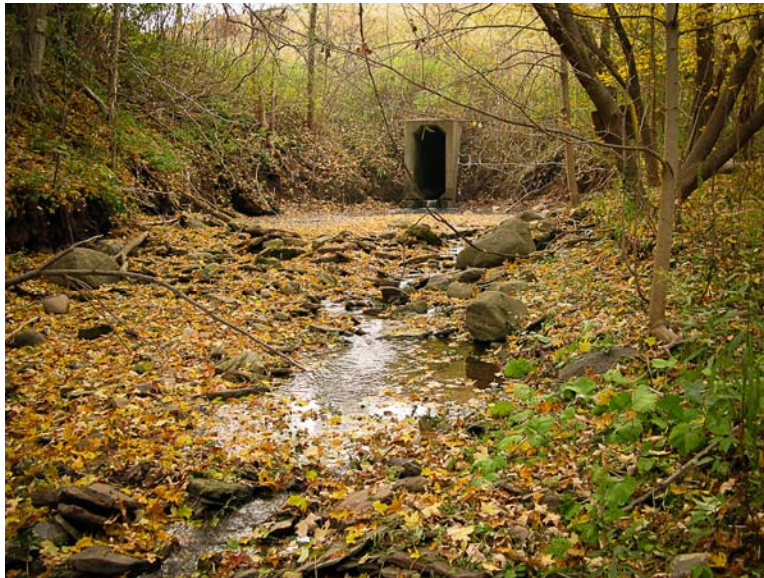


Region of Peel

Bovaird Drive Environmental Assessment

Preliminary Constraint Assessment for
Terrestrial Resources



Jim Dougan
Steve Hill
Ian Richards
Lynn Wardle

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77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

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1 INTRODUCTION

As outlined in the RFP for the Bovaird Drive project, the objectives are to review current and future level of service on the west section of Bovaird Drive in the City of Brampton. The study corridor for this project is located along Bovaird Drive, directly east of the Peel/Halton boundary, east of the town of Norval. The section of Bovaird Drive to be studied is approximately 4.8 kilometers long, and bound by Caseley Drive on the west limit, and Lake Louise Drive / Worthington Drive on the east limit.

This preliminary assessment is provided to review the context of terrestrial resources and associated policy constraints for the Bovaird Drive study corridor, in Brampton, Ontario. This report summarizes background terrestrial resource data obtained from multiple sources, interpretation of aerial photography for the study corridor, and the results of preliminary site reconnaissance for vegetation and wildlife. The interpretation of these data provides the context and the direction for future work to identify the sensitivity and potential constraints associated with terrestrial resources within and adjacent to the study corridor, for consideration in the impact assessment or road improvement alternatives.

2 METHODS

2.1 BACKGROUND REVIEW

The following reports and resources were accessed to provide background natural heritage information for the current report:

- City of Brampton Official Plan
- Region of Peel Official Plan
- North West Brampton Phase 2 Urban Expansion Area Environmental Open Space Study (D & A et al., 2005)
- Credit Valley Subwatershed Study [Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b)] (TSH et al. 2004)
- North West Brampton Landscape Scale (LSA): In support of the Mount Pleasant Secondary Plan Subwatershed Study (D&A, 2007)

Mapping Data

The follow background data were accessed to characterize significant natural heritage features, vegetation communities, and species within the vicinity of the study corridor:

- Credit Valley Conservation, Ecological Land Classification (based on Lee et al. 1998)
- Natural Heritage Information Centre query
- Ministry of Natural Resources Provincially Significant Wetland Mapping
- Areas of Natural and Scientific Interest Mapping
- Environmentally Sensitive Areas Mapping

Relevant Policy

Government of Canada

- Migratory Birds Conservation Act (MCBA)
- Species at Risk Act (SARA)

Province of Ontario

- Conservation Authorities Act (CAA) and Regulations
- Endangered Species Act
- Fish and Wildlife Conservation Act
- Greenbelt Act
- Ontario Environmental Assessment Act (EAA)
- Planning Act; Ontario Planning and Development Act; Provincial Policy Statement 2005

Region of Peel

- Official Plan – Office Consolidation (2008)
- Significant Woodland & Wildlife Habitat Study (2009)
- ROPA 21A

City of Brampton

- Official Plan - City Concept (2008)

Credit Valley Conservation

- CVC Watercourse and Valleyland Protection Policies
- CVC Watershed Planning and Regulations Policies (2010)

2.2 PRELIMINARY FIELD RECONNAISSANCE

Preliminary reconnaissance of the existing natural features at the site was undertaken in the autumn of 2009. This included site visits to identify vegetation and wildlife resources at the site. The preliminary vegetation reconnaissance was conducted by Steve Hill on October 19th, 2009, and the wildlife reconnaissance was conducted by Ian Richards on October 5th, 2009. Since both site visits were late in the year, the primary objective was to confirm existing ELC mapping, identify potential wildlife habitat, and scope fieldwork for the 2010 field season.

