Ash. The ground layer contains Sensitive Fern, Dwarf Raspberry (*Rubus pubescens*) and Fowl Manna Grass. Trees are large with some specimens approaching 50 cm DBH.

Maple – Ash - Poplar Mineral Deciduous Swamp (SWD3-3a) occurs nearby and contains a co-dominant canopy of Swamp Maple, Green Ash and Trembling Aspen. The ground layer is similar to SWD3-3.

Willow Mineral Thicket Swamp (SWT2-2) consists of a rather tall canopy dominated by Bebb's (*Salix bebbii*) and Pussy Willows (*S. discolor*). It is a seasonally flooded area that surrounds a permanent man-made pond in the central portion of the site. Ground cover consists of grasses and sedges.

Glossy Buckthorn Mineral Thicket Swamp (SWT2-2a) forms a dense patch in the northeast corner of the site and extends onto the adjacent property to the north. The canopy consists almost entirely of Glossy Buckthorn. This non-native plant is considered a principal invasive species by White, Haber and Keddy (1993) consequently this is a poor quality wetland unit.

4.2.1.4 Marsh and Submerged Aquatic

Marsh consists of seasonal or permanent wetlands dominated by graminoids or herbaceous plants.

Cattail Mineral Shallow Marsh (MAS2-1) is dominated by Hybrid Cattail (*Typha X glauca*). Several units occur onsite including north and south of the existing landfill, and in the former gravel pit to the north. These are mostly in man-made wet depressions.

Reed Canary Grass Mineral Meadow Marsh (MAM1-1) dominated by Reed Canary Grass (*Phalaris arundinacea*) occurs in one unit along the north property boundary but also occurs in some intermittent channels that were not mapped.

Mixed mineral meadow marsh (MAM1-10) occurs in the abandoned pit in the north part of the site. A diverse variety of plant species are intermixed including Hybrid Cattail, Soft Bulrush (*Scirpus validus*), Marsh Fern (*Thelypteris palustris*), Field Horsetail (*Equisetum arvense*) and sedges.

Submerged Aquatic (SAS1) occurs in several permanent or semi-permanent ponds that contain submerged aquatic vegetation that may include pondweeds (*Potamogeton* spp.), stoneworts (*Chara* sp.) or other species, or some ponds may have sparse submerged aquatic plants. One pond in the north contains a dense growth of stoneworts and was designated as **Stonewort Submerged Aquatic (SAS1-3)**.

4.2.2 Flora

A total of 162 vascular plant species were recorded during field investigations of which 33 (20%) are non-native species. A list of plant species recorded is included in Appendix A.

The only plant species at risk encountered was the Endangered Butternut (*Juglans cinerea*). Three individual trees occur within the southeast corner of the landfill property, well outside of the proposed landfill expansion (see **Figure 3**). Although the Butternut is relatively common south of the Canadian Shield, COSEWIC has designated it "endangered" because of a disease, the Butternut Canker, which has rapidly spread through North America. This disease causes a high degree of mortality in Butternut trees. The Butternut is listed provincially as "S3?" (provincially rare to uncommon, status uncertain) by the NHIC. No individuals showed symptoms of the lethal Butternut canker.

The plant species list was compared against the flora of Ottawa Region (Brunton 2005) to determine possible presence of locally or regionally significant species. No locally rare species were encountered but 17 are considered to be locally uncommon by Brunton (2005).

4.2.3 Wildlife

Wildlife surveys focused on breeding bird surveys and nocturnal amphibian surveys, as discussed in the following sections. Some key wildlife observations are shown on **Figure 4**.

4.2.3.1 Birds

During the breeding bird surveys on June 1 and 3, 2011, a total of 34 species were recorded within the existing landfill property and 50 species within the west and north project envelopes (Appendix B). Survey work in 2006 recorded 48 species of birds on the existing landfill site which included some non-breeding species such as Turkey Vulture (*Cathartes aura*) and gulls (Gartner Lee 2006). Bird records are provided in Appendix B.

The most commonly occurring breeding birds include Red-winged Blackbird (*Agelaius phoeniceus*), European Starling (*Sturnus vulgaris*); Song Sparrow (*Melospiza melodia*), American Robin (*Turdus migratorius*), Yellow Warbler (*Dendroica petechia*) and Common Yellowthroat (*Geothlyphis trichas*). These species are typical of relatively disturbed, early successional vegetation.

The forested areas both on the existing landfill property were found to support three species of forest area sensitive breeding birds as recognized by MNR (2012) for Site Region 6E. Two species Yellow-bellied Sapsucker (*Sphyrapicus varias*) and Veery (*Catharus fuscescens*) were recorded in the adjacent lands and probably within the woodlot on the proposed landfill expansion. One area sensitive grassland species: Savannah Sparrow (*Passerculus sandwichensis*), was recorded in some of the fields within the proposed landfill expansion. The approximate locations of the area sensitive species are all shown on **Figure 4**.

Eastern Meadowlark (*Sturnella magna*) and Barn Swallow (*Hirundo rustica*) have been listed as Threatened Species federally by COSEWIC (2015) and are discussed further in section 6.1. Neither were observed on site but both were on an adjacent property west of William Mooney Road. It is also noteworthy that approximately 100 Bank Swallow (*Riparia riparia*) nesting holes were observed on a steep exposed earthen bank within the central portion of the landfill property in June 2011. Landfill manager Ross Wallace (pers. comm.) said that the colony had been present there for a number of years. Bank Swallow is a Threatened species that will be discussed in greater detail in Section 6.1

The ponds on the landfill property are used for staging by a small number of migratory waterfowl as observations of Ring-necked Duck (*Aythya collaris*) and Lesser Scaup (*Aythya affinis*) on May 3, 2011 indicate. Ring-billed Gull (*Larus delawarensis*) and likely other gull species were frequent visitors to the existing landfill while it was operational. Canada Goose (*Branta canadensis*) also may congregate in ponds or in surrounding fields. A flock of 70 were observed in a field north of the landfill on June 1, 2011. On September 26, 2013, at least 400 Canada Geese were loafing in two shallow ponded areas on the existing landfill. On June 13, 2007, the wetlands to the north revealed the presence of a breeding pair of Canada Geese, and one breeding pair of Mallards (*Anas platyrhynchos*).

The data from the most recent Ontario Breeding Bird Atlas (Cadman *et al.* 2007) was examined for the general site vicinity. In the 10 x 10 km atlas square 18VR21 that includes the WCEC property, 105 species were recorded as confirmed, probable or possible breeders that was conducted from 2001 to 2005. Five of the recorded species are Threatened or Endangered (all Threatened) that include Whip-poor-will, Barn Swallow, Bank Swallow, Eastern Meadowlark and Bobolink. These species are discussed in section 6.1.

4.2.4 Amphibians

Amphibian calling surveys were conducted on evenings of May 3 and June 1, 2011 at areas of apparent amphibian habitat within the operating landfill and the adjacent area. Five species were recorded between the two surveys. Surveys had been conducted previously in 2006 (Gartner Lee 2006). The specific locations of where the amphibian species were recorded calling during the 2006 and 2011 surveys are indicated on **Figure 4**.

A total of six species (including American Toad *Anaxyrus americanus*, Spring Peepers *Pseudacris crucifer,* Grey Treefrogs *Hyla versicolor*, Green Frog *Lithobates clamitans and* Northern Leopard Frog *Lithobates pipiens*) were recorded within the landfill property and all but one occur within the proposed landfill expansion area. Most species were found at several breeding sites. The Wood Frog (*Lithobates sylvatica*) was only found in the SWD2-2a unit just to the north of the proposed landfill expansion. Five species were recorded from that swamp

unit in 2006 but only one in 2011. Four species were recorded in the ponds 150 m southeast of the swamp in 2011 however (**Figure 4**).

Several man made ponds north of the existing landfill and in the abandoned gravel pit to the northeast of there, supported mixed choruses, of breeding amphibians. Spring Peepers and Grey Treefrogs were often in choruses of between 10 and 20 calling individuals. Other species were in smaller numbers.

Only the Green Frog and, to a lesser extent Northern Leopard Frog, remain in the permanent ponds through the summer. Other species bread in the ponds but spend most of the active season in the adjacent woodlands or old field habitat. Therefore the proximity to ponds and woodlands is important to maintain functional amphibian habitat.

There were no nationally or provincially at-risk amphibian species or provincially rare (S1 through S3) species recorded.

4.2.5 Other Fauna

Seven mammal species were observed during visits to the site, or by landfill staff throughout the year (**Table 4**). Additional species such as Striped Skunk (*Mephitis mephitis)*, Meadow Vole (*Microtus pennsylvanicus)* and other small mammals are likely present on the site, but these species are cryptic, often nocturnal and therefore difficult to observe. None of the species recorded are rare or At-Risk nationally or provincially.

Table 4. Mammals Recorded at Ottawa Landfill

Common Name	Scientific Name	Comments
Woodchuck	*Marmota monax*	• Observed in southwest and south-central woods; young seen
Muskrat	*Ondatra zibethicus*	• Observed in northernmost pond (SASa)
Gray Squirrel	*Scirus carolinensis*	• Observed in woodlot on south edge of existing landfill
Eastern Chipmunk	*Tamias striatus*	• Observed in woodlot on south edge of existing landfill
Meadow Jumping Mouse	*Zapus hudsonius*	• Observed in edge of northwest woods
Coyote	*Canis latrans*	• Occasionally seen by landfill staff
Red Fox	*Vulpes vulpes*	• Occasionally seen by landfill staff; probable den seen at edge of northwest woods
Northern Raccoon	*Procyon lotor*	• Observed in several locations; regularly seen by landfill staff
White-tailed Deer	*Odocoileus virginianus*	• Observed in several locations; minor winter concentration in northwest woods

During the December 2006 field visit, a small group of White-tailed Deer *Odocoileus virginianus* was observed in the northwest woods. The conifer trees in this section of the site likely provide

good wintering habitat for a small number of deer due to the shelter provided by the trees. The remaining woods appear to be of lower quality for wintering wildlife because they contain few conifer trees (species that keep their needles) to provide shelter, and fewer mature trees to provide cavities for nesting or hibernation.

Eastern Garter Snake (*Thamnophis sirtalis*) was the only reptile species observed on the landfill property. A few other common reptile species likely occur, such as Midland Painted Turtle (*Chrysemys picta)* in the ponds on the property.

4.3 Natural Heritage Designations

Some of the natural heritage features within the study area are already designated for their environmental functions and therefore receive some level of protection through the Provincial Policy Statement (MMAH 2005).

Provincially Significant Wetland

The Ontario Wetland Evaluation System was developed by the Ontario Ministry of Natural Resources in response to an increasing concern for the need to conserve wetland habitats in Ontario. The wetland evaluation system aims to evaluate the value or importance of a wetland based on a scoring system that takes into consideration four principal components - biological, social, hydrological, and special features. Based on scoring, a wetland can fall into one of two classes, Provincially Significant or Locally Significant. The Province of Ontario, under the Provincial Policy Statement (PPS) protects wetlands that rank as Provincially Significant. The PPS states that "*Development and site alteration shall not be permitted in significant wetlands*".

Two units of the Provincially Significant Goulbourn Wetland have been mapped by MNR west of William Mooney Road and approximately 400 m west of the landfill property at its closest point. The wetland boundary is more than 600 m from the closest point of the proposed landfill footprint (see **Figure 3**). The wetland is much more extensive to the southwest on the other side of Highway 417.

There are several non-regulated wetland features in the landfill property including the proposed landfill expansion area. These include man-made wetland units north of the existing landfill and in the abandoned pit which are not connected to surface drainage off site. There is also the SWD2-2a swamp unit along the north edge of the property boundary. Two swamp units (SWD3-3 and SWD3-3a) occur on the south part of the landfill property. These do not qualify as part of the PSW because they are either man-made or are not hydrologically connected within 750 m to another unit of the PSW.

It should be noted that the Mississippi Valley Conservation Authority (MVCA 2010) confirmed that this small pocket of wetlands are not included on any of their mapping schedules and are not regulated by them. Although not regulated, they may provide important functions in regard to recharge functions or wildlife habitat.

Significant Woodland

The Ottawa Official Plan OPA 76 (2009) has identified Significant Woodlands in their jurisdiction based on meeting all three of the following criteria:

- is a contiguous woodland patches that contain mature woodlands greater than 80 years,
- contains forest interior habitat greater than 100 m from an edge and
- is located within 5 m of a surface water feature.

Areas in the study area which are mapped in Annex 14 (Schedule L3) of the OPA are shown on **Figure 3**. Note that the Significant Woodland includes the southern portion of the woodlots in the landfill property and the forest block on the adjacent parcel north of the proposed landfill expansion that extends on-site. According to the PPS the function of the significant woodland must be maintained.

The Carp River Watershed Plan (Robinson Consultants 2004), which includes the study area, also maps woodlands as part of Greenland strategy to protect watershed functions. Their designation is based on woodlands that are at least 50 years of age. The woodlands mapped are quite similar to the Significant Woodland of the OP but include the woodlot within the proposed landfill expansion but not the woodlot in the north. The OP states that not all Significant Woodland are shown on Schedule L3.

The main woodlot in the proposed landfill expansion was not mapped in the Ottawa OP but qualifies as Significant Woodland because: it contains mature forest at least 80 years old, contains 1.3 ha of forest interior habitat and contains some small wetland pockets as well as an intermittent stream at the south end of the woodlot. This woodlot is therefore also mapped as Significant Woodland on **Figure 4**.

4.4 Landscape Connectivity

Landscape connectivity (which includes the concept of ‘wildlife corridors’) has become recognized as an important part of natural heritage planning. A wide range of benefits can be attributed to the maintenance or re-connection of the natural landscape. These benefits may include: increased local species richness and biodiversity, more immigration and movement

opportunities for individuals between core natural areas, and greater likelihood of seed dispersal and exchange of other genetic material between populations.

The Natural Heritage Information Centre (2003), of the Ontario Ministry of Natural Resources, produced The Big Picture 2002. This project utilized remote sensing imagery, geographic information systems (GIS), and the principles of landscape ecology to produce a digital map of existing and potential cores and corridors in Southern Ontario. Due to the inherent limitations of the automated methodology, the Big Picture 2002 maps should not be used without human interpretation. Nonetheless, it provides a useful tool for objectively assessing the overall connectivity of the landscape and the relative contribution of specific natural communities to that connectivity.

Although The Big Picture 2002 shows the overall landscape connectivity of the region as quite good, the specific connectivity value of the study area appears relatively low (**Figure 5**). Highway 417 to the south, forms a significant obstacle and cause of mortality for wildlife that attempt to cross. In addition a 1.8 m high chain link fence surrounds most of the landfill including the edge of the Highway 417 right-of-way which is an additional obstacle for wildlife movement. The highway bisects the Goulbourne PSW where there is a natural interface for about 1.5 km. Traffic is nearly continuous but some wildlife are likely able to move across particularly at night when traffic is less. Certainly the largest contiguous block of core forest and wetland habitat lies on the southwest side of Highway 417. The adjacent industrial area northeast of Carp Road effectively isolates the site to the east. There is a potential wildlife corridor along the north branch of Huntley Creek just to the north of Richardson Sideroad. Forest cover remains, but is fragmented by residential development and a series of roads, but habitat linkage is fairly good in that direction.

5. Description of the Proposed Landfill Expansion Area

The southern half of the proposed landfill expansion area is situated on WM-owned lands and the northern half is on lands that have been recently acquired WM. The proposed landfill would be situated immediately north of the existing, now closed landfill. The final contours of the proposed landfill are roughly shown in **Figure 6** and reflect a raised rectangular landform with a maximum elevation (top of final cover) of 155.7 mASL. This elevation would be approximately 30 m above the surrounding existing grade. By comparison, the maximum elevation of the existing Ottawa WMF landfill is considerably higher at approximately 172 mASL which is 47 m above the surrounding grade. The contours reflect maximum side slopes of 4H to 1V, and a minimum slope of 5%. The footprint area of the new cells is 37.8 ha but including surrounding roads, facilities, stormwater ponds and clearing, the landfill operations will cover approximately 68 ha. Details of the proposed landfill are described and depicted in drawings in WSP Canada Inc. (2014) and provides information on all main aspects of the landfill design and operations including:

- site layout design;
- surface water management
- leachate management;
- gas management; and,
- landfill development sequence and daily operations.

The development and filling of the landfill will occur in a series of phases beginning in the east, then working westward and upward in successive cells. The main access road into the landfill will enter off Carp Road then run along the south side of the new landfill (north side of existing landfill) continue west and turn north along the west side of the landfill, then east towards the working area. Ten phases of development to final closure have been identified by WSP Canada Inc. (2014). The time sequence of the progression between phases is unknown and depends on the rate of refuse that is transported to the site. The overall footprint of the final filled proposed landfill at the time of closure in relation to the existing vegetation pattern is shown on **Figure 6.**

A 100 m buffer is maintained between the north limit of the proposed landfill and the lands to the north (e.g., lands which front onto Richardson Side Road) in accordance with Ontario Regulation 232/98, and an approximate 350 m buffer is maintained between the east limit of the footprint and Carp Road. A light industrial building (e.g., the Laurysen building) is situated in the eastern portion of the WM optioned lands, which WM anticipates using for equipment storage/maintenance or waste diversion activities at some point in the future but will continue to be used by Laurysen in the interim. An approximate 50 m buffer is maintained between the toe

of slope of the existing and new landfill footprints, thus allowing sufficient area for a new waste haul road to the new footprint, and for maintenance and monitoring access. The west limit of the proposed landfill maintains a setback of 100 m from William Mooney Road. This buffer retains a linear portion of the existing woodlot within the west part of the WM-owned lands.

6. Significance of the Environment Potentially Affected

The significance of the existing environment that will be potentially affected by the proposed landfill footprint is evaluated in the context of the criteria identified in the Provincial Policy Statement (PPS). Figure 6 shows the footprint of the proposed landfill superimposed over the natural vegetation that would be removed.

6.1 Significant Habitat of Endangered and Threatened Species

In the PPS "Endangered and Threatened" species are those species listed or categorized as an "Endangered Species" or "Threatened Species" on the MNRF (2015) provincial species at risk list which are protected under the Ontario Endangered Species Act. One Endangered (Butternut) and four Threatened species (Bank Swallow, Barn Swallow, Eastern Meadowlark and Blanding's Turtle) were observed or recorded within close proximity to the proposed landfill expansion. Of these, only the Bank Swallow occurs within the footprint of the proposed landfill expansion. These are described below.

The Ontario Breeding Bird Atlas (Cadman *et al.* 2007) recorded five Threatened species in the 10 x 10 km atlas square 18VR21 that includes the WCEC property which are Eastern Whip-poor-will, Barn Swallow, Bank Swallow, Eastern Meadowlark and Bobolink. These are all discussed below except for Eastern Whip-poor-will. This species typically occurs in semi-open mixed or deciduous woodland in relatively quiet undisturbed sites. We believe that the WCEC site does not provide suitable habitat for Eastern Whip-poor-will because the existing forest habitat on site has a closed canopy that is too dense to be optimal for this species. Furthermore the noise and disturbance of past landfill activities and the constant noise from the adjacent Highway 417 do not make good conditions for this shy vociferous species.

6.1.1 Butternut

Butternut is listed as 'Endangered' in the federal *Species at Risk Act* (COSEWIC 2011) and in the provincial *Endangered Species Act* (ESA)(MNR 2013). As such, it is afforded protection under the ESA.

AECOM identified Butternut, in the site vicinity but they are more than 500 m from the proposed landfill expansion footprint (**Figure 3**). Three individual trees occur within the existing landfill site, near the north edge of the dry-fresh birch deciduous forest in the south corner. Four other

individual trees occur in the forest block southwest of William Mooney Road but are well out of any potential impact from the proposed expansion.

6.1.2 Barn Swallow

Barn Swallow has been listed as Threatened Species federally by COSEWIC (2015) and provincially by COSSARO (MNRF 2015) because of long term declining trends in their populations.

Barn Swallows most frequently nest on human-made structures such as buildings (especially barns) and bridges, and they forage widely over open habitats in their quest for aerial insects. A Barn Swallow nest was observed in an abandoned barn west of William Mooney Road, about 200 m from the landfill expansion area. The barn is on lands not owned by WM and the landfill expansion is not anticipated to impact any Barn Swallows using the barn.

There are no buildings on most of the expansion footprint that are potentially suitable for nesting Barn Swallows. On September 26, 2013 an AECOM ecologist searched any potentially suitable buildings within the proposed landfill expansion area for the presence of old Barn Swallow nests. The characteristic mud nests are easily recognizable and will often persist for several years after being occupied by the birds, and therefore it is possible to confirm nesting of this species outside of the breeding season. The only buildings within this area were the Laurysen Kitchens building and an abandoned house along Carp Road. The Laurysen Kitchens is a large metal building that is currently used for industrial operations. There is continual human presence, also the eaves and metal configuration are generally not suitable for Barn Swallow nests, and none were present. The doors and windows of the abandoned house were sealed, and the eaves were carefully checked. No bird nests of any kinds were observed around the abandoned house.

As a result of the survey, it is concluded that the proposed landfill expansion will not have any impact on Barn Swallow nesting habitat.

6.1.3 Bank Swallow

Bank Swallow has been listed as Threatened Species federally by COSEWIC (2015) and provincially by COSSARO (MNRF 2015) because of long term declining trends in their populations.

Approximately 100 Bank Swallow nesting burrows were observed on a steep exposed earthen bank within the existing landfill property, and the south edge of the proposed landfill footprint on June 3, 2011 (see location on **Figure 4**). Dozens of birds were observed around this bank but it

is not known how many burrows were actually occupied at the time. No subsequent surveys of the colony have been conducted. Landfill manager Ross Wallace (pers. comm.) reported seeing a small number of swallows around the bank in the summers of 2012 and 2014. He also noted that the colony had been active there for a number of years prior to 2011.

Bank Swallow is a colonial nesting species that is dependent on an earthen cliff face that is steep and high enough to prevent access by predators. Some level of erosion is necessary to maintain a shear bank face, but not so rapid as to erode out the nests during the nesting period.

Bank Swallow was only designated as Threatened in Ontario in June of 2014 and therefore was not a listed species during field investigations nor at the time of the EA (AECOM 2012) or previous EIS (AECOM 2014). It was addressed however because an active Bank Swallow colony qualified as a Significant Wildlife Habitat feature in MNR (2012) and therefore needed protection.

6.1.4 Eastern Meadowlark and Bobolink

Eastern Meadowlark has been listed as Threatened Species federally by COSEWIC (2015) and provincially by COSSARO (MNRF 2015). Eastern Meadowlark is an open country bird that nests in relatively extensive old fields, meadows and hayfields which are dominated by grasses and forbs. It will use meadows with some shrub cover but does not inhabit thickets. Four occupied territories were noted during breeding bird surveys all southwest of William Mooney Road in the series of fields that are in the early stages of succession following abandonment of former farmland. The nearest territory was approximately 200 m from the edge of the proposed landfill footprint. The landfill expansion area consists of cultivated cropland that does not provide suitable habitat. Any field habitat that occurs on site is quite sparse and degraded or not extensive enough to support nesting Eastern Meadowlark. As a result it is not expected that the proposed landfill expansion will have any impact on Eastern Meadowlarks or their habitat.

The provincially Threatened Bobolink (*Dolichonyx oryzivorus*) often occurs in the same locations where Eastern Meadowlark is present and therefore was specifically searched for. The breeding bird survey was conducted on two dates in early and mid June at an appropriate time of year when this species would have been present. Surveys adequately covered the open field in broad transects roughly 250 m apart. No Bobolinks were encountered and furthermore the habitat within the proposed landfill expansion is similarly not suitable for the species.

6.1.5 Blanding's Turtle

Blanding's Turtle (*Emydoidea blandingii*) has been listed as Threatened Species federally by COSEWIC (2015) and provincially by COSSARO (MNRF 2015). None were observed through

the course of field investigations, however an adult was observed and photographed within 2 km of the proposed landfill expansion area in the summer of 2014. Details of this observation were provided by the Kemptville District staff of MNRF.

MNR (2013) has prepared a general habitat description for identifying Blanding's Turtle habitat. Three habitat categories are identified which are:

Category 1 ..... nest or overwintering site and buffer of 30 m

Category 2 ..... wetlands up to 2 km from an occurrence as long as wetland units are within 500 m of each other and 30 m buffer surrounding these wetlands

Category 3 ..... area from 30 to 250 m surrounding these wetlands up to 2 km from an occurrence

The Blanding's Turtle occurrence was to the south of the site and therefore wetlands on the south side of the existing landfill and on the WM property would qualify as Category 2 since they occur within 500 m. Category 3 habitat is also present on the property for lands extending 250 m surrounding those wetlands.

These wetlands are more than 500 m from the nearest wetland unit within the footprint of the proposed landfill expansion area. The wetlands on the proposed landfill expansion area are situated within 2 km of the Blanding's Turtle record but are more than 500 m from the nearest Category 2 area and therefore are not Blanding's Turtle habitat. Those wetlands were formed as a result of past excavating and therefore are not strictly natural. We have submitted habitat mapping to MNRF Kemptville and have discussed it on a conference call with MNRF area biologists Kerry Reed and Shaun Thompson on March 9, 2015. They agreed with our mapping and concluded that the wetlands in the proposed expansion do not qualify as Blanding's Turtle habitat because of the separation.

6.1.6 Flooded Jellyskin

Flooded Jellyskin (*Leptogium rivulare*) is a lichen species that is designated as Threatened under the Ontario Endangered Species Act (MNRF 2015). It typically grows on tree trunks in seasonally flooded swamps. This species was known from only three locations in the province but in the past few years has been discovered in a number of locations in eastern Ontario (Brinker and Lewis 2013). MNR in their review comments on the final EA in 2012, requested that a specific survey be conducted for the Flooded Jellyskin since they believed that potentially suitable habitat may occur on site. A survey of deciduous seasonally flooded swamps within and immediately surrounding the proposed landfill expansion area was conducted on

September 26, 2013 by an AECOM ecologist. Results of the survey were provided to MNR who were then satisfied that Flooded Jellyskin is not present on site.

6.2 Significant Wetlands

No provincially significant wetlands occur on the site but one is situated nearby. Portions of the Provincially Significant Goulbourn Wetland have been mapped by OMNR in the core natural area approximately 400 m southwest of the landfill property at its closest point and more than 600 m from the closest point of the proposed landfill footprint.

There are several non-regulated wetland features within the on-site study area which include a deciduous swamp unit on the north boundary that extends onto the adjacent property, a pond and marsh of non-natural origin located in the old aggregate pit as described in section 4.3. There are also several units of marsh, thicket swamp and pond also of man-made origin on the north side of the existing landfill, and are apparently fed by surface runoff. These wetlands all form functional amphibian breeding areas.

MVCA (2010) confirmed that wetlands within the landfill property are not included on any of their mapping schedules and are not regulated by the MVCA and therefore are not significant wetlands. Although not regulated, they may provide important functions in regard to recharge functions or habitat for wetland dependent wildlife.

6.3 Significant Woodlands

The Natural Heritage Reference Manual (OMNR 2010) provides a number of criteria for the identification and evaluation of significant woodlands. Under the Planning Act, the Province provides guidelines in identifying significant woodlands, but it is the responsibility of the planning authority (i.e., the local or regional municipality) to complete the identification, evaluation, and designation of these features.

Section 2.4.2 of The Ottawa Official Plan OPA 76 (2009) defines Significant Woodlands in the rural area as woodlands that combine all three features listed below in a contiguous, forested area:

i. Mature stands of trees 80 years of age or older; and
ii. Interior forest habitat located more than 100 m inside the edge of a forest patch; and

iii. Woodland adjacent to a surface water feature such as a river, stream, drain, pond or wetland, or any groundwater feature including springs, seepage areas, or areas of groundwater upwelling;

As discussed in Section 4.3 the Significant Woodland shown on **Figure 3** identifies the areas that are mapped on Schedule L3 of the City of Ottawa OP and areas that meet the Significant Woodland criteria but had not been previously mapped.

6.4 Significant Valleylands

Valleylands perform important ecological functions (e.g., diverse habitats in valleylands due to microclimate variations) as well as impart cultural importance. No significant valleylands or valley features were identified in the study area.

6.5 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is covered in Section 2.3.1 of the Natural Heritage Policies of the PPS. The four principle components are identified and described in the Significant Wildlife Habitat Technical Guide (OMNR 2000). These are:

a) Seasonal Concentrations of Animals;
b) Animal Movement Corridors;
c) Rare Vegetation Communities or Specialized Habitats; and
d) Habitat of Species of Conservation Concern.

The following sections provide an assessment of existing conditions against the four component parts of Significant Wildlife Habitat under the PPS (OMNR, 1999). Note that “Habitat of Species of Conservation Concern” does not include Threatened or Endangered Species.

6.5.1 Seasonal Concentrations of Animals

Some species of animals gather together from geographically wide areas at certain times of year. This could be to hibernate or to bask (e.g., some reptiles), over-winter (e.g., deer yards) or to breed (e.g., colonial birds). Maintenance of the habitat features that result in these concentrations can be critical to sustaining local or sometimes even regional populations of wildlife.

Approximately 100 Bank Swallow nesting burrows were observed on a steep exposed earthen bank within the existing landfill property, and the south edge of the proposed landfill footprint.

Dozens of birds were observed around this bank but it is not known how many burrows were actually occupied at the time. Bank Swallow is a colonial nesting species. The location is important since there are a large number of breeding individuals that will forage over a large distance away from the site and therefore it is a concentration. The birds are dependent on an earthen cliff face that is steep and high enough to prevent access by predators, yet subject to some level of erosion that maintains a face, but not so rapid as to erode out nests. A colony of Bank Swallows of this size would likely qualify as Significant Wildlife Habitat (OMNR 2000).
In December 2006 a small group of White-tailed Deer was observed in the forest north of the property boundary. The conifer trees in this section of the site likely provide good wintering habitat for a small number of deer due to the shelter provided by the trees. There is much more extensive conifer forest west of Highway 417 which would make better habitat. None of the study area has been mapped as a deer wintering area by OMNR and therefore it is not regarded as significant.

6.5.2 Animal Movement Corridors

Landscape connectivity (often referred to as “wildlife corridors”) has become recognized as an important part of natural heritage planning and a wide range of benefits have been attributed to the maintenance or re-connection of the natural landscape. In essence, corridors allow animals to move between areas of high habitat importance. Examples of corridors include wooded areas connecting forest patches, river valleys, streams and shorelines. Conservation of distinct habitat types to protect species is not effective unless the corridors between them are also protected.

Through air photo interpretation, a review of potential linkages among the on-site, site vicinity and regional study areas and other adjacent core areas was assessed. These linkages would be the routes that have the best opportunity for wildlife movement and dispersal of vegetation.

Within the proposed landfill expansion area there is undoubtedly some movement of wildlife between the woodlots on the north and south sides. However this is no corridor of connecting vegetation since active cropland occurs between the two wooded areas. Therefore this corridor would not constitute significant wildlife habitat for animal movement corridors. Furthermore, the proposed landfill footprint will not prevent wildlife from moving between the woodlots that will remain on the north and south sides of it. Wildlife will still be able to move on the west side of it.

6.5.3 Rare Vegetation Communities or Specialized Habitats

Rare vegetation communities apply to the maintenance of biodiversity and of rare plant communities (rather than individual rare species). Specialized habitat conditions can include woodlands supporting amphibian breeding ponds or woodlands supporting interior-sensitive birds. Within the study area there are no rare vegetation communities; however, there are two

types of specialized habitats: amphibian breeding ponds and woodlands/grasslands supporting area-sensitive birds.

The site contains several permanent and intermittent ponds that are used by breeding amphibians. To meet the definition of amphibian breeding habitat according to MNR (2012) the area should contain at least three frog or toad species and a minimum of 20 breeding individuals. **Figure 4** shows that five breeding ponds within the area affected by the proposed landfill expansion contained five amphibian species and more than 20 individuals. These sites qualify as SWH under this criterion. The Wood Frog was only found in the ash swamp (SWD2-2a), and Northern Leopard Frog was recorded at only two ponds. The other four species were recorded at several sites on the landfill property. Most of the amphibian species breed in the ponds but spend most of the active season in the adjacent woodlands or old field habitat. Therefore the proximity and habitat linkage between ponds and woodlands is important to maintain functional amphibian habitat.

The forest and cultural meadow habitats in and adjacent to proposed landfill expansion support three species of forest area sensitive breeding birds as recognized by OMNR (2012). Only one area sensitive species was recorded in the proposed landfill expansion and that is Savannah Sparrow, a grassland species. The approximate locations of where the area sensitive species were recorded are all shown on **Figure 4**. To qualify as SWH under this category, forest must be a contiguous area of at least 30 ha, with at least some interior habitat defined as >200 m from edge. The contiguous forest on the landfill property is close to 30 ha in total area but it is quite narrow and does not contain any forest area that is more than 200 m from an edge. Similarly under the “open country bird breeding habitat” criteria, a grassland area must be at least 30 ha in area to qualify as SWH. Meadow on the WM site is considerably less than 30 ha. Consequently no SWH woodland bird breeding or open country bird breeding habitat are present.

6.5.4 Habitats of Species of Conservation Concern

This category includes species that may be locally rare or in decline, but that have not reached the level of rarity that is normally associated with Endangered or Threatened designations. The Significant Wildlife Habitat Technical Guide (OMNR, 2000) suggests that the highest priority for protection be provided to habitats of the rarest species (on a scale of global through to local municipality); and that habitats that support large populations of a species of concern should be considered significant. Apart from the Endangered and Threatened species already discussed in Section 5.1, no Special Concern species at risk were encountered, and no other species were identified as regionally or locally significant.

A summary of SWH components represented on the land subject to the proposed landfill expansion is shown in **Table 5** below. Significant Wildlife Habitat only applies to Seasonal

Concentrations of Animals for the Bank Swallow colony and specialized habitats for amphibian breeding habitat.

Table 5. Types of Significant Wildlife Habitat Present at WCEC

SWH Component	Location	Type	Meets SWH
Seasonal Concentrations of Animals	On-site Adjacent Lands	Bank Swallow nesting colony Deer wintering habitat	Yes No
Animal Movement Corridors		Wildlife corridor	No
Rare Vegetation Communities		None found	No
Specialized Habitats	On-site On-site	Amphibian breeding habitat Area Sensitive bird habitat	Yes No
Habitats of Species of Conservation Concern		None found	No

6.6 Significant Areas of Natural and Scientific Interest

MNR identifies two types of ANSIs (life science and earth science) which have been identified on the basis of scientific surveys and evaluation criteria. Because these identified ANSIs are a critical complement to provincial parks and conservation reserves, such ANSIs represent important natural features that are not found in protected areas. No significant ANSIs were identified in the study area.

6.7 Fish Habitat

No fish habitat was identified in the proposed expansion area as no watercourses are present. South Huntley Creek which provides poor quality fish habitat lies 40 m to the northwest of the property boundary and 120 m from the proposed landfill footprint.

6.8 Significant Features Summary

The only features that were identified following the criteria of the Provincial Policy Statement are Significant Woodlands for the woodlot on the north side of the proposed landfill footprint, and Significant Wildlife Habitat for the wetlands that provide amphibian breeding habitat.

Habitat for a Threatened species is present. An active Bank Swallow colony occurs within the area affected by the proposed expansion although not on the actual landfill footprint. Three other Threatened species and one Endangered Species have been recorded within 1 km of the proposed landfill expansion, however they are sufficiently removed or buffered that no impacts to those species are anticipated.

7. Impacts on the Terrestrial Environment

The significance of the existing environment that will be potentially affected by the proposed landfill footprint is evaluated in the context of the criteria identified in the PPS.

As noted in AECOM (2011) there are no permanent or intermittent streams within the proposed landfill expansion. As such, there are no predicted changes in water quality, aquatic habitat or aquatic biota. The nearest fish habitat is an upstream section of South Huntley Creek located approximately 120 m away from the proposed landfill footprint. Consequently, the following discussion of potential effects pertains to the terrestrial environment.

Probably the most significant impact from most developments is the removal of natural vegetation and resulting loss of habitat for native wildlife and floral species that depend on that habitat. The proposed landfill footprint on **Figure 6** shows the natural vegetation that would be removed which amounts to 24.9 ha. The total footprint of the landfill expansion and all associated facilities is approximately 68 ha.

A summary of the vegetation loss is listed on **Table 6**. The forest and wetland are higher functioning in that they are older, more complex, provide more structure and better habitat than the cultural meadow. Cultural meadow occurs in a former gravel pit or in disturbed areas in the vicinity of the existing landfill. Meadow can develop rapidly on abandoned land, is largely comprised of non-native plants that are able to colonize opportunistically and therefore is considered less significant than woodland or wetland vegetation.

Table 6. Summary of Vegetation Removals

ELC Community Type	Total Vegetation To Be Removed
Forest (FOC, FOD, FOM, CUP, CUW)	**9.50 ha**
Wetland (SWT, MAM, MAS, SAS)	**4.00 ha**
Cultural Meadow (CUM)	**11.40 ha**
Total Vegetation Removed	**24.90 ha**

The complete access road will be constructed in the first phase of landfill development. Hence forest removal to at least accommodate this road will need to occur at the outset.

7.1 Types of Effects on Natural Environment

The impacts to natural heritage features occur during two stages. First, during the construction stage natural vegetation is cleared resulting in habitat being removed. This is the period of most

significant impact, but other impacts continue to occur during operations and maintenance of the facility.

7.1.1 Construction Effects

This section outlines the project-related impacts on vegetation and wildlife based on typical construction works.

7.1.1.1 Vegetation

Vegetation clearing (and associated habitat removal) is required to accommodate the landfill and all associated facilities is the primary direct effect related to construction. Clearing is accomplished with a crew using chain saws to fell the larger trees. Then a bulldozer or other heavy equipment push down and topple smaller trees. Large stumps are pulled or pushed out of the ground and then the topsoil layer is scraped off. Currently the plan is to remove the woodlot in a single sequence.

The direct removal of forest vegetation has the secondary effect of creating new forest edges that expose the retained vegetation to the effects of increased light, noise, wind, sun, salt spray and are also subject to colonization by invasive non-native plant species. While the creation of the edge is a direct construction effect, the edge effects that influence the retained vegetation are indirect effects that extend into and affect tree health some distance into the woodland. The edge effects would apply to the woodlot on the south side of the proposed landfill footprint that will be partially removed, as well as the woodlot on the north side where the perimeter access road will cut into the edge of the feature.

In addition to the effects described above, the construction of the landfill may affect health of retained vegetation by accelerating erosion on steep sloped or spills of contaminants, fuels and other materials.

7.1.1.2 Wildlife

Construction can have a number of direct effects on wildlife. For example, construction will displace individuals or species wherever their habitat is removed. It may also obstruct their movement patterns across the landscape. These construction effects can have secondary effects by fragmenting habitat and isolating portions of wildlife populations that were formerly contiguous.

Direct construction effects are generally associated with:

- Habitat loss or modification;
- Wildlife injury or mortality due to vehicles and construction equipment; and
- Effects on animal movement.

1. Wildlife Habitat Loss

Loss of wildlife habitat may result in loss of species, fragmentation of habitat and of wildlife populations, reduction of wildlife habitat quality, destruction of active nests of migratory birds, loss of amphibian breeding and foraging habitat. Construction of the landfill will result in the direct removal of some terrestrial forest, field and wetland vegetation and therefore displace the wildlife that lives in the portions of those habitats that are removed.