The wildlife visit took place from 9:00 a.m. to 11:30 a.m., and the weather conditions were 18 degrees C., with overcast skies and light west winds. The survey consisted of driving the entire length of the Bovaird Drive corridor, from Worthington Avenue to the Halton/Peel County line just east of Norval, with regular stops to investigate suitable habitat for wildlife. This habitat included woodlands, secondary successional growth, wetlands, hedgerows, stormwater management ponds, streams and their associated riparian corridors, and non-agricultural open field habitat. All habitat or wildlife observed was recorded, and notes made with regards to wildlife that could potentially occur at other times of the year.

3 FINDINGS

3.1 BACKGROUND REVIEW

3.1.1 STUDY AREA CONTEXT

Site Description and Vegetation Features

According to Credit Valley Conservation's Ecological Land Classification data, the majority of the land bound by the study corridor is designated as anthropogenic and includes agricultural fields and commercial lots (Figure 1). Despite the dominance of these uses, there are a number of natural features present including cultural meadow, cultural woodland, deciduous forest, marsh, and streams. The non-cultural natural features are concentrated at the western third of the study corridor, and are primarily associated with tributaries of the Credit River.

3.1.2 EXISTING NATURAL HERITAGE STUDIES

Credit Valley Subwatershed Study and [Huttonville Creek (7), Springbrook Creek (8a), Churchville Tributary (8b)] (TSH et al. 2004)

This report provides guidance on the significance, sensitivity and linkage potential among natural features associated with the Huttonville Creek Subwatershed. Other useful information is provided in the form of indentifying and classifying natural features with regard to development constraints. The subwatershed study area encompassed the lands east of Mississauga Road. Constraint levels were characterized based on habitat patch area, condition, linkage role, and urban tolerance.

North West Brampton Phase 2 Urban Expansion Area Environmental Open Space (EOS) Study (2005)

This report provides the most recent detailed synthesis of terrestrial resources for the study corridor and adjacent areas. The terrestrial component of the EOS study consolidated various reports ranging from City and Region of Peel Official Plans to previous subwatershed studies. The broader objectives of the study were to evaluate constraints and opportunities in North West Brampton, evaluate the significance of environmental features and their functions, make recommendations toward Natural Heritage System planning, undertake preliminary analysis in support of future subwatershed studies, and to define the Terms of Reference for future Secondary Planning.

The study identified existing natural heritage resources, broadly defined the significance of existing natural features, and identifies proposed environmental features (including but not limited to potential linkage opportunities). These data provide the background for identifying potentially significant features, and determining the location and potential impact on linkages.

North West Brampton Landscape Scale (LSA): In support of the Mount Pleasant Secondary Plan Subwatershed Study (City of Brampton, August 2007 Draft)

This report provided a landscape scale ecological context for the Mount Pleasant subwatershed and the North West Brampton Study Area, which encompassed the Bovaird Drive study corridor. The study built on existing natural heritage data from various jurisdictions to provide a landscape scale context that evaluated the quality, function, and linkage of terrestrial and aquatic systems within the area.

Results and recommendations from this study provide the regional context for terrestrial resources at the Bovaird Drive study corridor; in part, this will help identify priority linkage corridors that connect the local features to those present across the broader North West Brampton Study Area.

Specifically, the two guiding criteria that were used from this study included the total functional priority of terrestrial resources and the rating of linkages and corridors. Total functional priority was a three-tiered rating that incorporated habitat and hydrological ratings for the natural area features; those that scored high were characterized as priority 1, whereas those that scored low were characterized as priority 3. Examples of priority 1 (high functional priority) were typically associated with the Credit River Valley and Huttonville Valley ESA, whereas examples of priority 3 (low functional priority) included features such as cultural environments that may provide some linkage or habitat, but was identified as having low priority for both terrestrial and hydrological functions. The evaluation of linkages for this study followed a stream reach method that was developed by CVC. In general, corridor and linkage ratings were characterized based on stream order (3rd order or above), lack of land use impact and connectivity among natural features and systems (see Appendix B in D&A 2007).

3.1.3 LEGISLATION, POLICY AND LAND DESIGNATIONS

Several levels of policy are relevant to terrestrial resources present at and within the vicinity of the Bovaird Drive corridor, based on provincial, regional, municipal, and conservation authority legislation, policies and regulations (Figure 2).