In particular the landfill expansion will result in removal of 4 ha of wetlands that include ponds that support five species of breeding amphibians. Many of the amphibians that breed in the ponded wetlands likely move into the adjacent forest area (that is proposed for removal) outside of the breeding season. Therefore both breeding, non-breeding and hibernation habitat is being lost.

2. Wildlife Mortality or Injury

Construction typically involves the clearing of existing vegetation followed by the removal of overburden soils (grubbing). All activities require the operation of heavy machinery. These activities have some potential for wildlife injury or mortality within the construction zone. Wildlife species vary in their vulnerability to construction-related mortality. Three factors largely determine the potential for wildlife to be affected:

- wildlife sensitivity to human disturbance;
- wildlife dispersal ability to evade or avoid disturbance; and/or
- timing of construction activities.

Species that are sensitive to disturbance and are capable of departing areas of increased human activity (i.e., large and medium mammals and birds) are less affected by construction. Species that avoid humans through mechanisms other than flight and/or move too slowly to flee disturbance (such as small mammals and amphibians) are at greater risk of mortality from construction activity.

Timing also determines the vulnerability of wildlife to construction-related mortality. The greatest potential for adverse effects is during the spring and summer, when migratory

birds are breeding, when most species (particularly mammals and birds) are rearing young in nests, burrows or dens, and when all species are most active, thus increasing their potential to enter into the construction zone. Wildlife vulnerability to construction is reduced during the fall and winter because migratory birds have left the study area, young-of-the-year have dispersed from nests, burrows and dens, and remaining species are generally less active and thus less likely to move into the construction zone. However, when species are dormant in hibernation, they have no opportunity to move away and will be inadvertently killed when vegetation is cleared and the ground layer grubbed.

3. <u>Effects on Animal Movement</u>

Terrestrial wildlife species will vary in their response to crossing the construction zone. Tolerant highly mobile species will continue to cross, but will likely adapt their movements to non-construction periods such as night. Less mobile species will be deterred, or may seek other routes if available. Adjustments of wildlife movement can be anticipated during the construction period but will be nearly impossible to document, since wildlife movement corridors are difficult to confirm.

Localized movement of amphibians between breeding sites and into adjacent forest where many of them likely forage outside of the breeding season will be disrupted as both breeding and summer habitat will be removed.

7.1.2 Operation and Maintenance Effects

7.1.2.1 Vegetation

The operation and maintenance of the landfill may also result in secondary effects to the adjacent vegetation features that are retained after clearing has occurred. The potential secondary effects to wetland, forest and other adjacent vegetation that may occur during the operation and maintenance of the landfill are outlined below:

- Spills of contaminants, fuels and other materials that may reach natural areas;
- Damage from excessive or improper application of herbicides and pesticides for vegetation management requirements; and
- Damage to adjacent natural vegetation from roadway maintenance activities such as salting and sanding, structure/culvert repairs, etc.

7.1.2.2 Wildlife

Operational and maintenance activities could result in secondary effects to wildlife including: mortality from equipment when wildlife moves from adjacent habitats into active areas. Noise, vibration, lighting and human presence may cause some wildlife to avoid immediately adjacent habitats.

7.2 Effects on Significant Environmental Features or Functions

7.2.1 Significant Habitat of Endangered and Threatened Species

The Threatened Bank Swallow nesting colony is situated on a steep faced earthen bank between the existing landfill and proposed landfill footprint. The colony has some resilience to human presence since it was functioning near where heavy equipment was operating at least occasionally and only 20 m from a frequently used landfill access road.

A stormwater management pond, the main landfill access road and a public drop-off are all proposed in close proximity to the location, therefore there will be more intensive human activity. Some grading below the bank face occurred in 2013 as part of the former gravel pit closure plan, but will be reworked to ensure that the bank is inaccessible to potential predators. Even if the bank face remains intact, it is not certain if the colony would tolerate the noise, dust, and vibration from construction. Nevertheless this bank has suitable characteristics and is being used by nesting Bank Swallows. Furthermore the birds have some tolerance of human activities, therefore retaining and working with the bluff is a better alternative than trying to create a new feature somewhere else that Bank Swallows would use for nesting.

The other Endangered or Threatened species do not occur within the immediate area of the proposed landfill footprint. The Butternuts are more than 500 m away. They are sufficiently well removed from any of the activities involved with the expansion that there will not be any impacts and no additional mitigation are required.

The nearest territory of Eastern Meadowlark was approximately 200 m from the edge of the proposed landfill footprint and on the opposite side of William Mooney Road. There is not likely much movement of the birds across the road onto the landfill property as there are no hayfields or suitable extensive meadows on the landfill site. The most important consideration for maintaining the birds would be to ensure that a fairly extensive block of old field habitat remains but those lands are not owned by WM.

The abandoned barn used by nesting Barn Swallows is about 200 m from the proposed landfill footprint and also on the opposite side of William Mooney Road. The expansion is not anticipated to impact Barn Swallows using the barn or foraging activities of the birds, consequently there are no anticipated impacts and no mitigation is required. The barn occurs on lands that are not owned by WM and therefore it is not their responsibility to maintain this habitat.

The Blanding's Turtle observation was approximately 1 km from the proposed landfill expansion and it is separated by a busy highway, a chain link fence and closed landfill mound. Therefore it is unlikely that Blanding's Turtle is present on site or a turtle from that location would be able to get to the area of the proposed landfill expansion. Nevertheless potential Blanding's Turtle habitat was assessed following MNR (2013) protocols and it was determined not to be present in the proproposed landfill expansion area (see section 6.1.5).

As long as the breeding habitat of the Threatened species lie more than 120 m from any proposed developments or land alteration there are no issues. If nesting habitat is located on-site or within 120 m, MNR Species at Risk Biologist should be contacted and informed to provide direction.

7.2.2 Significant Wetlands

The nearest area that is potentially part of the Provincially Significant Goulbourn Wetland lies at least 600 m from the nearest point of the proposed landfill footprint. Consequently it is well beyond the 120 m limit that requires a study to determine suitable buffers. It is also a sufficient distance that no impacts to the functions and features of the wetland are anticipated. No mitigation or special precautions are required.

There is some non-significant wetland proposed to be removed with the landfill expansion. In total 4.0 ha of wetland are proposed for removal. These wetlands were created as a result of past human activities (former gravel pit and storm water collection ponds) and therefore are not provincially significant. Nevertheless they do provide habitat for wetland wildlife and flora.

7.2.3 Significant Woodlands

The area of Significant Woodland is shown on **Figure 3** as described in Section 6.3. The landfill expansion will remove approximately 9.0 ha of Significant Woodland. Most of this removal (8.5 ha) will be from the block of forest on the north side of the existing landfill that includes a mix of coniferous (FOC4-1), mixed (FOM7-2) and deciduous (FOD8-1) forest communities. A small area of forest (0.5 ha) will also be removed from the edge of the woodlot on the north side of the rezoning application consisting mainly of fresh-moist poplar forest (FOD8-1) which is also

Significant Woodland. Another 0.3 ha will be removed from the woodlot in the northeast corner which does not qualify as Significant Woodland.

In addition the woodlot within the proposed landfill expansion area contains 1.34 ha of interior forest habitat that is greater than 100 m from an edge. The proposed landfill will remove all of this forest interior.

At the north end, a narrow strip of woodlot will be removed from the north side of the proposed landfill. This is young deciduous forest that may be fairly resilient to edge effects but it provides a buffer to an upland to the Green Ash – buckthorn swamp (SWD2-2a) and therefore the swamp will be exposed at its edge. There also may be some changes in surface drainage to the swamp.

7.2.4 Significant Wildlife Habitat

7.2.4.1 Seasonal Concentrations of Animals

The Bank Swallow nesting colony as qualifies as Significant Wildlife Habitat but is discussed under section 7.2.1 since it is now designated as Threatened.

7.2.4.2 Rare Vegetation Communities or Specialized Habitats

Within the study area there are no rare vegetation communities; however, there are the presence of specialized habitats in the form of amphibian breeding ponds on the proposed landfill footprint. In total 4.0 ha of wetland habitat that supports five species of breeding amphibians will be removed, consisting of a combination of cattail shallow marsh, mixed mineral meadow marsh, willow thicket swamp and open water aquatic (pond). The calling amphibians were recorded from six small individual wetland units that will be removed.

All of the amphibian species also breed in other nearby wetlands including on the south side of the existing landfill, and the swamp woodlot on the north side of the rezoning application. Consequently the overall function of amphibian breeding for all of these species will remain. However the loss of this area of breeding habitat is likely to result in the reduction of the amphibian population on the immediate site, particularly as some of the nearby forest and field which provide amphibian summer foraging habitat will also need to be removed.

The amphibian breeding areas to be removed are either the direct result of, or have been altered by, human land use activities in the past. The wetlands consist of marsh and open water pond in an early successional stage that contains a low diversity of plant species. It shows that amphibians have been able to colonize these wetlands relatively recently and therefore should

also be able to move into new sites of suitable habitat if they become available. Marsh and pond habitats are relatively easy to restore or create in another location, as a means of maintaining the function by shifting the location instead of eliminating it.

7.2.5 Fish Habitat

No watercourses are present within the proposed landfill expansion area, consequently no fish habitat occurs on site. South Huntley Creek which provides poor quality fish habitat lies 40 m from the boundary and 120 m from the edge of the proposed landfill footprint (i.e. grading limit). The stream lies within cultural thicket vegetation which provides some buffer. The adjacent area in the 120 m setback from the landfill is proposed to be a forest compensation area, where no grading is to occur. As a result there will be no impacts to fish habitat and no mitigations required other than standard sediment and erosion control.

7.2.6 Tree Conservation Report

Related to the loss of Significant Woodland is the loss of tree cover on the site as a result of the proposed landfill expansion. The City of Ottawa requires a Tree Conservation Report (TCR) where proposed development results in the loss of tree cover. Typically a TCR requires individual tree assessment of trees to be removed. In this case the landfill requires removal of a 9 ha forested area which would include several thousand trees with a >10 cm diameter at breast height (DBH). City Environmental Planner Sami Rehman (pers. comm.) agreed that a tree by tree assessment is not required here but that tree area to be removed should be characterized in enough detail to understand what is being lost.

Portions of three forest types are scheduled to be removed. Fresh-moist White Cedar coniferous forest (FOC4-1) forms a dense monoculture of White Cedar ranging mostly from 20 to 40 cm DBH and a canopy of 15 to 20 m tall. The fresh-moist White Cedar – hardwood mixed forest (FOM7-2) is quite similar except that approximately 25% of the canopy consists of deciduous trees (primarily Trembling Aspen, Paper Birch or Green Ash). Shrub and ground layers are sparse where the cedar canopy is dense. Glossy Buckthorn is widespread and abundant in the shrub layer wherever there is sufficient light. The east portion of the woodland that is proposed for removal is a fresh-moist Poplar Deciduous Forest (FOD8-1) dominated by Trembling Aspen with some Balsam Poplar. The trees have an average DBH of 30 cm and the canopy averages 20 m. The ground layer is more developed than in the coniferous or mixed forest. In addition some sections of hedgerow would be removed that consist of several tree species including American Elm, American Basswood, Black Cherry and Green Ash.

8. Mitigation to Minimize Environmental Impacts

Identified potential effects and recommended mitigation or compensation measures as well as net effects are described in detail in the sections below.

The intent of the design is to avoid affecting significant environment features and functions. Where impacts to terrestrial ecosystem features cannot be avoided, mitigation measures are recommended to negate or minimize negative effects. In situations where appropriate mitigation measures are not available, or significant net adverse effects will remain following the application of mitigation, compensation may be applied to offset the negative effect through replacement of the feature/function elsewhere on site, or off-site if necessary.

8.1 General Construction Mitigation

During construction, environmental protection and mitigation involves: implementation of standard construction practices; conformance with commitments made during the environmental assessment process; and recognition of additional control measures that may be identified through good construction environmental practice. These mitigation measures range from Best Management Practices (BMPs) to site specific strategies that should be incorporated to reduce the residual effects across the Study Area.

8.1.1 Clearing and Grubbing

Mitigation measures will be applied during clearing and grubbing activities to minimize removal of native vegetation; minimize impact to retained features, maintain water balance and avoid native soil disturbance. Examples of measures that should be applied where applicable include:

a) Vegetated areas bordering the working area will be protected with temporary tree protection and sediment fencing as determined in the final grading plan. Equipment, storage of materials, and other construction activities will not be permitted in these zones. Consideration should be given to ensuring fencing does not create a wildlife movement barrier;

b) Tree removal will be restricted to the working area. Vegetation removals associated with clearing, site access and staging will occur outside the key breeding bird period identified by Environment Canada for migratory birds (typically April 20 to July 31 for this area) to ensure compliance with the *Migratory Birds Convention Act*, 1994 (MBCA);

c) Although strongly discouraged, if works must be conducted during the breeding bird season, a nest survey will need to be conducted by a qualified avian biologist prior to commencement of works to identify and locate active nests of species covered by the MBCA. Clearing cannot occur where active nests are found until the young birds have fledged from their nest;

d) Clearing of the woodlot should progress from east to west, thereby allowing fleeing wildlife to escape into the remaining woodlot on west side;

e) Tree grubbing will be restricted to the required construction activity zone. Where possible, tree stumps will be cut flush to the ground and grubbing avoided to minimize soil disturbance, particularly in erosion prone areas;

f) Trees will be felled in a manner that avoids damaging other standing vegetation that is being retained;

g) Cut and grubbed material will be disposed of through chipping but large logs can be salvaged for wood if feasible. Where possible, cut branches may be piled into brush piles for wildlife habitat. Wood chip material may also be used in the edge plantings (at the identified edge management and landscape areas). This material will help retain soil moisture, promote colonization of native species and prevent weed spread;

h) Forest topsoil that can be re-spread within 6 months of initial storage will be used wherever practical and feasible at forest edge planting sites and stormwater management facility margins. This will be a practical measure to re-cycle substrates, maintain soil moisture, and provide a good growing medium for plantings; and

i) After clearing, the edges of the cleared area shall be checked and any trees damaged will be repaired or removed. An arborist is to inspect damage to trees.

8.1.2 Sediment and Erosion Control

Mitigation measures will be used for erosion and sediment control to prohibit sediment from entering adjacent water bodies, wetlands and forested areas. The primary principles associated with erosion and sediment control (ESC) protection measures are to a) minimize soil mobilization; b) minimize the duration of soil exposure; c) retain existing vegetation where feasible; d) keep runoff velocities low; and, e) trap sediment as close to the source as possible.

It is recommended that ESC measures developed during subsequent design phases follow the most current standard industry practices available. For example, the *Greater Golden*

Horseshoe Area Conservation Authorities' Erosion and Sediment Inspection Guide (2008) provides comprehensive direction for selection, deployment and inspection of ESC techniques. The following list summarizes the basic principles and performance guidelines that will be employed during the development of detailed design and contract documents and drawings.

a) Erosion and sediment control measures will be installed prior to construction and maintained within their effective limits throughout the construction and until the restoration of disturbed vegetation, rock revetments or similar are successfully completed;

b) Erosion and sediment control structures will be designed, installed, maintained, and removed according to *Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites (1987);*

c) Earth stockpiles shall be enclosed with appropriate sediment and erosion control fencing;

d) Runoff from material stockpiles or site de-watering will be filtered through an appropriate device (temporary settling facility, filter bag, etc.) before release;

e) Sediment control structures will be regularly inspected, particularly after storm events, and repaired as required. The structures will be cleaned out when accumulated sediment reaches half the design height;

f) Re-stabilize and re-vegetate exposed surfaces as soon as possible, using native vegetation seed mixes and plantings or other appropriate cover, in consultation with agencies, and;

g) Adhere to permits, acts, guidelines: *Ontario Water Resources Act* and *Federal Fisheries Act*.

1. Grading

Mitigation measures will be used during grading to minimize the overall grading footprint and keep gradients low. The primary principles associated with grading mitigation measures are similar to those described above for clearing/grubbing and sediment and erosion control.

a) The design completed in subsequent design phases will ensure that drainage from any unstabilized surface is captured and adequately filtered prior to discharge to natural areas, including receiving drainage features;

b) Erosion and sediment control measures will be designed and then installed on site prior to any grading;

c) In dust sensitive areas, dust suppression methods (water or other as appropriate) will be used as required to control off-site migration of particulates; and

d) Adhere to permits, acts, guidelines: Dust suppressant license required from MOE for use of registered dust suppressants other than water.

2. <u>Equipment Maintenance and Materials Management and Disposal</u>

Mitigation measures will be used during equipment maintenance activities and material management to avoid release of chemicals and other materials from construction equipment and construction areas into natural areas and watercourses. These include:

a) Refuelling will not be permitted within 30 m of any woodland, wetland or watercourse, or the top of bank areas; and

b) Adhere to permits, acts guidelines: Fuels and hazardous materials shall be stored and handled in compliance with Ontario Regulation 347 of the EPA, the Gasoline Handling Act, Ministry of Consumer and Commercial Relations.

8.2 Specific Mitigation and Enhancements

The following mitigation measures are recommended and provided to minimize environmental impacts to natural features and to compensate where significant features are proposed to be removed.

The landfill will result in the permanent removal of approximately 24.9 ha of natural vegetation communities (**Table 6**), in particular consisting of forest (9. ha), and wetland (4.0 ha). The opportunity to offset vegetation removals through restoration/creation and/or enhancement was identified during the preparation of the EA (AECOM 2012) and opportunities will continue to be explored by WM and plans developed, as appropriate and feasible, in subsequent design phases.

Re-creating biologically complex forests and wetlands is not realistically feasible, at least not in the short term. However, habitat creation can embody a number of design principles targeted at initiating forest (or other habitat) development through a combination of terrain preparation, nodal plantings, seedbank or plant salvage, natural seeding from nearby sources, quick cover initiation, and protection from herbivores. In addition, restoration, creation or enhancement at a new site can restore or create new functions and values which are equal to or even exceed those at the original site.

8.2.1 Forest Edge Management Strategy

Edge management measures will be implemented to protect newly created forest edges where the adjacent retained habitat is large enough to warrant this measure. These measures will mitigate effects of increased sun, wind and change in humidity and shade at a newly opened forest edge to protect the overall forest area that will be retained. Older undisturbed forests are more susceptible to edge effects than younger forests.

The proposed landfill expansion will require the removal of most of the forest block (8.5 ha) (**Figure 7**) resulting in a new forest edge of approximately 310 m in length. The retained forest stand will be approximately 80 m wide, along the east side of William Mooney Road. The forest here consists primarily of White Cedar Coniferous Forest (FOC4-1) and fresh-moist White Cedar – hardwood mixed forest (FOM7-2), which is about 75% White Cedar, mixed with Paper Birch and Trembling Aspen. The White Cedar forms a dense canopy with heavy shade and therefore the ground layer is rather sparse. Mature closed canopy White Cedar is particularly prone to edge effects and therefore edge management is important along that edge.

Mixed forest (FOM7-2) in approximate area of proposed new forest edge.

Note abundance of Glossy Buckthorn in the understorey shrub layer.

The other location where a new forest edge will be created is along the south and east fringes of the swamp along approximately 250 m near the north property boundary (**Figure 7**). Here the forest is a poplar deciduous forest (FOD8-1) that is younger and therefore more resilient to edge effects than the older cedar dominated forest. However it occurs immediately along the edge of the deciduous swamp unit SWD2-2a which makes it more sensitive.

The new edge of the forest will be the grading limit of the proposed landfill. If timing of landfill development allows, pre-stressing a forest edge is the best way to consolidate a firm forest edge. It entails cutting a narrow strip 15 m wide, along the new edge at least two years before the forest area is removed and therefore is possible with a long term schedule. The concept of the pre-stressing is depicted on Drawing L2 in AECOM (2014). The trees should actually be cut 5 m further into the forest than where the edge needs to be to allow regeneration of robust young woody regrowth that will form protection from the mature forest to the west. Trees within this 5 m wide swath should be cut down to just above ground level. Roots should be left intact and no grubbing should occur in this zone. Large logs should be removed from the swath (and ideally salvaged for wood) while smaller branches should be chipped and spread in the linear swath clearing. Best time to cut trees is in early autumn outside of breeding season but before animals are in hibernation. Animals would be dormant and would have no opportunity to move away if clearing occurs in winter.