There are two high-level policy areas within the Bovaird Drive Study corridor: the western section of the study corridor that is protected under the province's Greenbelt Act (2005), and the reaches of Huttonville Creek that support Redside Dace which is protected under the provincial Endangered Species Act (2007) and federal Species at Risk Act (2005). Figure 2 identifies the general limits of the Greenbelt; within this area there are specific NHS policies and protection zones that require consideration. Redside Dace is discussed in more detail in the Preliminary Fish and Fish Habitat Assessment section.

Other areas representing regional and municipal-level policy constraints, are the core Greenland features that are part of the Greenlands System for the Region of Peel and the City of Brampton.

Terrestrial resources that fall under provincial policy include those within the boundary of the Greenbelt Protected Countryside, or areas identified as significant wetland and or wildlife habitat. Bovaird Drive west of Heritage Road falls within the boundaries of the Greenbelt Protected Countryside.

Natural features within the study corridor are recognized in the Region of Peel and City of Brampton Official Plan Greenlands System, including core valleylands and core forest. The core valleylands are those associated with the Credit River and its tributaries. Four valley systems are located within the study corridor; the Credit River Valley, located at the western edge of the study corridor, is a major valley system and floodplain. Other identified tributary valleys are located a) approximately 1 km east of the town of Norval (tributary 2A, Figure 2), b) approximately 0.25 km south of Bovaird Drive and 0.6 km west of Heritage Road (tributary 2B, Figure 2), and c) south of Bovaird Drive just east of Mississauga Road (Huttonville Creek). Two core forest patches are identified in background mapping at the

northern edge of the study corridor. The first is approximately 0.5 km north of Bovaird Drive and 0.3 km west of Heritage Road, the second approximately 0.5 km north of Bovaird Drive and 0.5 km west of Mississauga Road. Huttonville Valley Environmentally Sensitive Area (ESA No. 16) is also within the vicinity of the study corridor, and is contiguous with the Huttonville Creek core valleyland. Other terrestrial resources that could be considered natural areas and corridors under the City of Brampton's OP will be considered as part of the EIS; such features would require a 10m setback from the greater of the limit of natural hazards and/or ecological sensitivities.

Most of the terrestrial resources under the jurisdiction of Credit Valley Conservation are covered by provincial, regional, and municipal legislation. The implementation guidelines and necessary setbacks are provided in the CVC Watercourse & Valleyland Protection Policies (CVC 1996). Credit Valley Conservation regulation of development (O. Reg. 160/06) applies to all proposed developments that will interfere with wetlands and alterations to shorelines and watercourses. Permission to develop may be granted where "the control of flooding, erosion, dynamic beaches, pollution or the conservation of land will not be affected by the development" (O. Reg. 160/06, s. 3 [1]). There are two unevaluated wetlands identified using the background mapping within the study corridor; the first is located on the north side of Bovaird Drive, approximately 0.5 km west of Heritage Road, the second is located at the southeast corner of Bovaird Drive and Heritage Road.

3.1.4 PRELIMINARY SITE RECONNAISSANCE & RECOMMENDATIONS

Vegetation

Credit River to Heritage Road

Heading east from Norval, Bovaird Drive rises out of the Credit Valley. On the north side there is a steep hillside with deciduous forest and a bottomland area (approximately 10m wide) between road shoulder and the slope. At the crest of the Credit River valley, there is a steep-sloped ditch on each side of the road. On the north side there is a small managed cultural meadow and asphalt trail before the top of bank leading down to a small tributary of the Credit River (tributary 2A, Figure 2). On the south side, the slope begins adjacent to the road shoulder and is covered by a small cultural meadow. Further work needs to be done to characterize the vegetation in these ravine areas and determine the level of sensitivity of these communities.

Heading further east along Bovaird, the remaining natural features tended to be wetland areas. These included stream corridors and small marsh habitats dominated by cattails. Where these streams intersect, their importance for potential connectivity should be evaluated. There was also a small woodlot dominated by deciduous tree species at the intersection of Bovaird and Heritage road.

Cattail marshes that were observed adjacent to the road tended to be small (~0.2-0.4 ha), and seemed to be agricultural land that was too wet for farming. The background information suggested that a large unevaluated wetland feature existed in the field directly west of the private school on the north side of Bovaird, however this feature has subsequently been utilized as agricultural land; there was only a small remnant of this cattail marsh adjacent to Bovaird.

Heritage Road to Mississauga Road

The cattail marsh at the southeast corner of Bovaird and Heritage road was still intact. Further field work should characterize the vegetation within this feature. That the feature was surrounded by

agricultural fields suggests that there is likely a large amount of disturbance here. On the opposite corner of the intersection, there was a small (<0.5 ha) deciduous woodlot that was likely on private land.