It is expected that woody shoots will sprout from the deciduous stumps during the first growing season after the trees are cut. Conifers generally do not sucker from their stumps but there is likely a good seedbank of White Cedar and therefore seedlings are likely to sprout in the newly opened clearing within two years.

It is also likely that much regrowth will consist of the highly invasive Glossy Buckthorn as this species is already well established within the woodlot, and it adapts well to disturbance. This non-native plant is considered a principal invasive species by White, Haber and Keddy (1993). This shrub produces abundant berries that fall to the ground and therefore the seedbank likely contains a high component of Buckthorn seeds. Disturbance to the soils along the new edge is likely to develop into even denser Glossy Buckthorn. The buckthorn will need to be controlled early to ensure that it does not dominate the new edge (although complete removal of this species is an unrealistic target).

When the new sprouts have begun growing they should be sprayed with a non-persistent systemic herbicide such as Garlon® or Roundup®. This should be done carefully with hand sprayer on a calm day to avoid or minimize contact with the other sprouting species. It should be conducted early in the growing season (late May / early June), after leaf out but before the suckers have grown too long. The degree of die-off and regrowth of the buckthorn should be monitored in the middle of the growing season to determine success. A second application of the herbicide may be needed in late summer.

There is also likely to be a considerable seedbank of Glossy Buckthorn in the soil and disturbance to soil may stimulate much of it to germinate. These seedlings will develop more slowly than the suckers from stumps, however. Early in the second growing season, the edge should again be monitored for Glossy Buckthorn and other invasive plants. Presumably there should be minimal buckthorn along the edge but there may be substantial germination of seed

in which case careful spraying of the non-persistent herbicide should again be administered. The amount of buckthorn regeneration should be monitored and evaluated to determine if continual control will give desired effects.

Key edge management principles that will be developed further during subsequent design phases are as follows:

1. Temporary vegetation protection fencing will be installed at the edge of the clearing limits where the edge of a forest community is removed prior to any tree cutting. This fencing will delineate the clearing limits and prevent further intrusion into the adjacent forested habitat;
2. Tree removal will be restricted to the working area and trees should be cut such that trees do not fall into forest to be retained. Care should be taken to avoid any damage to branches of trees to be retained. Damaged branches should be cut off cleanly at their base. Tree cutting should occur outside of the breeding bird season to prevent destruction of bird nests.
3. Vegetation will be retained in areas not requiring grading or other works. Grading requirements will be reviewed during subsequent design phases to facilitate that objective;
4. Trees along 5 m out from the newly created edge will have the trunks flush cut slightly above ground level (not grubbed) to stimulate suckering regeneration that will help fortify the new edge. No materials or equipment should be stored within this area;
5. Wood chip material will be applied in the edge plantings (at the identified edge management areas) that will be developed during subsequent design phases. This material will help retain soil moisture and prevent weed spread;
6. Removal of hazard trees will be undertaken along the new edge as required to maintain safety;
7. Buffer plantings will be installed to help increase shade and reduce wind in retained vegetation, and;
8. Pre-stressing of forest edges in selected areas should be implemented if the construction schedule allows it. Pre-stressing involves cutting a 10 m wide swath along the future forest edge. On one side of swath is the protected forest but on the other side forest is temporarily retained providing shelter while the future forest edge grows in with shrubs and saplings. When the forest is cleared (two of more years later) the edge is firmly established and better able to protect the retained forest from edge effects.

8.2.2 Forest Compensation

This forest compensation plan addresses the requirement to compensate for forest that is proposed to be removed for the landfill expansion. This is also meant to satisfy the Tree Conservation Report as required by the City of Ottawa (2013b). A total of approximately 9.0 ha of Significant Woodland will be removed including an 8.5 ha forest block and another 0.5 ha along the north side of the proposed landfill (see **Figure 7**).

The goal is to create functional natural forest to compensate for the forest that needs to be removed for the proposed landfill expansion. The purpose of the Tree Conservation Report (City of Ottawa 2013b) is to retain as much natural vegetation as possible.

The objectives are:

a) To plant appropriate native plants that will eventually develop into forest
b) Provide habitat for thicket and eventually forest dependent wildlife;
c) Provide habitat for a variety of locally indigenous native flora;
d) Mimic the structure and species composition of natural forest
e) Provide natural linkage to existing natural habitats;
f) Prevent proliferation and domination by invasive plant species; and
g) Provide visual barrier to the landfill as much as possible.

Performance Objectives

The following measures are to be achieved to be able to consider the compensation enhancement project a success

1. Minimum 9 ha of planted trees and shrubs to re-establish a functional forest
2. Maintain as much interior forest habitat as possible
3. Achieve 75% survival of woody trees and shrubs in planted area
4. At five years after planting, the forest should be dominated by native woody plants (i.e. more than 75% of woody plant cover in reforestation areas are native)

Site of Planted Forest

Most of the site area will eventually be occupied by the landfill expansion but it will be developed in phases over a number of years. A detailed planting plan of forest compensation has been

prepared by AECOM (2015) in Landscape Drawings L1 to L9 which are part of this application. An 80 m wide band that is currently cultivated will form a buffer between William Mooney Road on the west and the proposed landfill to the east (Figure 7 and Landscape Drawing L6). This buffer consists of approximately 6.95 ha that is particularly well suited for forest restoration because it would provide a wildlife corridor between two existing woodlots and at the same time it would provide a visual barrier between the landfill and nearby lands screening landfill operations from the public realm. As the land was cultivated for many decades there is not likely to be a forest seedbank present in the soil, but forest lies adjacent and therefore will be a source of natural seeding to enhance the compensation forest area. Another 1.3 ha area of reforestation will be added to the northeast edge of the woodlot in Zone 4c (Figure 7 and Landscape Drawing L7). Since these two compensation areas will be situated immediately beside the edge of existing forest, they will have the effect of increasing the amount of interior forest habitat there (*i.e.* forest that lies more than 100m from the edge). The amount of interior forest created equals the amount that will be removed. The increase in functional interior forest will not occur instantly with planting but will develop gradually once the planted trees mature into a forest.

Additional plantings of native trees and shrubs are proposed in a few other areas east, northeast and northwest of the proposed landfill to make up the minimum required compensation amount and achieve the level of visual screening required. The cultural woodland along Carp Road already contains scattered trees and shrubs, therefore plantings will occur in the gaps between existing vegetation in an additional compensation area. Two smaller areas have also been identified along Richardson Sideroad to provide visual screening of the landfill. In total over 9.5 ha will be planted thereby achieving the target of no net loss of significant woodland. Table 7 indicates location and areas where planting is scheduled to occur.

Table 7. Forest Compensation Areas

Vegetation Type	Area to be Planted
Zone 3 (west and north side of proposed landfill)	7.505 ha
Zone 4 (northeast side of proposed landfill)	2.019 ha
TOTAL	**9.524 ha**

Planting locations, numbers and size specifics have been specified in the Landscape Drawings prepared by AECOM (2015). Only appropriate native species are listed in the drawings. The drawings show a mix of larger trees and shrubs in areas where screening or instant greenery are desired, and smaller seedlings in the extensive reforestation area. The strategy to implement the planting plan are described in the steps below.

Recommended Strategy

1. The forest area scheduled for removal shall be examined to identify plant material that can be salvaged and transplanted to the forest compensation area. Planting material could consist of shrubs, saplings and ground flora. Much of the forest consists of dense White Cedar where the ground flora is sparse. Deciduous or mixed stands may contain more salvageable forest ground flora as well as shrubs or saplings. If so, areas should be marked to remove plants, or to lift soil that can be moved with seed bank intact. The feasibility of salvage will need to be assessed for suitability of plant material and practicality of moving them.

2. Because of the abundance of the highly invasive (and undesirable) Glossy Buckthorn in the forest that will be removed, soil should only be moved if the buckthorn is absent or at least scarce. Otherwise a great seed source of buckthorn may be inadvertently transplanted to the compensation area.

3. Ideally plantings should be made in scattered clusters consisting of a mix of several tree and shrub species with some gaps between where some natural regeneration can occur. The clusters should be variable in composition to promote diversity. Plantings should not have uniform even spacing as this does not mimic nature. Planting patches should consist of saplings, seedlings and more advanced transplanted material to speed up natural succession across the reforestation area and to provide some protection against climatic conditions for the smaller material.

4. The planting plan includes a mix of larger trees in areas where visual screening is desirable, and seedlings in extensive reforestation areas. Whips or seedlings should be planted as bare root stock in spring before they have leafed out, or in the autumn. Plants should be watered immediately after planting, then two weeks later and then once per month over the summer of the first growing season.

5. Tree stakes are not necessary and should not be used. Small tree guards or bark wrap should be placed on the trees to prevent rodent damage but these need to be removed two years after planting.

6. A native ground cover seed mix as shown in AECOM (2015) shall be applied to areas of bare ground after the trees and shrubs have been planted.

7. The forest compensation area should be clearly delineated and signed once planted to keep it off limits to vehicles and equipment.

Management and Monitoring

Management involves taking necessary steps to ensure that the planted material achieves good survival so that it will be in the process of developing into forest. Once the wetland plants are well established, the required management is expected to be minimal unless unforeseen situations arise. Management will occur in conjunction with the regular monitoring. Monitoring is necessary to document the rate of success and to determine if and where corrective actions are needed to meet the performance objectives.

1. Plant survival and growth should be monitored. Ideally plants will be planted in spring and first monitored in late summer. If woody plants have less than 75% survival, then those plants should be replaced that autumn or in the following spring. As some mortality is likely, greater than 75% survival is considered success.
2. Plant survival and growth should be monitored annually for five growing seasons. Again plants should be replaced in autumn or spring if less than 75% survival is achieved. If mortality is unusually high due to herbivory or other causes, a shift in species or other may be recommended.
3. There is a risk that site may be colonized by some aggressive non-native plants in particular Glossy Buckthorn or Common Buckthorn. When plant survival is monitored, the extent of woody non-native plant establishment should be conducted to determine if corrective action is needed. Hand digging may be effective if the invading plants are small and limited in distribution, and should be done on monitoring visits if feasible. The application of herbicides by a licensed pesticide applicator may be required if non-native woody plants are establishing rapidly. While complete eradication of buckthorns may not be feasible, they should be controlled for the first three years.
4. It is expected that some natural succession of native plant species will occur among the planted material and this should be encouraged and documented.

8.2.3 Bank Swallow Nesting Habitat

AECOM has developed the following Bank Swallow enhancement and monitoring plan with consultation from both Environment Canada and MNRF Kemptville in January 2015.

The earthen bank currently used by nesting Bank Swallows will be retained within the landfill plan. Although it is in close proximity to the proposed landfill, maintaining the existing site is a better option than attempting to create another nesting site because of the uncertainty that a

new site would actually be colonized by the birds. The existing bank has the right characteristics since the swallows have been using it for a number of years.

The predicted timing of when landfill development will begin has not been determined and it could be several years away, consequently the colony may not be affected for some time. The colony population will be monitored in the breeding season of 2015 to establish a baseline. The population will again be monitored in the breeding season before development begins and then annually through the construction period.

The following recommendations have been made in an effort to protect the active colony at its present location.

Recommendations

1. The area above and below the bank should be clearly marked and cordoned off with snow fencing to ensure that equipment and personnel keep a sufficient distance from the colony to minimize disturbance to the birds. Fencing or other means of demarcation should be erected 10 m back from the top of bank and 10 m back from either side if possible, or along the edge of the proposed roads on these sides. In addition the area below the bank face to the storm water pond should not be accessible by personnel during the breeding season. Fence posts should not stick up to become potential perches for raptors that would prey on the swallows.

2. Heavy construction work should avoid the immediate vicinity of the nesting bluff during the breeding season of any year (May 1 to July 31).

3. Since the bank face needs to remain steep in order to continue providing a suitable nesting site, some periodic excavation at the base of the bank may be required. The physical structure of the bank should be examined each year in early spring to ensure that it is still suitable for the swallows. Excavation work, if necessary, should be done in the spring before the birds have returned from migration.

4. If the bank's face slumps, the slumped material should be excavated to rebuild the face (although this may prove very difficult to achieve).

5. The colony should be monitored during the breeding season in June during the year of construction and for the two following years to determine the number of active nesting pairs, as a gauge of success.

Monitoring Plan

Monitoring will be required to determine how the Bank Swallow is faring with the protective measures in place but also with an increased level of disturbance due to landfill expansion. Monitoring needs to be conducted on the structure of the bank face to determine its continued suitability for nesting birds. The distance from the top of bank face to the access road is approximately 15 to 20 m and eventually the face may compromise the integrity of that road. Adaptive management may be needed to protect the road and lengthen the number of years that the birds can potentially nest there.

The use of the bank by the nesting Bank Swallow also needs to be monitored to measure success of the effort to protect the bank, or determine if some other adaptive management should be implemented. Monitoring should occur during the year(s) when construction occurs within 30 m of the Bank Swallow colony (*e.g.* for storm water pond and road upgrades) and for at least two more subsequent years.

The following approach to monitoring is recommended:

Bank Monitoring

1. Early spring inspection of bank to ensure it is suitable for nesting Bank Swallows prior to their return from migration. Count number of nest holes.
2. If part of slope has slumped then recommendations will be made in consultation with Waste Management and MNRF to determine what adaptive management should be taken to restore suitable conditions prior to the Bank Swallow's return.
3. Establish and mark several photo stations that can be used for taking comparative photos. Take representative photos at each station.
4. Setup permanent marking stakes that can be used to measure rate of erosion. These should be low stakes or be designed so as not to provide suitable perches for raptors that could sit and wait to prey on swallows. One stake should be placed below bank to compare measurement to base and another 10 m back from top of bank to measure the rate of recession of bank as a predictor of bank longevity. The distance from permanent stake to bank shall be measured before (March–April) and after the breeding season (August-September). The height and length of the exposed vertical face will also be measured.
5. Measurements will be plotted over time of successive visits to document the rate of bank erosion.

Bird Nest Monitoring

1. During the peak of breeding season in the latter part of June (15-30), the colony will be monitored. At this point the eggs should be mostly hatched and adults will be catching insects and frequently flying in and out of nest sites to feed their young. The bank face with nest holes will be photographed. A print of the nest will be used to identify nest holes for markup.
2. The colony will be divided into sections of roughly 20 nests. Sections will be identified by placing a stake at base or there may be an existing identifiable feature on the bank. Each section will be observed for a period of 20 minutes through a spotting scope from at least 30 m away to determine how many of the nest holes are occupied. Any holes where a bird is seen entering or exiting will be marked on the photograph as occupied. Each section will be done in 20 minute intervals to complete coverage of the colony. This will form the basis for determining how many Bank Swallow holes are actually occupied.
3. Alternatively a video camera will be setup on a tripod at a suitable vantage point to view the colony and programmed to film for a 60 minute period. The video footage will be viewed later to determine which holes are occupied.
4. A maximum number of birds observed flying around and over the bank will be recorded.

Contingency Plan

A detailed contingency plan is not being prepared at present because of the uncertainly of the start of construction and what the status of the colony will be at that time. An appropriate population decline contingency threshold will be determined based on that status through consultation with MNRF. Contingency could include creating another suitable nesting bank on-site, off-site or some other means of compensation in the event that the colony was abandoned as a result of landfill related activities. An ESA Overall Benefit Permit is not required at the present time since a date for start of construction has not been determined and therefore a timetable of when impacts are likely is not known.

8.2.4 Wetland Creation and Enhancement

Development of the proposed landfill expansion will result in the removal of approximately 4 ha of wetland habitat that provides at variety of environmental functions including providing breeding habitat for five species of amphibians. As a result a plan has been developed to compensate for the area of wetland that would be removed through the development of the landfill.

WM has committed to a restoration/creation/enhancement strategy to offset removals of wetland in the proposed landfill footprint that will be developed co-operatively with applicable agencies through detailed design, and implemented through the construction phase.

Goals and Objectives

The goal is to create a similar amount of functional wetland on-site or within the vicinity of the wetlands that are being removed for landfill expansion.

The objectives are:

a) Provide breeding habitat for amphibians that are salvaged from the wetlands that will be removed;

b) Provide habitat for a variety of native wetland flora;

c) Provide habitat for a variety of other native wetland fauna;

d) Ensure wetland is not overwhelmed by invasive plant species; and

e) Provide structural variability along shoreline to increase biotic diversity.

Performance Objectives

The following measures are to be achieved in order to consider the compensation enhancement project a success:

1. Minimum 4 ha of created or enhanced wetland
2. Dominated by native wetland plants (*i.e.* more than 50% of plant cover in wetland consists of native plants)
3. Will contain a mix of open water marsh, emergent shallow marsh, meadow marsh and thicket swamp (at least 0.25 ha of each).
4. Presence of at least 4 species of breeding amphibians
5. Compensation wetland utilized by at least 4 species of native wetland breeding birds

Site of Enhancement Wetland

The compensation wetland site has been identified on lands owned by WM and is within 1 km of the wetlands that are scheduled to be removed. Consequently organisms living within the condemned wetlands, will have opportunity to relocate to nearby suitable habitat without having to cross barriers or inhospitable habitat. The compensation wetland occurs immediately south of the closed landfill which includes and surrounds two storm water ponds and one former gravel pit pond which range in size from 0.58, 1.45 and 2.75 ha. The largest pond is

surrounded by an additional area of marsh of approximately 1.0 ha. These ponds are an ideal location for the wetland compensation and enhancement to occur for the following reasons:

- They currently contain relatively deep standing water, and adjacent to wetland therefore maintaining wetland conditions is a certainty.
- Two of the ponds are steep sided with minimal emergent vegetation and surrounded by highly disturbed cultural meadow that have potential for excavating and contouring to expand marsh habitat.
- A small number of amphibians of two species were found to already breed there.
- They are located within 1 km from wetlands that will be removed.
- A continuous habitat corridor exists between the wetlands to be removed and the compensation wetland.
- A 15 ha block of deciduous swamp and forest occurs immediately adjacent to the west which would provide good summer habitat for the species that would breed in the compensation wetland.

These ponds are fed by surface water drainage from the closed landfill and from a portion of the swamp immediately to the west. The ponds do not drain out of the site but instead infiltrate into the ground below them.

Restoration Strategy

A detailed wetland restoration and enhancement plan has been developed on Drawing L3 of AECOM (2015). It includes different wetland depth zones which are meadow marsh, emergent marsh, shallow marsh and submerged aquatic vegetation. In addition thicket swamp has been proposed with shrub plantings. Drawing L3 tabulates and lists and number of trees, shrubs, herbaceous and aquatic plants for planting. Some flexibility has been incorporated to allow for use of plant materials that can be salvaged from the wetlands that will be removed.

The amount of wetland area to be removed from the proposed landfill footprint and to be created or enhanced are shown on Table 8. The steps to implement the wetland compensation plan as depicted on Landscape Drawing L3 (AECOM 2015) are described below.

Table 8. Wetland Vegetation Removed and Created

Vegetation Type	Area to be Removed	Area Created / Enhanced
Pond (SAS)	1.5 ha	2.19 ha
Marsh	1.5 ha	1.43 ha
Thicket Swamp	1.0 ha	0.40 ha
TOTAL	**4.0 ha**	**4.02 ha**

Steps in Developing the Strategy

1. Ideally, the physical wetland work should be completed in late summer or early autumn when the water levels are at their lowest. Planting of woody plants can be done in the autumn or early spring, both planting and seeding of herbaceous or graminoid wetland plants should occur in the spring.