Another larger cattail marsh was located at the southeast corner of Bovaird Drive and Mississauga road. Further work should also be done here to characterize the vegetation community and inventory species. This wetland was being fed by Huttonville Creek that runs under Bovaird from the north side of the road. On the northeast corner of the intersection, the creek has apparently undergone a significant amount of management through a stream corridor restoration initiative.

Mississauga Road to Lake Louise Drive/Worthington Drive

The majority of land in this section of the Bovaird Drive study corridor was agricultural or urban. The only two features that were visited on this trip were the small deciduous woodlot approximately 0.5 km south of Bovaird Drive just west of Ashby Field Road, and the storm water facility on the north west corner of Worthington Drive.

Summary

Based on the assessment of existing information and the reconnaissance field survey, future field work should focus on the forested hillsides and ravines on the western side of the study corridor, the two large cattail marshes where Heritage road and Mississauga road intersect Bovaird, and the stream corridor that has undergone previous restoration work on the northeast corner of Bovaird and Mississauga road. Considerations should also be made on the connectivity function of the stream corridors that cross Bovaird Drive, west of Heritage Road.

Wildlife

Given the time of year (early October), it is not surprising that very little wildlife was observed during the site visit. A few common ubiquitous bird species were noted, including Red-tailed Hawk, American Crow, American Robin, Common Grackle, Red-winged Blackbird, Song Sparrow and American Goldfinch, but no mammals, reptiles or amphibians were detected. Two Common Ravens were observed foraging alongside Bovaird Drive, just west of the GO train station near Ashby Field Road. Given the habitat available, it is not likely that these birds bred in the area; this species has been expanding its range south from the Canadian Shield over the last 20 years (Peck, 2007), so it is likely that these birds bred further north and were migrating south to find winter habitat. These two birds may have been young birds (that is, born in the summer of 2009) which often disperse more than the adults in the fall to find their own winter habitat.

Credit River Valley

In most of the roadside areas (within 100 metres of the road) there were relatively few areas that would present constraints in terms of wildlife habitat. The most significant areas are associated with the Credit River valley on the extreme west end of the study corridor in the town of Norval, where Bovaird Drive comes within 100 metres of the river, which is on the south side of the roadway. The immediate roadside areas that would be most affected by construction are in residential uses with very limited wildlife habitat. The current study corridor does not include the Credit River crossing. Although the Credit River represents significant valleylands and the associated forested area represents significant woodlands, the distance that features are set back from the road precludes interference with any features that would represent constraints from the standpoint of wildlife.

Woodlands

There are no significant woodlands within 100 metres of Bovaird Drive. There is a woodlot east of Heritage Drive and west of Mississauga Road, located about 380 metres north of Bovaird Drive, which was surveyed by Ontario Ministry of Natural Resources (Mark Heaton, OMNR Aurora) on June 16, 2006. Common breeding birds, deer, coyote and raccoon were observed. The woodlot is well north of Bovaird Drive and it is unlikely that road construction would cause any disturbance to the wildlife. Another small woodlot exists 625 metres east of Mississauga Road, approximately 450 metres south of Bovaird Drive. It is a small woodlot and unlikely to be significant for wildlife. As noted above, the only other woodlands in the study corridor are associated with the Credit River valley. These woodlands are set back from the road and buffered by residential uses along the existing roadside. On the north side of Bovaird Drive, immediately adjacent to the road just inside the western end of the study corridor, there are woods and scrub (BOV-1) which probably support breeding birds in the summer. Since it is relatively close to the road and part of continuous habitat extending from the Credit River to the south, this would be an area of constraint during construction. Breeding bird surveys and nest surveys would need to be conducted to ensure that disturbance to these birds does not occur if clearing occurs within the breeding window (May to August).

Wetlands

There are no provincially significant wetlands within the study corridor. The Churchville-Norval Wetland Complex is located along the Credit River valley from the village of Norval extending south to Churchville. However, this wetland cover is fragmented in the south end by Norval, with only one small section existing on the south side of the Credit River, about 100 metres south of Bovaird Drive at the extreme west end of the study corridor. The wetlands would not be affected by construction based on the distance and the buffering provided by intervening residential uses, as well as riparian forest cover and the creek and the valley slope.

There were a few small wetland pockets adjacent to Bovaird Drive, such as on the south side approximately 600 metres east of Mississauga Road. However, there was no open water or wetland habitat available which would preclude use by more significant wetland wildlife. Another small wetland pocket is located on the north side of Bovaird Drive, approximately 440 metres west of Heritage Road (BOV-3A). There is a limited amount of wetland habitat present, with no open water within it and it is completely surrounded by agricultural habitat. Wetland species, if present, would be limited in terms of abundance and diversity.

Hedgerows

The only hedgerows that are significant in size and location, therefore possibly supporting breeding birds in the summer, are two located 135 and 215 metres east of Heritage Road, on the south side of Bovaird Drive. The eastern hedgerow is 15 metres from the road, and extends south approximately 325 metres; the western hedgerow comes to within 50 metres of the road, and extends south (parallel to the eastern hedgerow) approximately 300 metres. At the south end, both hedgerows merge into a smaller fragmented woodlot that extends west and crosses Heritage Road, approximately 415 metres south of Bovaird Drive. These hedgerows, are surrounded by agricultural fields and extending south to a wooded area, would probably support breeding birds and therefore represent an area of constraint (at their north ends only, adjacent to Bovaird Drive) for road construction. The timing of clearing in this area may would need to avoid the breeding bird season (May to August) in order to avoid nest disturbance.

Stream and creek crossings

The study corridor ends approximately 300 metres east of the Credit River crossing, and therefore will not directly impact the river or its riparian zone. The only other stream or creek with running water that crosses Bovaird Drive is a small creek that runs from north to south, and under the road, approximately 25 metres east of Mississauga Road. The creek runs under the road via a culvert, and contains no wetlands and very limited riparian habitat (a few scattered trees, mostly on the north side). Therefore, considering the lack of habitat and the fact that the creek has already been modified to flow through a culvert, it is not a constraint area. It is likely that very few birds breed in the area, and few if any amphibians utilize the habitat (perhaps American Toad). Other tributaries of the Credit River do cross Bovaird Drive (see Figure 2), but were not assessed for wildlife or wildlife habitat during this preliminary site visit.

Open fields and secondary (successional) areas

Most of the open areas adjacent to Bovaird Drive are agricultural fields and therefore are unlikely to support nesting of open field species, such as Bobolink, Eastern Meadowlark and Savannah Sparrow. One area, to the south of Bovaird Drive, and just west of Ashby Field Road, is not agricultural and contains grasses and shrubs. Although adjacent to a new subdivision to the east and limited overall in extent, this field may support open field species such as Eastern Kingbird and Savannah Sparrow. Therefore, the north end of this field, adjacent to Bovaird Drive, should be assessed during breeding season.

Open water

The only open water within the study corridor is a storm water management pond, located on the north side of Bovaird Drive, just west of Worthington Avenue. The pond is located between Unsworth Street to the north, and Creditview Road to the south. It is approximately 175 metres by 80 metres in size. There is very limited wetland growth around its edges, and a few scattered, ornamental trees. Given its location within development, this pond would not be considered an area of constraint. A few waterbirds may utilize the pond, such as Canada Goose and Mallard which were both observed during the site visit in September, 2009, but few species would attempt to nest here. Other waterbirds, such as Great Blue Heron, may stop occasionally to feed during migration, but would not nest here. The American Toad, which is common and widespread and utilizes a wide variety of wetland habitats, may utilize this pond for breeding.

Other data

The Atlas of the Breeding Bird of Ontario, 2001 – 2005 (Cadman et al., 2007) conducted breeding bird surveys throughout Region of Peel. The data available from the 10 X 10 kilometre square that includes Bovaird Drive, does not indicate any significant species present. The Atlas of the Mammals of Ontario does not indicate any significant mammal records for the study corridor (Dobbyn 1994). The Ontbirds listserve archives (Ontbirds, 2009) does not indicate any significant records from the study corridor. As noted above, the OMNR did some field surveys (M. Heaton, June 16, 2006) in a woodlot adjacent to the study corridor, but no significant species were reported. Finally, a query of the Natural Heritage Information Centre (NHIC) database did not reveal any significant species records for the study corridor (NHIC, 2009).

Based on the data available and this preliminary wildlife site assessment, it is recommended that breeding bird surveys be conducted in 2010. These surveys would follow the protocols outlined in the Ontario Breeding Bird Atlas 2001 – 2005 (OBBA, 2001), that is, there be two surveys performed at

least 10 days apart, between the dates of May 24 and July 12. The breeding bird survey will focus on roadside observations, creek crossings, wetland pockets, and hedgerows in proximity to the study corridor.

Nocturnal frog surveys should be conducted following the protocols of the Ontario Marsh Monitoring Program (BSC, 2003). These two surveys would take place in the last 15 days of April and May, under suitable weather conditions. A third survey in the second half of June is not recommended, as the only species calling later is Bullfrog, which is not likely to occur in the study corridor given the available habitat.

During 2010 surveys, potential wildlife crossing sites will also be examined based on habitat connectivity and crossing structures (i.e. culverts), and notes made on any roadkills. This will assist in the identification of areas which may need to be addressed later in the design process in terms of safety and wildlife passage.