2. Wetland enhancement will require excavation to contour the steep slopes of the two storm water ponds to make the shoreline slopes more gradual which will allow for a wider area of emergent marsh. Contouring will result in a slight expansion of the pond rim or making part of the pond bottom shallower, or both. The central area of the pond should remain at its current depth.

3. Wetland creation will require shallow excavation to create a depression in a wider area around the ponds. Presumably this would occur around the south and southwest sides of the ponds in area that is currently disturbed cultural meadow. The excavation will need to dig into the shallow or seasonal groundwater table. If soil is excessively sand and gravelly, then some importation of topsoil may be required.

4. When soil is stripped, top soil should be piled separately so that it can be placed back if needed (e.g. if the excavations dig into the subsoil). Excess subsoil should be removed from wetland area.

5. A native naturalized marsh seed mix as listed on Drawing L3 shall be spread onto the shallow depression area where meadow marsh vegetation is to be established.

6. Thicket swamp shall be established by planting suitable mix of wetland shrubs in clumps within excavated depression. The following species have been designated within the conceptual wetland enhancement and creation plan to provide thicket conditions: Bebb's Willow (*Salix bebbiana*), Red-osier Dogwood (*Cornus sericea*), Nannyberry (*Viburnum lentago*), Narrow-leaved Meadowsweet (*Spiraea alba*), Northern Honeysuckle (*Lonicera villosa*) and Winterberry (*Ilex verticillata*).

7. Establishing emergent marsh along the contoured pond shoreline will involve the planting of appropriate shoreline wetland plants. The following species have been designated within the conceptual wetland enhancement and creation plan to provide emergent marsh conditions: Sweet Flag (*Acorus calamus*), Soft-stem Bulrush (*Schoenoplectus tabernaemontani*), Blue Flag Iris (*Iris versicolor*), Water Plantain (*Alisma subcordatum*), Water Smartweed (*Polygonum amphibium*) and Large-fruited Burreed (*Sparganium eurycarpum*).

8. The submerged aquatic plants in ponds are typically dominated by Stoneworts and little else. If this is the case, several species of submerged plants will be planted which include: White Water Lily (*Nymphaea alba*), Bladderwort (*Utricularia vulgaris*), Canadian Waterweed (*Elodea canadensis*), Yellow Pond Lily (*Nuphar variegatum*) and Broad-leaved Pondweed (*Potamogeton natans*).

Amphibian Salvage

Amphibian breeding habitat was identified as one of the important functions of the wetlands to be removed, which also qualifies as SWH. As a result salvaging and moving amphibians from the condemned wetlands to the wetland restoration area is an important component of the wetland enhancement. Ideally, wetland restoration and enhancement activities should be completed prior to moving amphibians. While it will not be possible to collect and translocate all individuals, a substantial number should be moved to stock the new wetland. Some adults will move on their own to adjacent remaining habitat to north, south and west, and some mortality is likely. The following approach is recommended.

1. Permits may be required from MNRF before amphibians are moved
2. It is recommended that the wetlands be removed through excavation in late summer or autumn when water levels are lowest and there are smaller numbers of amphibians in the ponds.
3. Moving of adults in the spring breeding season will likely be ineffective as they are very mobile and difficult to catch (except for American toads), and would likely try to move back to their traditional breeding sites.
4. Consequently moving egg masses and larvae will be more effective. In late spring (e.g. June) when most larvae are large and somewhat less fragile, a representative number should be captured using minnow traps, dip nets and seine nets. They should be placed in pond water in suitable containers and transferred to the enhanced wetland site for release within 2 hours of capture.
5. At the point when wetlands are being removed (preferably late summer when water level is the lowest), frogs and tadpoles (and potentially fish) should be captured and moved to the enhanced wetland area. The water in the ponded wetlands should be pumped down thereby concentrating the amphibians and making them easy to collect. Traps and nets should be used for capture. Amphibian salvage may be further hindered if discharge from the groundwater layer is in excess.

The purpose of catching and moving amphibians at two times (late spring and late summer) is to catch the full suite of species to stock the enhanced wetland. Late summer salvage will mostly capture Green Frogs and their larvae, and to a lesser extent Northern Leopard Frog. The other amphibians do not permanently live in the wetland but breed there in spring, then spend most of the summer in forest, field and thicket habitat. Their tadpoles have a three month larval period, where it takes over a year for Green Frog larvae to develop.

Assessment of Enhancement Site

Although a detailed planting plan has been prepared additional site specific information about the ponds should be documented prior to implementation of the enhancement. The following information should be gathered and incorporated as appropriate to ensure that a functional wetland compensation is achieved:

a) bathymetry of ponds to determine depth and steepness of edge

b) mapping of extent and composition of marsh vegetation along shoreline of the ponds

c) assess abundance and types of invasive plants present to determine if they are likely to spread and dominate in the enhanced wetland

d) description of submerged vegetation within the ponds

e) description of soil types and moisture regime on lands surrounding ponds, and within ponds

f) determine if there are issues of soil contamination on lands surrounding ponds where excavation may occur

g) acquire some understanding of hydrology feeding the ponds, such as inflow, outflow and seasonal water level fluctuations

h) identify any logistical constraints to enhancing wetland habitat at this location

i) the wetlands that will be removed on the landfill footprint should be investigated for opportunities to salvage suitable plant material that can be used in the enhancement wetland.

AECOM has conducted additional field investigations in September 2015 to examine and has obtained much of this site specific information that will be incorporated into final details of the wetland enhancement plan. In addition wetlands to be removed have been examined for plant salvage opportunities.

Management Strategy

Management primarily involves ensuring that the wetland continues to function as such. Once the wetland plants are well established, the required management should be minimal unless unforeseen situations arise. Management will coincide with the regular monitoring that will occur after wetland enhancements have been implemented. Monitoring may determine where corrective actions are needed to meet the performance objectives.

1. Plant survival should be monitored. If woody plants have less than 75% survival, then those plants should be replaced. If there is significant die-off of emergent or submergent plants then these should be replaced or substituted with another species, since those species may not be suitable to the conditions on site (particularly if coming up from seed.). As a result the survival target of herbaceous plantings is 25% cover.
2. Large numbers of Canada Geese have been noted at some ponds on the landfill and present a challenge to restoration since they may graze all of the emergent plants as they are becoming established. While it will be very difficult to exclude them completely, planting tall shrubs and trees near shore of ponds will make shoreline less attractive to geese. Geese activity will need to be monitored and if over grazing is seen to occur, corrective management techniques (i.e. enclosure screens) and their feasibility will be evaluated and applied if possible.
3. There is a risk that the wetland may be colonized by aggressive non-native plants such as Common Reed (*Phragmites australis)* and Glossy Buckthorn. The establishment of wetland plants will need to be monitored and corrective action to eliminate or at least control these species may be required. Hand digging may be effective if invasive species are just colonizing and are still localized. Otherwise the application of non-persistent herbicides may be required.
4. Over time, it is expected that natural succession will occur so that much of the marsh may eventually transform into thicket swamp. Also colonization by other native as well as non-native plant species into the wetland is likely. This will be allowed to occur.

Monitoring Program;

Monitoring is important to document the success of the enhancement effort or to determine if any corrective management is required. Planted plant survival, changing species composition, rate of succession, or any changes in physical environment (e.g. erosion) will be monitored by a

qualified ecologist for a period of five years after the wetland is enhanced. Monitoring should occur at a minimum twice annually, early (May) and late (August or September) in the growing season. Additional monitoring may be prudent if issues arise that require corrective action.

Monitoring should include documentation of the following:

1. Physical characteristics of the wetland such as water levels, presence of erosion, evidence of flooding, water flow, etc.;
2. Condition and distribution of vegetation including survivorship of planted and seeded material, as well as natural establishment of wetland plants and succession;
3. Locations and rate of colonization by invasive plant species;
4. Amphibian breeding activities;
5. Breeding birds in the enhancement wetlands;
6. Incidental observation of other wetland wildlife including birds, mammals, turtles, dragonflies;
7. Photographic monitoring stations will be setup around the wetland perimeters and marked with metal stakes. Photographs will be taken in standard directions at wide angle to record physical conditions, plant growth and any changing conditions. Photos should be taken at the same locations, focal length and direction during all vegetation surveys to be comparable;
8. A determination if any corrective management is required.

Monitoring will occur at the following time periods for five years:

a) Nocturnal amphibian surveys should be conducted on three visits in April, May and June every second year to document the full suite of species. Monitoring should occur at each pond location. During nocturnal surveys weather conditions, species, numbers and calling locations within the ponds should be recorded.

b) Early in the growing season (late May / early June) in the year following wetland enhancement to document vegetation etc.

c) Late in the growing season (August / September) following wetland enhancement to document vegetation etc.

Where wetland improvements are not occurring as planned, appropriate corrective management will be recommended and Waste Management will be contacted to authorize or implement the necessary activities.

Results of monitoring and other components of the wetland compensation as implemented will be summarized in annual reports that will be submitted to the City of Ottawa.

9. Summary and Net Effects

Overall the proposed new landfill will result in the removal of some natural forest and wetland vegetation resulting in some loss of wildlife habitat but through compensation there will be no net loss or area. Mitigations are recommended to minimize the environmental impacts, in particular compensating for vegetation loss by creating or enhancing forest and wetland habitat elsewhere on site. Table 8 summarizes the significant environmental impacts, and the recommended mitigations to minimize these impacts. The net effects are the remaining anticipated impacts after the mitigations have been applied.

Table 9. Summary of Impacts of Landfill

Feature	Environmental Impact	Mitigation Recommendations	Net Effects
Significant Woodland	Loss of 9 ha of Significant Woodland	Compensation planting of forest including 7.5 ha along west, and north edge of landfill property and 2.0 ha in the northeast area for total of 9.5 ha. Salvage plants from forest to be removed and transplanted into restoration areas where possible	No net loss of Significant Woodland forest cover
Interior Forest (>100 m from forest edge)	Loss of 1.34 ha of interior forest habitat	Creation of 1.42 ha of interior forest due to forest compensation planting that adds to 0.52 ha existing in adjacent woodlots for total of 1.94 ha of interior habitat	No net loss of interior forest habitat
Forest Edge effects	Edge effects along 560 m of Significant Woodland, e.g., treefalls, sunscald & spread of invasive plant species	If feasible, pre-stressing new edge at least 2 years before adjacent forest is removed. Edge management plan includes careful tree removal, invasive plant control, promote shrubby regeneration and some edge planting.	Reduced Edge effects along 560 m of Sig. Woodland

Table 9. Summary of Impacts of Landfill

Feature	Environmental Impact	Mitigation Recommendations	Net Effects
Wetland	Loss of 4.0 ha of wetland vegetation	Creation or enhancement of 4.0 ha of wetland habitat that includes excavation, planting, and trans-location of plants and amphibians.	No net loss of wetland area
Bank Swallow nesting colony	Possible abandonment of colony due to disturbance from construction and operations	Heavy construction near colony will only occur outside breeding season. Design slope to maintain vertical face. Protective measures to maintain slope, and keep out people during breeding season.	Bank Swallow colony is maintained at site for many years
Amphibian Breeding Sites	Loss of 3.0 ha of marsh and pond that provides amphibian breeding habitat.	Creation / enhancement of 3.3 ha of marsh and pond that provides amphibian breeding habitat. Salvage and move amphibians from condemned wetlands	No net loss of amphibian breeding habitat and no loss of function
Wildlife Corridor	Partial loss of link across field to north	Creation of wildlife corridor within compensation forest planting parallel to William Mooney Road.	No net loss of wildlife corridor function

As long as the recommended mitigations (as detailed in Section 8) are implemented, no significant residual net effects of forest or wetland habitat loss are anticipated. A small amount of interior forest will be lost but the overall area of forest cover will be slightly increased. The forest functions will not be instantly created in the compensation areas however, since mature forest will be replaced with young trees that will take a number of years to grow. In the interim the developing vegetation will provide habitat for plants and animals adapted to early successional communities. The wetlands to be removed are in an early successional stage and therefore those functions will be more rapidly replaced in the compensation wetland.

The woodlot proposed for removal contains only 1.34 ha of interior habitat (which was found to support very few area sensitive forest breeding birds) and therefore is insignificant in the local context of the Ottawa region, where there are many core forest areas containing substantial units of interior forest habitat.

The only Species at Risk occurring in or immediately adjacent to the proposed landfill footprint is an active colony of Threatened Bank Swallows. A detailed protection plan has been developed through consultation from Environment Canada and MNRF.

Monitoring is an important component (Section 8), to ensure that compensation or other mitigations are occurring as planned or to recommend and implement corrective management as required.

It is anticipated that all of the existing environmental functions currently occurring on the WCEC property will be maintained as the proposed landfill is developed.

Report Prepared By:

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Senior Ecologist

Report Reviewed By

Jillian deMan, H.B.Sc
Terrestrial & Wetland Ecologist

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List of Figures

Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion Area

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2005, 2008 and 2010

Kilometers
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UTM Zone 17N, NAD 83

Waste Management of Canada Corporation
West Carleton Environmental Centre

Study Area

February 2015
Project 60289364

AECOM

Figure 1

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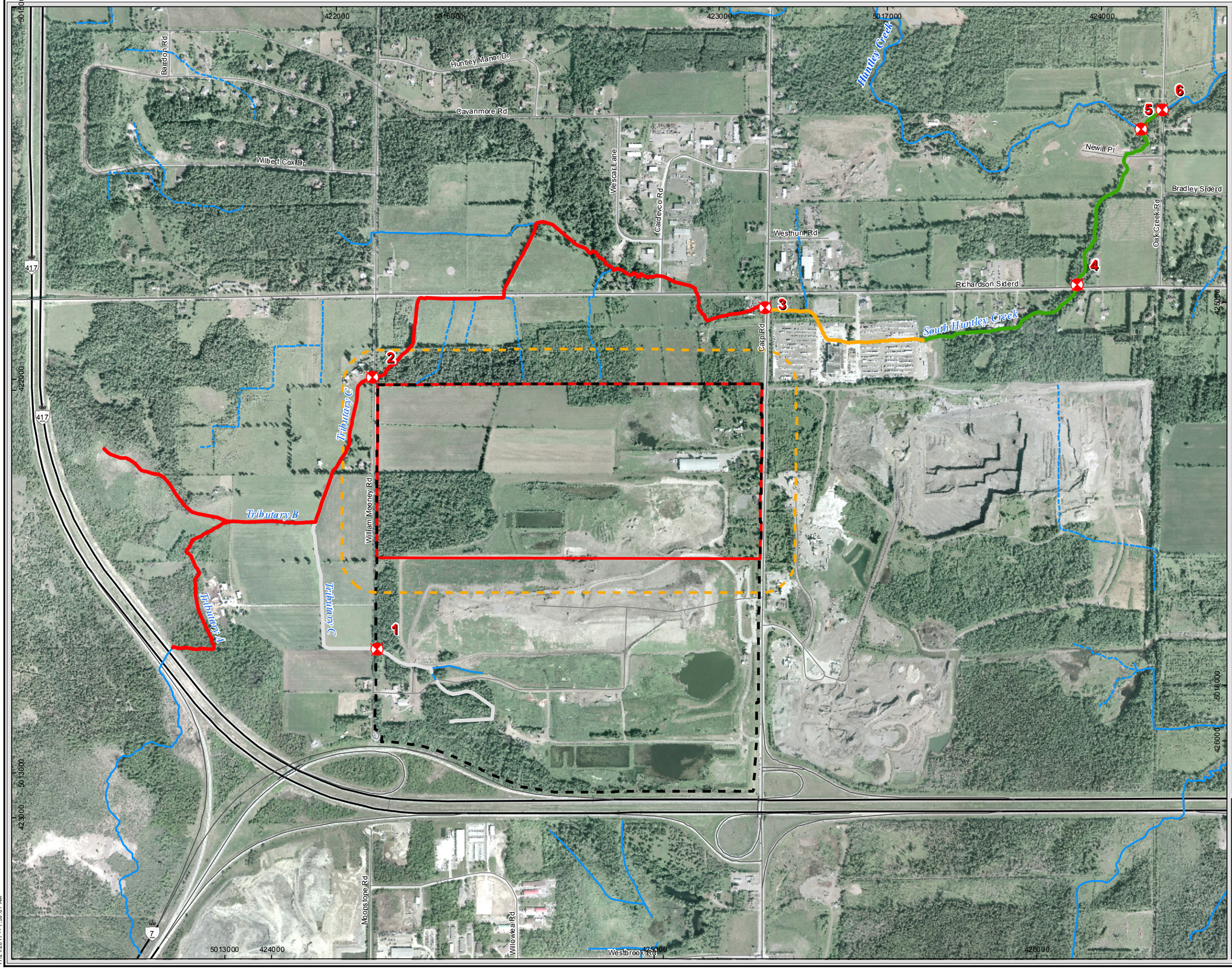

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Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion Area
- Monitoring Stations
- Intermittent Stream
- Permanent Stream

Fisheries Habitat Classification

- Good
- Moderate
- Poor
- None

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2005, 2008 and 2010

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UTM Zone 17N, NAD 83

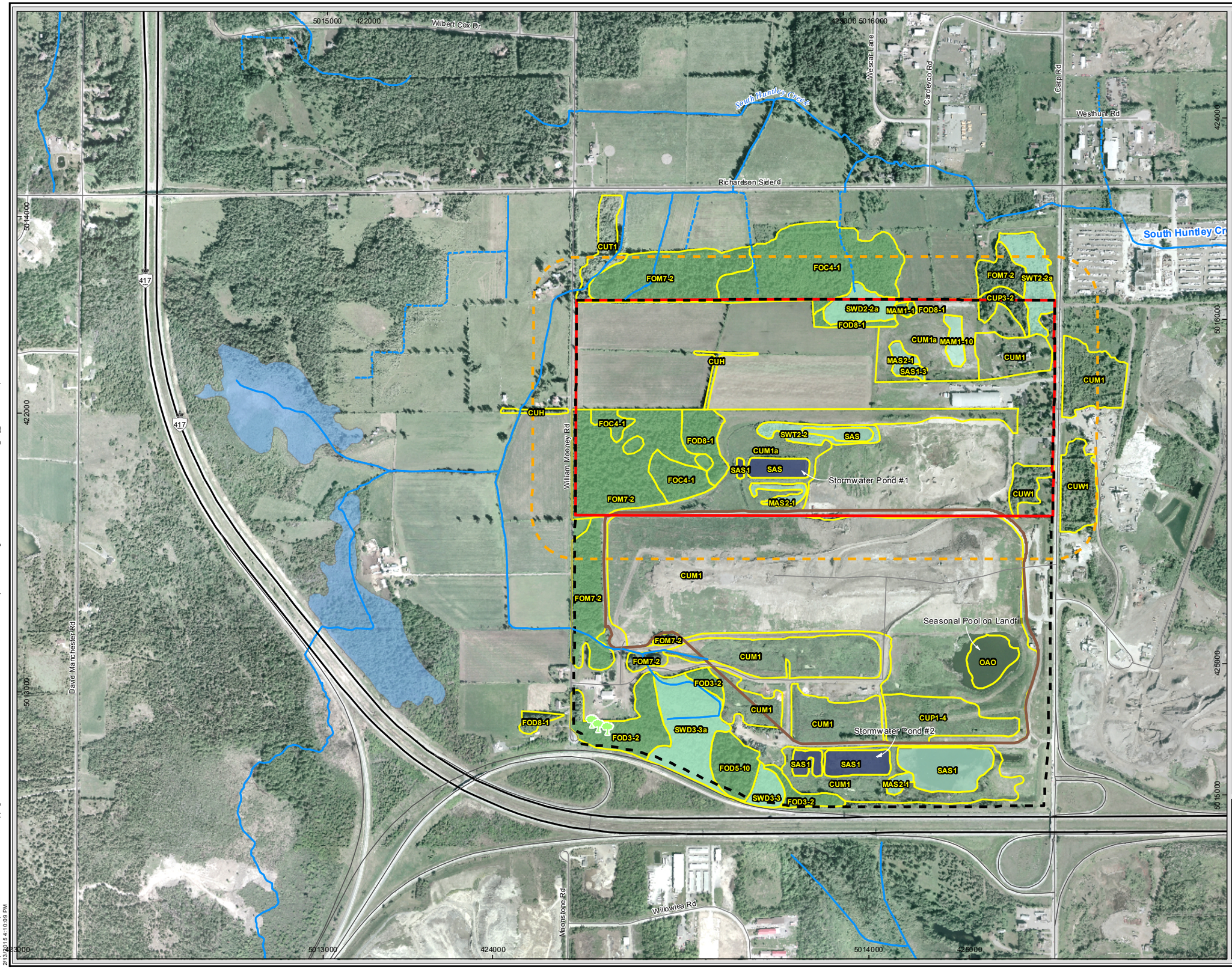
Waste Management of Canada Corporation
West Carleton Environmental Centre

Fish Habitat Classification

February 2015
Project 60289364

AECOM

Figure 2



Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion
- Existing Closed Landfill
- Vegetation Community
- Butternut Tree
- Intermittent Stream
- Permanent Stream
- Provincially Significant Wetland
- Other Wetlands
- Storm Water Ponds
- Significant Woodlands (Ottawa Official Plan)

Vegetation Communities

	Forest
FOC4-1	Fresh-moist Cedar Coniferous Forest
FOD3-2	Dry-fresh Paper Birch Deciduous Forest
FOD5-10	Dry-fresh Sugar Maple - Birch - Poplar Deciduous Forest
FOD8-1	Fresh-moist Poplar Deciduous Forest
FOM7-2	Fresh-moist Cedar - Hardwood Mixed Forest
	Cultural
CUH	Cultural Deciduous Hedgerow
CUM1	Cultural Meadow
CUM1a	Dry Cultural Meadow
CUP1-4	Poplar Deciduous Plantation
CUP3-2	White Pine Conifer Plantation
CUT1	Buckthorn - Dogwood Cultural Thicket
CUW1	Cultural Woodland
	Swamp
SWD2-2a	Green Ash - Buckthorn Mineral Deciduous Swamp
SWD3-3	Swamp Maple Mineral Deciduous Swamp
SWD3-3a	Maple - Ash - Poplar Mineral Deciduous Swamp
SWT2-2	Willow Mineral Thicket Swamp
SWT2-2a	Glossy Buckthorn Mineral Thicket Swamp
	Marsh & Aquatic
MAM1-1	Reed Canary Grass Mineral Meadow Marsh
MAM1-10	Mixed Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OAO	Open Water
SAS1	Submerged Aquatic
SAS1-3	Stonewort Submerged Aquatic

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2005, and 2010

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Waste Management of Canada Corporation
West Carleton Environmental Centre

Vegetation Communities

January 2013
Project 60191228

AECOM

Figure 4

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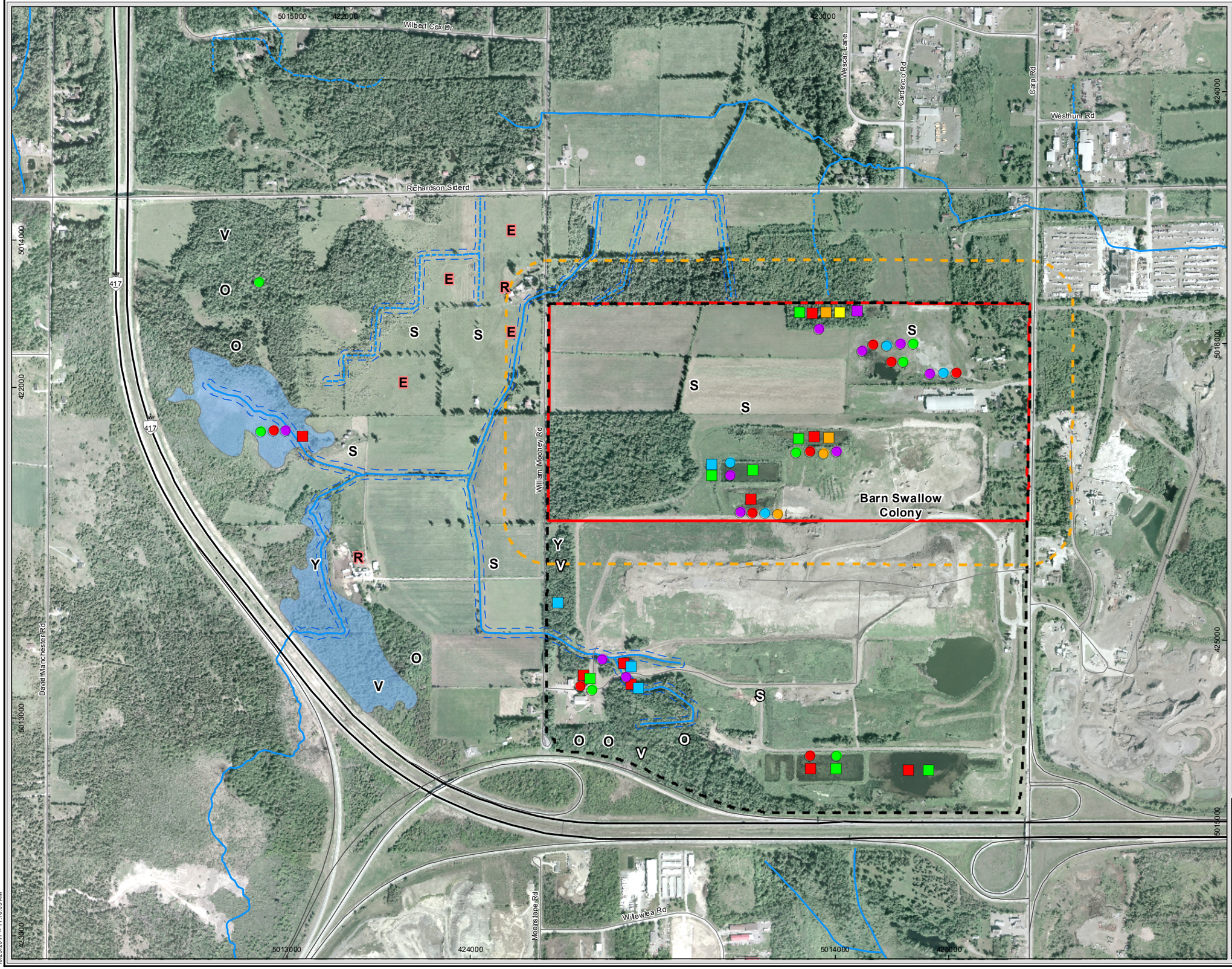

Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion Area
- Watercourse Buffer Area (15 m)
- Provincially Significant Wetland (PSW)

Area Sensitive Bird Species Observed

2006	Year	2011
O	Ovenbird	O
S	Savannah Sparrow	S
V	Veery	V
Y	Yellow-bellied Sapsucker	Y

Species at Risk Observed

2006	Year	2011
E	Eastern Medowlark	E
R	Barn Swallow	R

Amphibians Observed

2006	2011	
		American Toad
		Green Frog
		Grey Treefrog
		Northern Leopard Frog
		Spring Peeper
		Wood Frog

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2005, and 2010

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UTM Zone 17N, NAD 83

Waste Management of Canada Corporation
West Carleton Environmental Centre

Wildlife and Aquatic Features

February 2015
Project 60289364

AECOM

Figure 4

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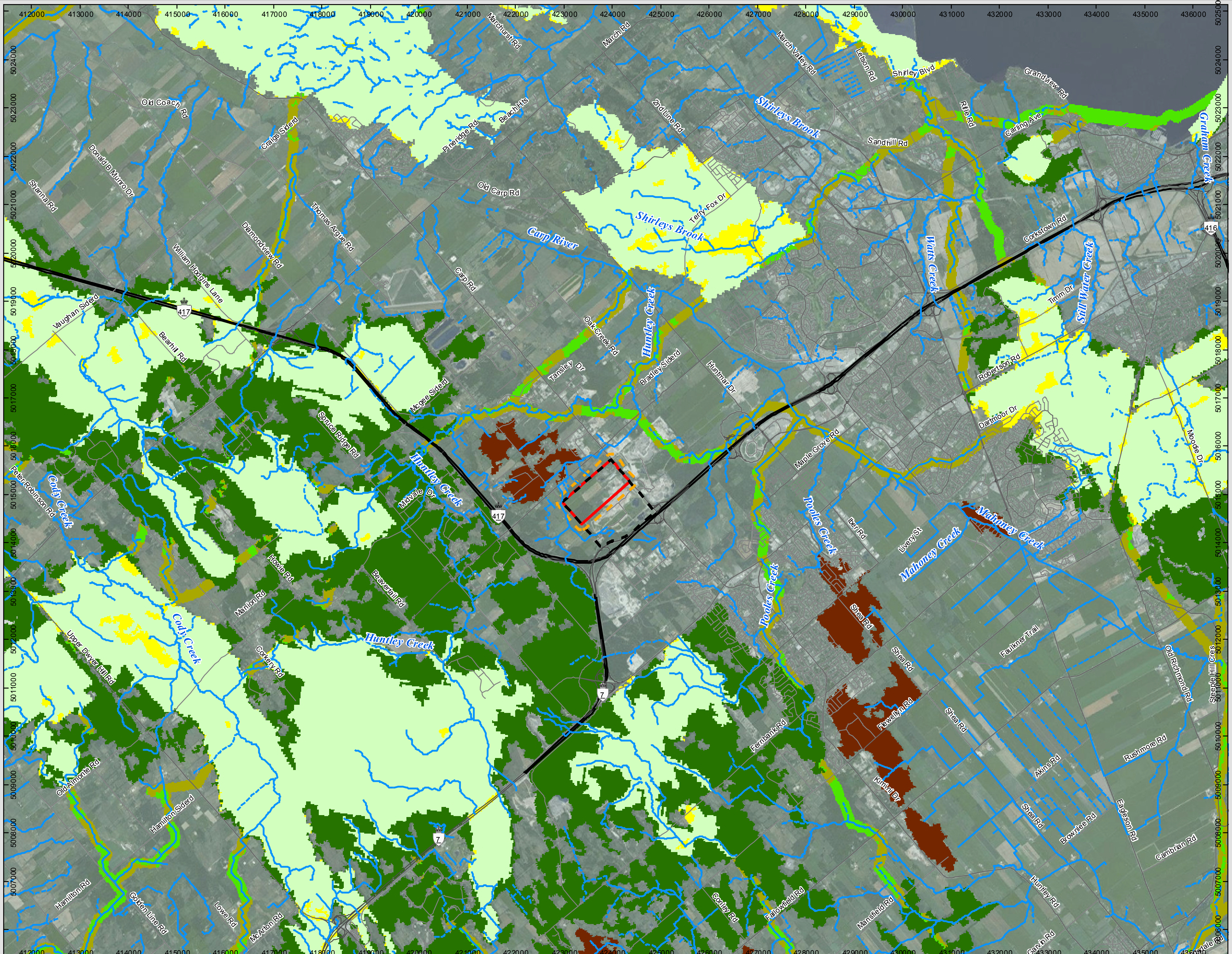

Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion Area
- Intermittent Stream
- Permanent Stream
- Potential Core Areas
- Potential Natural Corridor
- Core Areas
- Natural Corridors
- Adjacent Natural Areas
- Isolated Core Area

Basemapping from Ontario Ministry of Natural Resources

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Waste Management of Canada Corporation
West Carleton Environmental Centre

Landscape Context

February 2015
Project 60289364

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Figure 5

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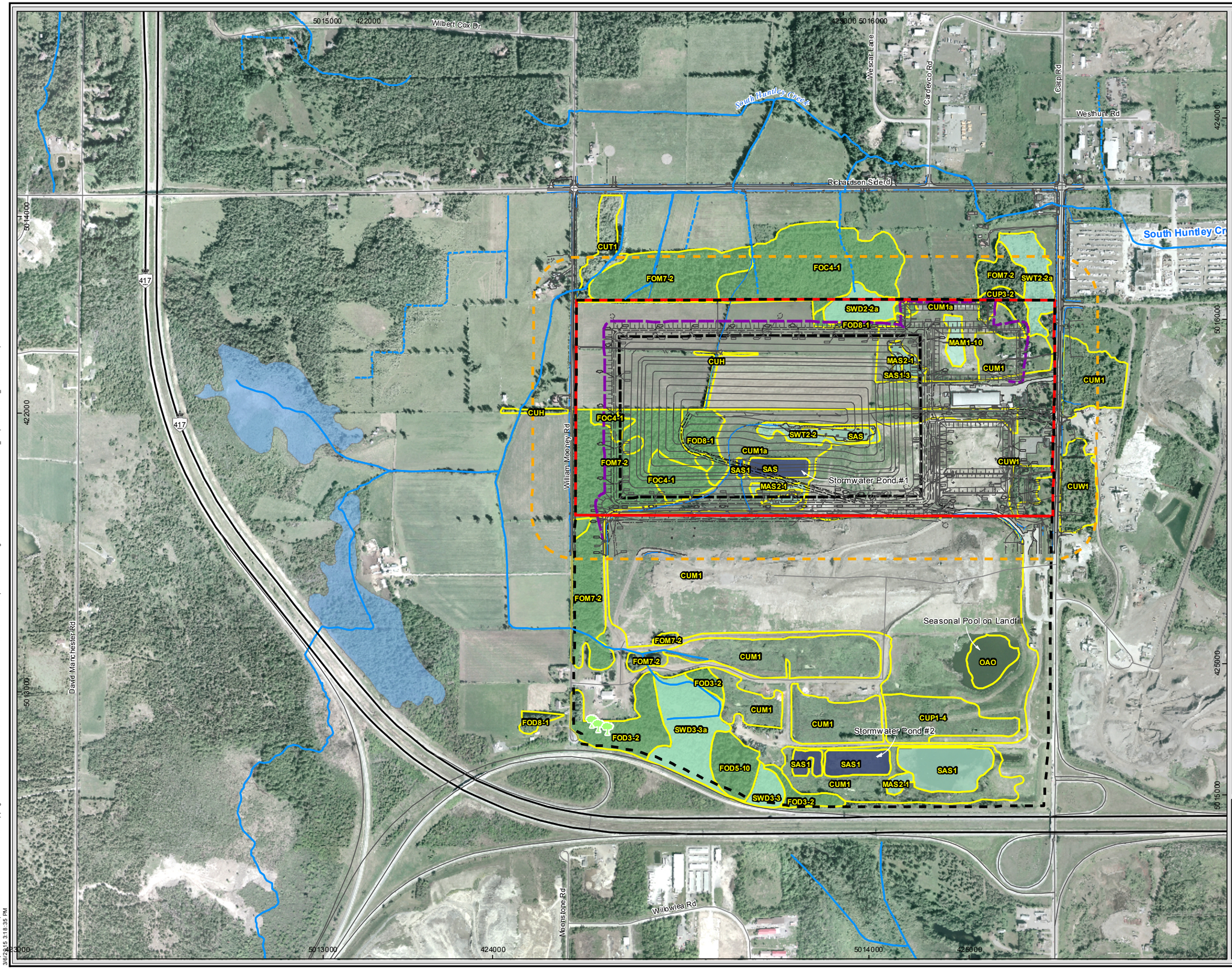

Legend

- Landfill Property
- Adjacent Lands
- Proposed Landfill Expansion
- Proposed Landfill Footprint
- Vegetation Community
- Butternut Tree
- Intermittent Stream
- Permanent Stream
- Provincially Significant Wetland
- Other Wetlands
- Storm Water Ponds
- Significant Woodlands (Ottawa Official Plan)

Vegetation Communities

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FOC4-1	Fresh-moist Cedar Coniferous Forest
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MAM1-10	Mixed Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh
OAO	Open Water
SAS1	Submerged Aquatic
SAS1-3	Stonewort Submerged Aquatic

Basemapping from Ontario Ministry of Natural Resources
Orthophotography: 2005, and 2010

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Waste Management of Canada Corporation
West Carleton Environmental Centre

Footprint of Proposed Lanfill

March 2015
Project 60340948

AECOM

Figure 6

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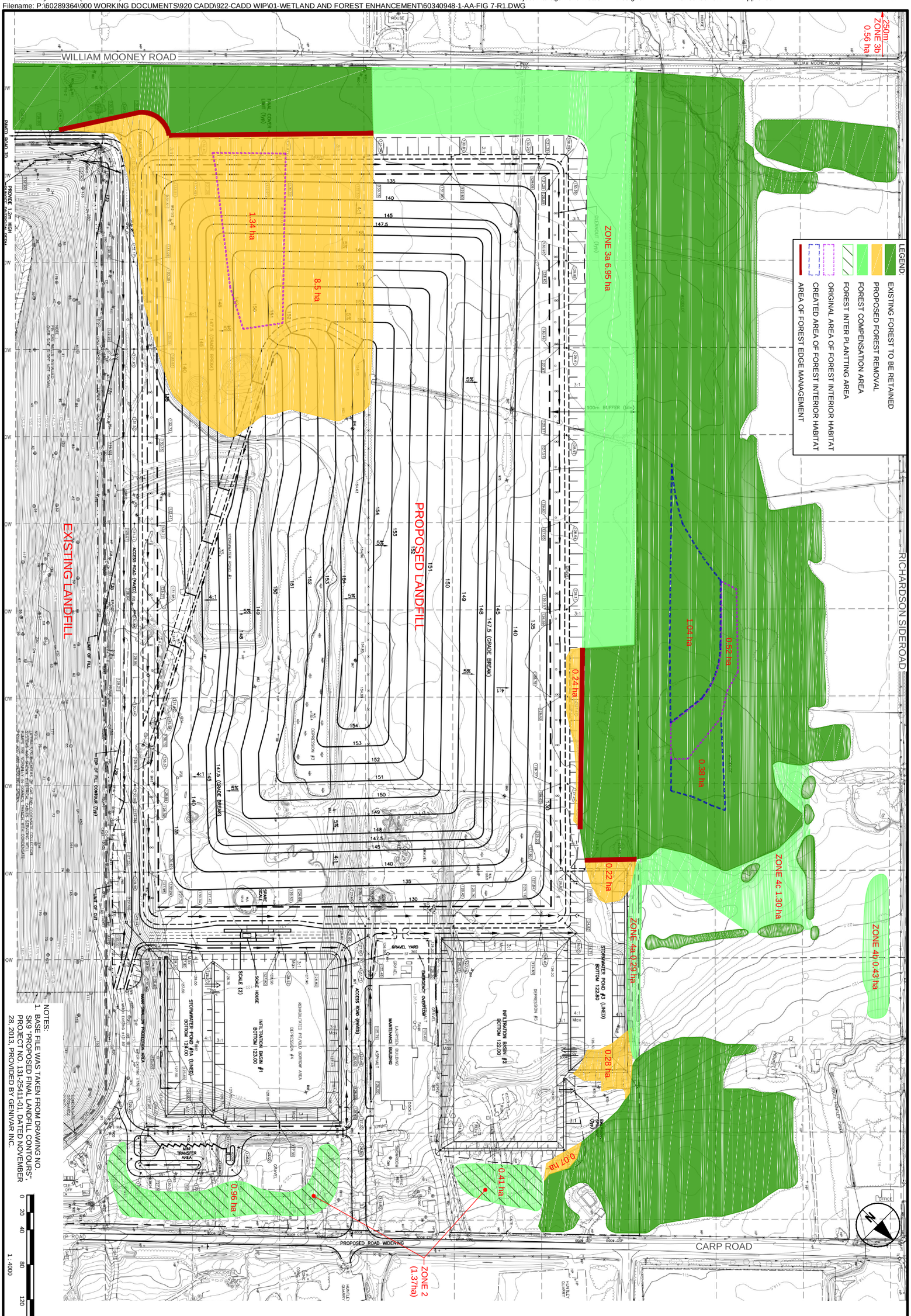