3.2 EXISTING CONDITIONS (2010 FIELDWORK)

3.2.1 ECOLOGICAL LAND CLASSIFICATION & OTHER LAND USE

Anthropogenic (Anthro; X% of study area)

Anthropogenic features included paved land, buildings, and lawns that are currently being manicured. Between the west end of the study area and Heritage Rd there are a number of private residences, a private school, and companies that front Bovaird Drive, or have access via paved driveways. Between Heritage Road and Mississauga Road there are two private residences, the Apple company, and a gas station. Between Mississauga Road and the eastern edge of the study area there are a number residences, subdivision developments, and a Go Train station. A number of these features have large areas of manicured lawns that may provide habitat for wildlife that are generally tolerant of anthropogenic disturbances.

Agricultural (Ag; X% of study area)

Agricultural land represents the greatest proportion of land area along the Bovaird Drive corridor study area. This land provides habitat for a number of grassland and anthropogenic species. Also, nestled among the fields, hedgerows and drainage ditches provide potential corridors for wildlife movement (see Ditch and Hedge categories).

Storm Water Pond (SWF; X% of study area)

A single storm water pond is located at the eastern edge of the study area. This feature is separated from Bovaird Drive by a swath of cultural meadow and Creditview Road.

Cultural Meadow (CUM; X% of study area)

Cultural meadows exist across the study area as either the upland areas adjacent to ditches or old-field habitats that have not been farmed in recent years. This community type supports a mix of native and exotic vegetation, most of which are typically considered weedy. Wildlife associated with this type of habitat area typically those that utilize early successional habitats, and tolerant of disturbance and low woody-plant cover.

Cultural Thicket (CUT; X% of study area)

Only a small proportion of the study area was classified as cultural thicket. This was restricted to the west end of the study area on the north hillside shoulder of Bovaird Drive. This feature also supported inclusions of meadow marsh plant communities resulting from ground water seeps. Given that these inclusions were small, they have

been represented as point locations on Figure XXX.

Cultural Savannah (CUS; X% of study area)

Cultural savannah habitats were restricted to two features (polygons 14 and 135). A formal sample was not conducted for polygon 135 based since only a small proportion of its area coincided with the study area. Therefore we relied on the CVC's designation. The vegetation community for polygon 14 was based on road side surveys from Bovaird Drive and Heritage Road.

Cultural Plantation (CUP; X% of study area)

One cultural plantation exists within the study area. This was a pine plantation located on the west back of Tributary 2A. It also borders a cultural meadow to the west and cultural savannah to the north. The feature is separated from Bovaird Drive by a private driveway and a small swath of cultural meadow to the south.

Cultural Woodland (CUW; X% of study area)

A number of cultural woodlands exist within and adjacent to the study area. These are typically associated with upland areas near the Credit River, tributary valleys of the Credit River, disturbed woodlands adjacent to development areas, and on residential property.

Deciduous Forest (FOD; X% of study area)

A small proportion of the study area exists as relatively high quality deciduous forest. These are restricted to west side of the study area, and are contiguous with the Credit River valley. Polygon 26 was a mixed deciduous forest with abundant Bitternut Hickory and a mix of White and Green Ash. Polygon 7 was predominantly a lowland forest associated with Tributary 2A and is dominated by Black Walnut, Green Ash, and Sugar Maple.

Meadow Marsh (MAM; X% of study area)

Only two features were classified as meadow marsh communities. This included the Cattail marsh east of Heritage Road, south of Bovaird Drive (polygon 10), and a small Cattail marsh north of Bovaird Drive, about two-thirds of the distance between Heritage Road and Mississauga Road (polygon 12). In both cases, these marshes likely result from drainage patterns associated small tributaries. Both were dominated by a mix of *Typha angustifolia* and *Typha latifolia*.

Open Water (OAO; X% of study area)

Only one feature was characterized as open water habitat. This included a small pond on the City of Brampton's property.

Ditch (X% of study area)

Much of the north and south side of Bovaird Drive east of Heritage Road are drained by engineered ditches. These features primarily supported cultural meadow communities, and in some cases standing water. These vegetation communities, however, were too small to characterize on their own.

Hedge (X% of study area)

A network of hedges exist across the study area. In some cases, these are well developed features and contribute directly to the connectivity between isolated natural features, and more extensive features such as the Credit River Valley. Woody species typically associated with these features included Common Buckthorn, Green Ash, and in some cases Shagbark Hickory and Bur Oak.