WEST CARLETON ENVIRONMENTAL CENTRE
Waste Management Canada

FOREST COMPENSATION PLAN

AECOM

Project No.: 60340948-2 Date: September 2015

Figure: 7

Appendix A

Plant Species Recorded Within the On-site Study Area

Appendix A. Plant Species Recorded in WCEC Study Area

AECOM

BOTANICAL NAME		COMMON NAME	Coef. of Conserv.	Wetness Index	Weediness Index	Provincial Status	MNR Status	COSEWIC Status	Global Status	Ottawa Region Status	Woodlots on Landfill Property	Wetlands on Landfill Property	Forest west of Wm. Mooney Road	Goulbourne Wetland	Cultural Meadow and Thickets
		Source	Oldham et al.	Oldham et al.	Oldham et al.	NHIC 2013	MNR (2013)	COSEWIC	NHIC 2013	Brunton - 2005					
PTERIDOPHYTES		**FERNS & ALLIES**													
Dennstaedtiaceae		**Bracken Fern Family**													
Pteridium	*aquilinum var. latiusculum*	Eastern Bracken-fern	2	3		S5			G5T		√				√
Dryopteridaceae		**Wood Fern Family**													
Athyrium	*filix-femina var. angustum*	Northern Lady Fern	4	0		S5			G5T5		√	√		√	
Dryopteris	*carthusiana*	Spinulose Wood Fern	5	-2		S5			G5		√	√		√	
Dryopteris	*cristata*	Crested Wood Fern	7	-5		S5			G5	uncommon				√	
Dryopteris	*intermedia*	Evergreen Wood Fern	5	0		S5			G5		√				
Dryopteris	*marginalis*	Marginal Wood Fern	5	3		S5			G5		√				
Gymnocarpium	*dryopteris*	Oak Fern	7	0		S5			G5		√		√		
Matteuccia	*struthiopteris*	Ostrich Fern	5	-3		S5			G5		√			√	
Onoclea	*sensibilis*	Sensitive Fern	4	-3		S5			G5		√	√		√	
Equisetaceae		**Horsetail Family**													
Equisetum	*arvense*	Field Horsetail	0	0		S5			G5		√	√		√	√
Equisetum	*hyemale*	Scouring-rush	2	-2		S5			G5T5			√			
Equisetum	*scirpoides*	Dwarf Scouring-rush	7	-1		S5			G5		√		√	√	
Equisetum	*variegatum*	Variegated Horsetail	5	-3		S5			G5T	uncommon		√			
Lycopodiaceae		**Clubmoss Family**													
Huperzia	*lucidula*	Shining Club-moss	7	-1		S5			G5		√		√		
Lycopodium	*dendroideum*	Prickly Tree Club-moss	7	0		S5			G5		√				
Ophioglossaceae		**Adder's Tongue Family**													
Botrychium	*virginianum*	Rattlesnake Fern	5	3		S5			G5		√		√		
Osmundaceae		**Royal Fern Family**													
Osmunda	*regalis*	Royal Fern	7	-5		S5			G5T		√			√	
Thelypteridaceae		**Marsh Fern Family**													
Thelypteris	*palustris*	Marsh Fern	5	-4		S5			G5T?		√	√		√	
GYMNOSPERMS		**CONIFERS**													
Cupressaceae		**Cedar Family**													
Juniperus	*communis*	Common Juniper	4	3		S5			G5						√
Thuja	*occidentalis*	Eastern White Cedar	4	-3		S5			G5		√	√	√	√	
Pinaceae		**Pine Family**													
Abies	*balsamea*	Balsam Fir	5	-3		S5			G5		√		√		
Larix	*laricina*	Tamarack	7	-3		S5			G5		√	√		√	
Picea	*glauca*	White Spruce	6	3		S5			G5		√		√		
Pinus	*strobus*	Eastern White Pine	4	3		S5			G5		√		√		
DICOTYLEDONS		**DICOTS**													
Aceraceae		**Maple Family**													
Acer	*negundo*	Manitoba Maple	0	-2		S5			G5		√				√
Acer X	*freemanii*	Freeman's Maple									√			√	
Acer	*saccharum*	Sugar Maple	4	3		S5			G5T?		√		√		
Acer	*saccharinum*	Silver Maple	5	-3		S5			G5		√				
Acer	*rubrum*	Red Maple	4	0		S5			G5		√	√	√	√	

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Anacardiaceae		**Sumac or Cashew Family**													
Toxicodendron	*radicans ssp. negundo*	Poison-ivy	5	-1		S5			G5T		√	√	√		√
Rhus	*hirta*	Staghorn Sumac	1	5		S5			G5		√				√
Apiaceae		**Carrot or Parsley Family**													
Daucus	*carota*	Wild Carrot		5	-2	SE5			G?						√
Osmorhiza	*claytonii*	Woolly Sweet-cicely	5	4		S5			G5				√		
Sium	*suave*	Hemlock Water-parsnip	4	-5		S5			G5			√			
Apocynaceae		**Dogbane Family**													
Apocynum	*androsaemifolium*	Spreading Dogbane	3	5		S5			G5T?				√		√
Araliaceae		**Ginseng Family**													
Aralia	*nudicaulis*	Wild Sarsaparilla	4	3		S5			G5		√		√		
Asclepiadaceae		**Milkweed Family**													
Asclepias	*incarnata ssp. incarnata*	Swamp Milkweed	6	-5		S5			G5T5					√	
Asclepias	*syriaca*	Common Milkweed	0	5		S5			G5						√
Asteraceae		**Composite or Aster Family**													
Achillea	*millefolium var. millefolium*	Common Yarrow		3	-1	SE?			G5T?		√				√
Ageratina	*altissima var. altissima*	White Snakeroot	5	3		S5			G5			√			
Antennaria	*neglecta*	Field Pussytoes	3	5		S5			G5						√
Arctium	*minus*	Common Burdock		5	-2	SE5			G?T?		√	√	√		
Bidens	*frondosa*	Devil's Beggar-ticks	3	-3		S5			G5			√		√	
Cirsium	*arvense*	Canada Thistle		3	-1	SE5			G?		√				
Erechtites	*hieracifolia*	Burnweed	2	3		S5			G5	uncommon		√			
Erigeron	*philadelphicus*	Philadelphia Fleabane	1	-3		S5			G5T?		√	√			
Eupatorium	*perfoliatum*	Boneset	2	-4		S5			G5					√	
Eurybia	*macrophylla*	Large-leaved Aster	5	5		S5			G5		√		√		
Euthamia	*graminifolia*	Grass-leaved Goldenrod	2	-2		S5			G5			√		√	√
Lactuca	*serriola*	Prickly Lettuce				SE5			G5		√				√
Leucanthemum	*vulgare*	Ox-eye Daisy		5	-1	SE5			G5						√
Prenanthes	*altissima*	Tall White Lettuce				S5			G5		√		√		
Solidago	*canadensis*	Canada Goldenrod				S5			G5		√				√
Solidago	*nemoralis ssp. nemoralis*	Gray Goldenrod	2	5		S5			G5T?						√
Solidago	*rugosa*	Rough Goldenrod	4	-1		S5			G5T?		√	√		√	
Symphyotrichum	*ciliolatum*	Ciliolate Aster	6	4		S5			G5						√
Symphyotrichum	*lanceolatum*	Panicled Aster				S5			G5		√		√	√	√
Symphyotrichum	*puniceum var. puniceum*	Purple-stemmed Aster	4			S5			G5T?					√	
Taraxacum	*officinale*	Common Dandelion		3	-2	SE5			G5		√				√
Balsaminaceae		**Touch-me-not Family**													
Impatiens	*capensis*	Spotted Touch-me-not	4	-3		S5			G5		√			√	
Betulaceae		**Birch Family**													
Alnus	*incana spp. rugosa*	Speckled Alder	6	-5		S5			G5T5		√	√		√	
Betula	*papyrifera*	White Birch	4	2		S5			G5		√	√	√	√	
Ostrya	*virginiana*	Hop Hornbeam - Ironwood	4	4		S5			G5		√		√		
Boraginaceae		**Borage Family**													

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Echium	*vulgare*	Vipers Bugloss		5	-2	SE5			G?						√
Lithospermum	*officinale*	Common Gromwell		5	-1	SE5			G?						√
Caprifoliaceae		**Honeysuckle Family**													
Diervilla	*lonicera*	Bush Honeysuckle	5	5		S5			G5				√		
Lonicera	*dioica*	Glaucous Honeysuckle				S5			G5	uncommon	√		√		
Sambucus	*racemosa*	Red Elderberry				S5			G5		√		√		
Sambucus	*nigra ssp. canadensis*	Common Elderberry	5	-2		S5			G5	uncommon		√		√	
Viburnum	*lentago*	Nannyberry	4	-1		S5			G5		√	√			
Caryophyllaceae		**Pink Family**													
Silene	*vulgaris*	Catchfly		5	-1	SE5			G?						√
Stellaria	*graminea*	Grass-leaved Stitchwort		5	-2	SE5			G?						√
Cornaceae		**Dogwood Family**													
Cornus	*canadensis*	Bunchberry	7	0		S5			G5		√		√		
Cornus	*sericea*	Red-osier Dogwood	2	-3		S5			G5		√	√		√	√
Chenopodiaceae		**Goosefoot Family**													
Kochia	*scoparia*	Summer Cypress		4	-1	SE5			G?		√				
Fabaceae		**Pea Family**													
Lotus	*corniculatus*	Bird's-foot Trefoil		1	-2	SE5			G?		√				√
Melilotus	*alba*	White Sweet-clover		3	-3	SE5			G?		√				√
Trifolium	*pratense*	Red Clover		2	-2	SE5			G?						√
Trifolium	*repens*	White Clover		2	-1	SE5			G?						√
Vicia	*cracca*	Cow Vetch		5	-1	SE5			G?						√
Fagaceae		**Beech Family**													
Fagus	*grandifolia*	American Beech	6	3		S5			G5		√		√		
Quercus	*rubra*	Red Oak	6	3		S5			G5		√		√		
Geraniaceae		**Geranium Family**													
Geranium	*robertianum*	Herb-robert		5	-2	SE5			G5		√		√		√
Grossulariaceae		**Currant Family**													
Ribes	*americanum*	Wild Black Currant	4	-3		S5			G5		√	√		√	
Ribes	*cynosbati*	Prickly Gooseberry	4	5		S5			G5		√	√	√		
Ribes	*hirtellum*	Smooth Gooseberry	6	-3		S5			G5	uncommon				√	
Guttiferae		**St. John's-wort Family**													
Hypericum	*perforatum*	Common St. John's-wort		5	-3	SE5			G?						√
Juglandaceae		**Walnut Family**													
Juglans	*cinerea*	Butternut	6	2		S3?	END	END	G4		√		√		
Lamiaceae		**Mint Family**													
Lycopus	*americanus*	Cut-leaved Water-horehound	4	-5		S5			G5			√		√	
Lycopus	*uniflorus*	Northern Water-horehound	5	-5		S5			G5			√		√	
Mentha	*arvensis*	American Wild Mint	3	-3		S5								√	
Prunella	*vulgaris ssp. vulgaris*	Common Heal-all		0	-1	SE3			G5T?		√		√	√	√
Scutellaria	*galericulata*	Marsh Skullcap	6	-5		S5			G5			√			
Lythraceae		**Loosestrife Family**													
Lythrum	*salicaria*	Purple Loosestrife		-5	-3	SE5			G5			√		√	

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Monotropaceae		**Indian Pipe Family**													
Monotropa	*uniflora*	Indian-pipe	6	3		S5			G5		√				
Oleaceae		**Olive Family**													
Fraxinus	*americana*	White Ash	4	3		S5			G5		√		√		
Fraxinus	*nigra*	Black Ash				S5			G5					√	
Fraxinus	*pennsylvanica*	Red Ash	3	-3		S5			G5		√	√		√	

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Onagraceae		**Evening-primrose Family**													
Circaea	*lutetiana ssp. canadensis*	Enchanter's Nightshade	3	3		S5			G5T5		√	√	√		
Ludwigia	*palustris*	Marsh Purslane	5	-5		S5			G5					√	
Oxalidaceae		**Wood Sorrel Family**													
Oxalis	*stricta*	Upright Yellow Wood-sorrel	0	3		S5			G5		√				√
Plantaginaceae		**Plantain Family**													
Plantago	*lanceolata*	English Plantain		0	-1	SE5			G5						√
Plantago	*major*	Common Plantain		-1	-1	SE5			G5						√
Plantago	*rugelii*	Rugel's Plantain	1	0		S5			G5						√
Polygalaceae		**Milkwort Family**													
Polygala	*paucifolia*	Fringed Polygala	6	3		S5			G5	uncommon			√		
Polygonaceae		**Smartweed Family**													
Polygonum	*cilinode*	Fringed Black Bindweed	2	5		S5			G5			√		√	
Primulaceae		**Primrose Family**													
Lysimachia	*thyrsiflora*	Tufted Loosestrife	7	-5		S5			G5					√	
Trientalis	*borealis*	Star-flower	6	-1		S5			G5T?		√	√	√		
Ranunculaceae		**Buttercup Family**													
Actaea	*rubra*	Red Baneberry	5	5		S5			G5		√				
Anemone	*canadensis*	Canada Anemone	3	-3		S5			G5		√	√		√	√
Clematis	*virginiana*	Virgin's-bower	3	0		S5			G5		√			√	
Ranunculus	*abortivus*	Kidney-leaf Buttercup	2	-2		S5			G5					√	
Ranunculus	*acris*	Tall Buttercup			-2	SE5			G5			√		√	√
Ranunculus	*sceleratus*	Cursed Buttercup	2	-5		S5			G5T5	uncommon				√	
Thalictrum	*pubescens*	Tall Meadow-rue	5	-2		S5			G5					√	
Rhamnaceae		**Buckthorn Family**													
Rhamnus	*alnifolia*	Alder-leaved Buckthorn	7	-5		S5			G5	uncommon				√	
Rhamnus	*cathartica*	Common Buckthorn		3	-3	SE5			G?		√	√	√		√
Frangula	*alnus*	Glossy Buckthorn		-1	-3	SE5			G?		√	√	√	√	√
Rosaceae		**Rose Family**													
Agrimonia	*gryposepala*	Tall Hairy Agrimony	2	2		S5			G5		√		√		
Amelanchier	*arborea*	Downy Juneberry		3		S5			G5	uncommon	√		√		
Fragaria	*virginiana*	Wild Strawberry	2	1		S5			G5		√		√		√
Geum	*aleppicum*	Yellow Avens	2	-1		S5			G5					√	
Geum	*canadense*	White Avens	3	0		S5			G5		√	√	√		
Malus	*pumila*	Common Apple		5	-1	SE5			G5		√		√		√
Potentilla	*argentea*	Silvery Cinquefoil		3	-2	SE5			G?						√
Potentilla	*recta*	Rough-fruited Cinquefoil		5	-2	SE5			G?						√
Prunus	*serotina*	Black Cherry	3	3		S5			G5		√		√		
Prunus	*virginiana ssp. virginiana*	Choke Cherry	2	1		S5			G5T?		√	√			√
Rosa	*blanda*	Smooth Rose	3	3		S5			G5				√		√
Rubus	*allegheniensis*	Alleghany Blackberry	2	2		S5			G5			√	√		√
Rubus	*idaeus*	Red Raspberry	3			S5			G5T5		√	√	√	√	√
Rubus	*occidentalis*	Black Raspberry	2	5		S5			G5	uncommon	√		√		

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Rubus	*pubescens*	Dwarf Raspberry	4	-4		S5			G5		√	√		√	
Spiraea	*alba*	Narrow-leaved Meadow-sweet	3	-4		S5			G5		√			√	
Rubiaceae		**Madder Family**													
Galium	*palustre*	Marsh Bedstraw	5	-5		S5			G5		√	√		√	
Galium	*triflorum*	Sweet-scented Bedstraw	4	2		S5			G5		√	√			
Rutaceae		**Rue Family**													
Zanthoxylum	*americanum*	American Prickly-ash	3	5		S5			G5		√	√			√
Salicaceae		**Willow Family**													
Populus	*alba*	Silver Poplar		5	-3	SE5			G5		√				
Populus	*balsamifera*	Balsam Poplar	4	-3		S5			G5T?		√	√		√	
Populus	*grandidentata*	Large-tooth Aspen	5	3		S5			G5		√				
Populus	*tremuloides*	Trembling Aspen	2	0		S5			G5		√	√		√	
Populus X	*canadensis*	Carolina Poplar			-1	SE1			HYB			√			
Salix	*bebbiana*	Bebb's Willow	4	-4		S5			G5			√		√	√
Salix	*discolor*	Pussy Willow	3	-3		S5			G5			√		√	
Salix	*lucida*	Shining Willow	5	-4		S5			G5					√	
Salix X	*rubens*	Hybrid Crack Willow				SE5			G5		√	√		√	
Salix	*petiolaris*	Slender Willow	3	-4		S5			G4			√		√	√
Saxifragaceae		**Saxifrage Family**													
Tiarella	*cordifolia*	Foamflower	6	1		S5			G5		√	√	√	√	
Scrophulariaceae		**Figwort Family**													
Veronica	*officinalis*	Common Speedwell		5	-2	SE5			G5		√		√		
Solanaceae		**Nightshade Family**													
Solanum	*dulcamara*	Bittersweet Nightshade		0	-2	SE5			G5		√	√		√	
Tiliaceae		**Linden Family**													
Tilia	*americana*	American Basswood	4	3		S5			G5				√		
Thymelaeaceae		**Mezereum Family**													
Dirca	*palustris*	Leatherwood	7	0		S4?			G4		√		√		
Ulmaceae		**Elm Family**													
Ulmus	*americana*	White Elm	3	-2		S5			G5?		√		√	√	
Urticaceae		**Nettle Family**													
Boehmeria	*cylindrica*	False Nettle	4	-5		S5			G5	uncommon				√	
Urtica	*dioica ssp. gracilis*	Stinging Nettle	3	-1	-1	SE2			G5T?			√		√	
Verbenaceae		**Vervain Family**													
Verbena	*hastata*	Blue Vervain	4	-4		S5			G5					√	
Violaceae		**Violet Family**													
Viola	*blanda*	Sweet White Violet	6	-2		S4S5			G4G5				√		
Viola	*conspersa*	American Dog Violet	4	-2		S5			G5		√		√		
Viola	*pubescens*	Yellow Violet	4	1		S5			G5		√		√		
Viola	*sororia*	Woolly Blue Violet	4	1		S5			G5		√	√	√		
Vitaceae		**Grape Family**													
Parthenocissus	*inserta*	Thicket Creeper	3	3		S5			G5		√	√	√		√
Vitis	*riparia*	Riverbank Grape	0	-2		S5			G5		√	√	√		√