4 POTENTIAL CONSTRAINT AREAS

Greenbelt Protected Countryside

According to the general infrastructure policies (4.2.1) of the Greenbelt Plan (2005), expansion of existing infrastructure is permitted in the Greenbelt Protected Countryside. Infrastructure projects should however, (i) minimize the area traversed and/or occupied by the resulting infrastructure, (ii) minimize the negative impacts and disturbances of the existing landscape, (iii) avoid key natural heritage features (unless need has been demonstrated and there is no reasonable alternative), and (iv) where the resulting infrastructure has inevitable impacts on the Natural Heritage System, steps should be taken to minimize the impacts on the features and their ecological functions.

These constraints apply to the natural heritage features located within the boundary of the Greenbelt Protected Countryside at the western section of the Bovaird Drive study corridor.

Core Area Valleylands and Woodlots

The Credit River Valley and Huttonville Valley ESA are the most significant natural features within the vicinity of the Bovaird Drive study corridor. The majority of terrestrial resources associated with these features lie outside of the study corridor boundary. The Credit River Valley intersects a small portion of the west side of the study corridor, and runs in an east direction southeast of Bovaird Drive. The northern tip of the Huttonville Valley ESA is located approximately 1.4 kilometers south of Bovaird Drive, just east of Mississauga Road. Huttonville Creek, however, crosses Bovaird Drive at Mississauga Road and the associated vegetated riparian and upland areas are therefore contiguous with the Huttonville Valley ESA. The Credit Valley subwatershed study has identified this habitat as being of high constraint as it is part of the primary valley of Huttonville Creek [see Figure 6.23a in TSH et al. (2004)].

The associated tributary valleys of the Credit River are considered significant features with respect to their linkage functions, riparian habitat and associated upland features. The LSA (2007) identified the steep valley of tributary 2A (Figure 2) as having moderate functional priority. The wetland east of this tributary on the north side of Bovaird Drive (part of tributary 2B, Figure 2) was identified as having high functional priority. The small patch on the south side and contiguous cultural meadow, however, were identified as having moderate functional priority. Other low to high functional priority features identified in the LSA study include forested areas and woodlands that are present on the north side of Bovaird Drive, between tributary 2A and Heritage Road (woodlot 1, Figure 2), between Heritage Road and Mississauga Road (woodlot 2, Figure 2), and at the north east corner of the intersection of Bovaird Drive and Heritage Road (Figure LSA4 in D&A 2007).

Although development and site alterations to Core Areas are prohibited under the Regional OP (Section 2.3.3.5), exceptions can be made for essential infrastructure if there are no alternative locations outside of the respective Core Area. Where development and site alteration are unavoidable, "they are directed away from the respective feature to the greatest extent possible". Furthermore, the impacts must be minimized, and efforts should be made to mitigate these impacts through restoration or enhancement.

These constraints apply to the Regional and Municipal OP-identified core area valleylands that are tributaries of the Credit River, and the two core area woodlots that are located north of Bovaird Drive and West of Heritage Road.

Linkage Corridors

One of the primary guiding principles outlined in the North West Brampton LSA is the importance of linkages that connect natural features with regional systems (such as the Credit River Valley and Greenbelt protection areas). Since the Credit Valley and Huttonville Valley ESA lie outside of the study corridor, natural features that link these core areas to disjunct natural features are important to identify. For the most part, linkages in the Bovaird Road study corridor have been identified above as being potentially significant. These include the valley lands associated with tributary 2A (Figure 2) and Huttonville Creek. The linkage function associated with tributary 2A was identified as being of low priority in the LSA, as was Huttonville Creek on the north side of Bovaird Drive; on the south side, where the associated terrestrial habitat of Huttonville Creek is contiguous with the Huttonville Valley ESA, the linkage function was identified as moderate priority (D&A 2007), and as having a constraint level 1 by TSH et al. (2004). For this report, where the valleyland features have potential to act as linkages, they have been rated as areas of both potential and high constraint. Smaller drainage features that cross Bovaird Drive were also rated as potential constraint areas, and will be assessed during the 2010 field season.

Where corridors are identified under provincial, regional, or municipal protection categories they are subject to the polices outlined above. Smaller scale feature may not have been identified as a priority, but their function at the locals scale should be considered.

Constraints associated with linkages associated with the Greenbelt Protected Landscape and core area valleylands are described above. Those that have no designation exist as small first or second order streams that are tributaries of the Credit River and cross Bovaird Drive at multiple locations (see Figure 2).

Species at Risk (SAR)

An Element Occurrence query of the NHIC database revealed that the only SAR in the vicinity of the study corridor is Redside Dace (*Clinostomus elongatus*) (NHIC, 2010). This species is typically found in coldwater streams. At the Bovaird Drive study corridor, it occurs in upstream and downstream reaches of Huttonville Creek where it crosses Bovaird Drive. The implications for potential constraints based on this species presence, will presumably be discussed in the preliminary report for the study corridor's aquatic resources. There were also restricted EO occurrences that still need clarification with the NHIC and OMNR.