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MONOCOTYLEDONS		**MONOCOTS**													
Araceae		**Arum Family**													
Arisaema	*triphyllum*	Small Jack-in-the-pulpit	5	-2		S5			G5T5		√		√		
Alismataceae		**Water-plantain Family**													
Alisma	*plantago-aquatica*	Common Water-plantain	3	-5		S5			G5			√		√	
Cyperaceae		**Sedge Family**													
Carex	*arctata*	Drooping Wood Sedge	5	5		S5			G5?		√				√
Carex	*aurea*	Golden-fruited Sedge	4	-4		S5			G5	uncommon					√
Carex	*blanda*	Woodland Sedge	3	0		S5			G5?			√			
Carex	*crinita*	Fringed Sedge	6	-4		S5			G5		√	√		√	
Carex	*eburnea*	Bristle-leaved Sedge	6	4		S5			G5				√		
Carex	*flava*	Yellow Sedge	5	-5		S5			G5					√	
Carex	*gracillima*	Graceful Sedge	4	3		S5			G5			√			
Carex	*granularis*	Meadow Sedge	3	-4		S5			G5						√
Carex	*hystericina*	Porcupine Sedge	5	-5		S5			G5					√	
Carex	*interior*	Inland Sedge	6	-5		S5			G5					√	
Carex	*intumescens*	Bladder Sedge	6	-4		S5			G5		√	√		√	
Carex	*lacustris*	Lake-bank Sedge	5	-5		S5			G5	uncommon				√	
Carex	*pellita*	Woolly Sedge	4	-5		S5			G5	uncommon				√	
Carex	*pensylvanica*	Pennsylvania Sedge	5	5		S5			G5		√		√		
Carex	*pedunculata*	Long-stalked Sedge	5	5		S5			G5		√		√		
Carex	*radiata*	Sedge	5	5		S5			G5		√		√		
Carex	*spicata*	Spiked Sedge		5	-1	SE5			G5						√
Carex	*sprengelii*	Long-beaked Sedge	6	0		S5			G5?				√		
Carex	*stipata*	Awl-fruited Sedge	3	-5		S5			G5			√		√	
Eleocharis	*erythropoda*	Red-footed Spike-rush	4	-5		S5			G5	uncommon				√	
Scirpus	*cyperinus*	Wool-grass	4	-5		S5			G5					√	
Juncaceae		**Rush Family**													
Juncus	*nodosus*	Knotted Rush	5	-5		S5			G5	uncommon	√				
Iridaceae		**Iris Family**													
Iris	*versicolor*	Blue-flag	5	-5		S5			G5			√		√	
Sisyrinchium	*montanum*	Montane Blue-eyed-grass	4	-1		S5			G5		√				√
Lemnaceae		**Duckweed Family**													
Lemna	*minor*	Lesser Duckweed	2	-5		S5			G5		√			√	
Liliaceae		**Lily Family**													
Allium	*tricoccum*	Wild Leek	7	2		S5			G5	uncommon			√		
Clintonia	*borealis*	Bluebead-lily	7	-1		S5			G5		√				
Maianthemum	*canadense*	Wild Lily-of-the-valley	5	0		S5			G5		√	√	√		
Trillium	*grandiflorum*	White Trillium	5	5		S5			G5		√				
Orchidaceae		**Orchid Family**													
Epipactis	*helleborine*	Common Helleborine		5	-2	SE5			G?		√				
Poaceae		**Grass Family**													

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Brachyelytrum	*erectum*	Bearded Short-husk	7	5		S4S5			G5	uncommon	√				
Glyceria	*striata*	Fowl Meadow Grass	3	-5		S5			G5					√	
Phalaris	*arundinacea*	Reed Canary Grass		-4	-2	S5			G5			√		√	√
Phragmites	*australis*	Common Reed	0	-4		S5			G5		√				
Poa	*compressa*	Canada Blue Grass		2	-2	S5			G?						√
Poa	*palustris*	Fowl Meadow Grass	5	-4		S5			G5						√
Poa	*pratensis*	Kentucky Bluegrass		1	-2	S5			G5T						√
Potamogetonaceae		**Pondweed Family**													
Potamogeton	*pectinatus*	Sago Pondweed		-5		S5			G5			√			
Typhaceae		**Cattail Family**													
Typha	*angustifolia*	Narrow-leaved Cattail	3	-5		S5			G5		√			√	
Typha X	*glauca*	Glaucous Cattail	3	-5		SE5			HYB		√			√	

FLORISTIC SUMMARY & ASSESSMENT

Species Diversity

Total Species:	**194**	
Native Species:	**156**	80.41%
Exotic Species	**38**	19.59%
Regionally Significant Species	none Rare but 19 Uncommon	
Species at Risk	1	
S1-S3 Species	1	
S4 Species	0	
S5 Species	161	

MNR (Provincial) Status
COSEWIC (National) Status

END:	Endangered
THR:	Threatened
SC:	Special Concern

Appendix B

Bird Species Recorded Within the On-site Study Area

Appendix B. Birds Species Recorded Within WCEC Study Area in 2011

AECOM

Common Name	Scientific Name	Species at Risk		Area Sensitive*	Existing Landfill			Proposed Landfill		West of Wm Mooney Rd	
		COSEWIC	MNR		Site Visit May 3, 2011	BBS** June 3, 2011	BBS** June 16, 2011	BBS* June 3, 2011	BBS* June 16, 2011	BBS* June 3, 2011	BBS* June 16, 2011
Green Heron	*Butorides virescens*					1					
Canada Goose	*Branta canadensis*				10	6	8	70			
Mallard	*Anas platyrhynchos*				5	1	6	2		1	
Blue-winged Teal	*Anas discors*				2						
Ring-necked Duck	*Aythya collaris*				3						
Lesser Scaup	*Aythya affinis*				1						
Turkey Vulture	*Cathartes aura*									1	
Red-tailed Hawk	*Buteo jamaicensis*				1			1	1		1
American Kestrel	*Falco sparverius*									1	
Wild Turkey	*Meleagris gallopavo*				3	1			1	2	3
Virginia Rail	*Rallus limicola*				1						1
Killdeer	*Charadrius vociferus*							1	1		
Spotted Sandpiper	*Actitis macularia*				3	2	1	1	1		
Ring-billed Gull	*Larus delawarensis*				10	20	40				
Mourning Dove	*Zenaida macroura*									2	1
Yellow-bellied Sapsucker	*Sphyrapicus varius*			A			1			1	
Hairy Woodpecker	*Picoides villosus*						1				
Northern Flicker	*Colaptes auratus*							1	1	1	
Pileated Woodpecker	*Dryocopus pileatus*					1					2
Alder Flycatcher	*Empidonax alnorum*									6	2
Eastern Phoebe	*Sayornis phoebe*							1		2	1
Great Crested Flycatcher	*Myiarchus crinitus*									2	1
Tree Swallow	*Tachycineta bicolor*					5	2				
Bank Swallow	*Riparia riparia*					30	20				
Barn Swallow	*Hirundo rustica*	THR	THR			3			1	2	3
Blue Jay	*Cyanocitta cristata*					1	2			2	2
American Crow	*Corvus brachyrhynchos*					2	2	1	2	2	2
Common Raven	*Corvus corax*						2			2	2
Black-capped Chickadee	*Poecile atricapillus*				5	3			2	1	2
White-breasted Nuthatch	*Sitta carolinensis*									1	
House Wren	*Troglodytes aedon*									1	
Veery	*Catharus fuscescens*			A						1	1
Wood Thrush	*Hylocichla mustelina*										2
American Robin	*Turdus migratorius*					7	3	5	1	9	3
Gray Catbird	*Dumetella carolinensis*									2	2
Brown Thrasher	*Toxostoma rufum*					1			1	1	2
Cedar Waxwing	*Bombycilla cedrorum*							1			
European Starling	*Sturnus vulgaris*				20	5	5	2	1	9	2
Warbling Vireo	*Vireo gilvus*					3	1				
Red-eyed Vireo	*Vireo olivaceus*					3	2	1		3	1
Yellow Warbler	*Setophaga petechia*					6			1	6	4
Magnolia Warbler	*Setophagaa magnolia*			A						1	
Black-and-white Warbler	*Mniotilta varia*								1	1	2
American Redstart	*Setophaga ruticilla*					3	1	1		2	1
Ovenbird	*Seiurus aurocapillus*			A		3	1			3	1
Northern Waterthrush	*Seiurus noveboracensis*					1				1	

Common Name	Scientific Name	Species at Risk		Area Sensitive*	Existing Landfill			Proposed Landfill		West of Wm Mooney Rd	
		COSEWIC	MNR		Site Visit May 3, 2011	BBS** June 3, 2011	BBS** June 16, 2011	BBS* June 3, 2011	BBS* June 16, 2011	BBS* June 3, 2011	BBS* June 16, 2011
Mourning Warbler	*Oporornis philadelphia*					1	1			1	
Common Yellowthroat	*Geothlyphis trichas*					3	1	1		6	3
Northern Cardinal	*Cardinalis cardinalis*					2					
Rose-breasted Grosbeak	*Pheucticus ludovicianus*					1				1	
Chipping Sparrow	*Spizella passerina*							1		1	1
Vesper Sparrow	*Pooecetes gramineus*					1					
Savannah Sparrow	*Passerculus sandwichensis*			A		1		4	2	7	2
Song Sparrow	*Melospiza melodia*				3	13	3	4	2	11	8
Swamp Sparrow	*Melospiza georgiana*									3	
White-throated Sparrow	*Zonotrichia albicollis*										1
Red-winged Blackbird	*Agelaius phoeniceus*				15	17	4	16	6	3	2
Eastern Meadowlark	*Sturnella magna*	THR	THR	A						5	2
Common Grackle	*Quiscalus quiscula*				5	1		2	1	2	
Brown-headed Cowbird	*Molothrus ater*									3	
Baltimore Oriole	*Icterus galbula*					3		1	2	1	
Purple Finch	*Carpodacus purpureus*									1	
American Goldfinch	*Cardeulis tristis*					5	1	1		3	1
House Sparrow	*Passer domesticus*				1					3	
TOTAL SPECIES					16	34	22	21	18	45	32
TOTAL INDIVIDUALS-					88	159	108	118	28	121	64

** Area Sensitive in Site Region 6E according to MNR (2012)*

*** BBS = Breeding Bird Survey*

Appendix C

Curricula Vitae of James Kamstra

James Kamstra, B.Sc., M.E.S.
Senior Terrestrial Ecologist

Professional History

1989 - present, AECOM, Senior Terrestrial Ecologist
1988 - 1989, Ministry of Natural Resources, Botanist/Endangered Species Specialist/Park Planner
1976 - 1987, Various Provincial and National Parks, Park Interpretive Naturalist

Education

MES, Environmental Studies, York University
BSc, Biology and Environmental Science, Trent University

Years of Experience

With AECOM: 25
With Other Firms: 3

Professional Affiliations

Committee on the Status of Species at Risk in Ontario (COSSARO) 2008-2014

Durham Region Environmental Advisory Committee 2001-06

Durham Land Stewardship Council 1995-2002

Blue Racer Species Recovery Team 1995-2001

E. Fox Snake and Hog-Nosed Snake Species Recovery Team 2003-2006

Mr. Kamstra has 25 years of experience conducting environmental impact studies, biophysical inventories, and ecological restoration projects. Through his extensive field experience, he has become a recognized expert in identifying flora and fauna, assessing ecological significance, and understanding the functions of ecosystems. Mr. Kamstra has completed numerous studies on the impact of a wide variety of developments on natural heritage features including wind turbines, water servicing, residential housing, industrial sites, landfills, gravel pits, mines, golf courses, highways, pipelines, and hydroelectric dams with experience across Canada, the United Arab Emirates and Belize. He is highly experienced with breeding bird surveys, herpetofaunal surveys, vegetation mapping, quantified vegetation sampling, tree saving plans, wildlife population surveys, and habitat evaluations. Mr. Kamstra is a qualified wetland evaluator and has evaluated several wetlands in southern Ontario. He has particular expertise in the fields of herpetology, ornithology, and botany, and has worked with many of Ontario's species at risk.

Mr. Kamstra has extensive species at risk experience in Ontario. He sat on advisory panel assisting MNR in developing the Endangered Species Act 2007 and currently sits on COSSARO, which determines species on the official list. He sits on two recovery teams and has written status reports and recovery strategies for several species. In addition, Mr. Kamstra has first-hand field experience with many species at risk through environmental impact studies.

Experience and Some Project Examples

Environmental Impact Assessments and Evaluations

Southeast Collector Trunk Sewer, York Regioin. Conducted vegetation and wildlife data and evaluated impact of route alternatives during original EA. More recently has developed plan to mitigate and monitor potential impacts to nearby Great Blue Heron colony. [2004 - 2015]

Casino Mine, Terrain Ecosystem Mapping, Yukon Territory. Conducted vegetation mapping through aerial photo interpretation and a detailed program of quantitative field sampling program as part of existing conditions report for Environmental Assessment of proposed gold and copper mine. [2010]

Taseko Aley Mine, Terrain Ecosystem Mapping, B.C. Conducted vegetation mapping through aerial photo interpretation and a detailed program of quantitative field sampling program for proposed niobium mine in northern Rocky Mountains using BC Terrestrial Ecosystem Mapping system. [2011 - 2013]

Next Era, Wind Turbine Farm. Detailed natural environment study of existing conditions and assessment for approval of ~200 proposed wind turbines in Lambton and Huron counties including vegetation, wildlife surveys and evaluation of significant wildlife habitat. [2011-2013]

Citizens Advisory Panel on Ontario Endangered Species Act 2006

Society for Ecological Restoration member

Ontario Regional Editor for North American Butterfly Association 2010-2014

Various Clients, Proposed Golf Course Environmental Evaluations. Conducted evaluations for many proposed sites including sites in Pickering, Uxbridge, Port Severn, Sutton, and Aurora. [1992 – 2007]

Various Clients, Provincial Highway Upgrades and Extensions. Performed environmental impact assessment on vegetation and wildlife from upgrades and extension for highways including Highway 403 (Hamilton), Highway 401 (Pickering, Cobourg, Mississauga), Highway 69 (Parry Sound), Highway 6 (Manitoulin) (Oakville), Highway 10 (Orangeville), Highway 11 (Sundridge, Bracebridge, Powassan), and Highway 407 (Durham extension). [1995 – 2013]

Various Clients, Gravel Pit and Quarry Expansion Assessments. Provided environmental impact assessments for proposed pits and expansions at many locations including Erin, Grafton, Guelph, Lakefield, Niagara Falls, Pontypool, Port Colborne, Dunnville and Trenton. [2000 – 2013]

Smoky Falls Hydroelectric Generating Facilities Upgrade, Cochrane District. Assess impact of replacing existing dam. [1998]

Kempenfelt Bay, Proposed Residential Area Evaluation, Barrie. Conducted evaluation on two large shoreline properties where large residential complex propose. [1990 – 1996]

Ottawa (West Carleton) Landfill Impact Assessment. Conducted environmental impact assessment of landfill expansion including impacts to the Threatened species for Waste Management. [2011 – 2014]

Clean Harbors Landfill Impact Assessment, Petrolia. Conducted environmental impact assessment of high level contaminant landfill expansion. [2011 – 2014]

Species at Risk Projects

Population Study and Translocation of Butler's Garter Snakes, Sarnia. Conducted a year mark-recapture study of population of Endangered snake to determine population size and habitat use on proposed. Prepared Benefit Permit application then translocated snakes from development site to receiver site with habitat enhancements for Cantaqleigh Investments Inc. [2007 – 2013].

Overall Benefit Permit for Fowler's Toad, Fort Erie. Prepared 17(2)c Endangered Species Act Permit to provide benefit for a Fowler's Toad population affected by condominium development [2010 – 2011].

COSEWIC Status Report of Queen Snake. Wrote status report update for this species was later designated as endangered. Included confirming presence at former sites.[2009]

Eastern Fox Snake Recovery Plan. Wrote the recovery plan for Eastern Fox Snake through consultation with Foxsnake – Hognose Snake Recovery Team. [2004 – 2006]

Butternut Evaluations. Is a qualified Butternut assessor and has completed numerous Butternut evaluation and compensation plans at variety of development sites.

Inventory of Species at Risk. Conducted inventory of species at risk, with an emphasis on reptiles at Queen Elizabeth II Wildlands Provincial Park [2005] and Massasauga Provincial Park. [2006]

Floral and Faunal Inventories

Severn River Corridor Biophysical Inventory, Muskoka. Conducted biophysical inventory as part of the Muskoka Heritage Areas Program to provide baseline data, to evaluate ecological significance and to aid in conservation management. Inventory involved involve documenting flora, fauna, and vegetation communities. [1991]

Cambden East Alvar Area of Natural and Scientific Interest. Conducted biophysical inventory to provide baseline data, to evaluate ecological significance and to aid in conservation management. Inventory involved involve documenting flora, fauna, and vegetation communities. [2001 – 2002]

Breeding Bird Surveys for Proposed Mines - Conducted breeding bird surveys for several proposed mines in remote sites using transects, point counts and area searches. Sites included **High Lake, Nunavut**. [2004], **Tulsequah, British Columbia** [2007], and **Schefferville, Quebec / Labrador** [2011]

Awenda Provincial Park Life Science Inventory.
Conducted complete detailed inventory of vegetation, flora, fauna of park including surveys, mapping, species lists and evaluation of significant features. [2008 – 2009]

Ecological Restoration

Ottawa (West Carleton) Landfill. Developed plan to restore wetland and forest habitat in order to compensate for habitat loss from proposed landfill expansion. [2013 – 2015]

Don River Wetland Restoration, Toronto. Provided input to wetland restoration at mouth of Don River. [2007 – 2008]

Oshawa Second Marsh Monitoring Program and Restoration. Developed monitoring program of breeding birds, amphibians, and vegetation in conjunction with habitat restoration. [1993 – 2003]

Grenadier Pond, High Park, Toronto. Contributed to restoration plan along shoreline of Grenadier Pond including recording baseline, removal of hardened shore and planting plan. [1996]

Wetland Restoration, Vaughan. Performed salvage of wetland vegetation and transplanting to created wetland pond. [1996]

Ecosystem Planning

Protection of Natural Heritage Features in King City Community Plan. [2004 – 2007]

Town of Whitchurch-Stouffville, Peer Review of Environmental Impact Studies. Provided peer review of EISs prepared by other consultants. [2000 – 2013]

Town of Whitby, Peer Review of Environmental Impact Studies. Provided peer review of EISs prepared by other consultants. [2000 – 2012]

International Experience

Environmental Impact Assessment, Abu Dhabi, United Arab Emirates. Assessed impact of proposed city landfill on natural environment. [2008 – 2009]

Chalillo Hydroelectric Dam Impact Analysis, Belize. Analysed impact of hydroelectric dam on three endangered species: Baird's Tapir, Scarlet Macaw, and Morelet's Crocodile. [2000 – 2001]

Various Tour Companies, Ecotour Guiding, Multiple Locations. Guided naturalist history tours to Belize, Bolivia, Brazil, Costa Rica, Ecuador, Guatemala, Guyana, Panama, Peru, Portugal, and Spain for Tours of Exploration, Quest Nature Tours, and Top Flight. [1987 – 2013]

Previous Employment

Flora and Fauna Survey and Park Planning, Ontario. Conducted a floral and faunal inventory of six environmentally significant areas in the Lake Erie Islands. Recommendations for protective management of the sites were presented. Also acted as a park planner in the Thunder Bay District, coordinating an areas of natural and scientific interest (ANSI) program. Responsible for addressing land use conflicts, and mapping and layout of brochures. [Ministry of Natural Resources, 1988 – 1989]

Various National and Provincial Parks, Interpretive Naturalist. Worked as an interpretive naturalist with Pukaskwa National Park, St. Lawrence Islands National Park, Algonquin Provincial Park, Ontario, and Shuswap Lake Provincial Park, British Columbia. Performed museum duty, prepared and presented interpretative programs. [1976 – 1987]

Publications

Kamstra, J. 2013. "Butterflies Region 22 Eastern Canada" pp.97-102 in NABA Butterfly Counts 2012 Report. North American Butterfly Assoc.

COSEWIC. 2010. COSEWIC Assessment and Status Report of the Queensnake *Regina septemvittata* in Canada. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 34 pp.

Kamstra, J. and S. Spisani, 2009, A life science inventory and evaluation of Awenda Provincial Park. Ontario Parks, Central Region.

Kamstra, J., 2006, National Recovery Strategy for the Eastern Foxsnake

(*Elaphe gloydi*) in Canada. Eastern Foxsnake and Eastern Hog-nosed Snake Recovery Team.

Kamstra, J., 2003, A life science inventory and evaluation of Cambden East Alvar. Ontario Ministry of Natural Resources, Kingston District.

Kamstra, J., M.J. Oldham and P.A. Woodliffe, 1995, A life science inventory and evaluation of six natural areas in the Erie Islands. Ontario Ministry of Natural Resources, Chatham District. 160p.