5 SUMMARY

The most likely terrestrial features to be impacted by development within the Bovaird Drive study corridor are the valleylands of the Credit River and its tributaries. Work conducted during the 2010 field season will be scoped to evaluate the sensitivity of vegetation and wildlife resources associated with these natural features. Emphasis will be placed on likely impacts based on planned improvements and the potential for mitigation and enhancements to improve linkages between disjunct natural features and protected areas (e.g. the Greenbelt Protected Countryside, the Huttonville Valley ESA, and the Credit River Valley).

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Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.

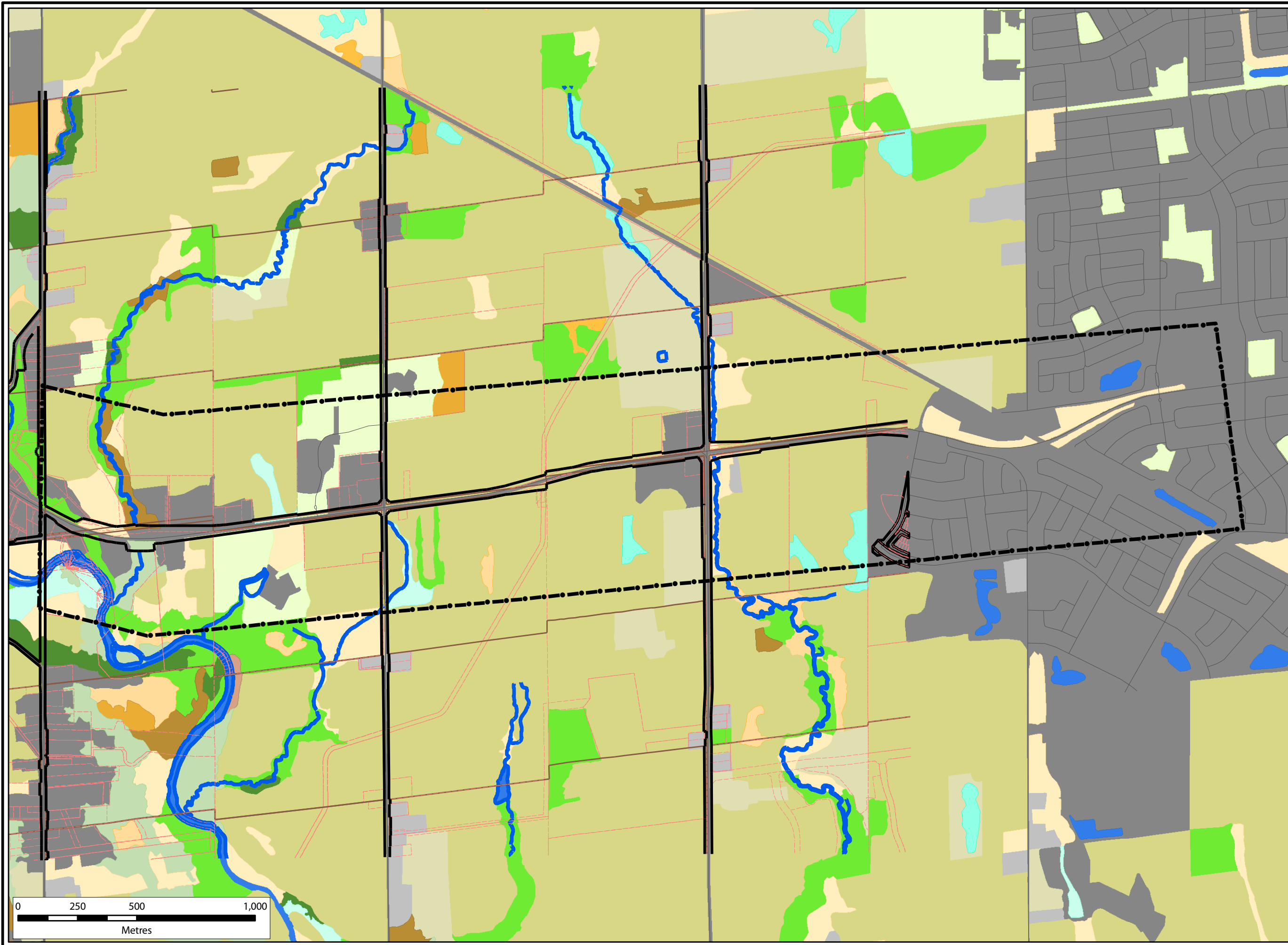
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7 FIGURES

Figure 1. ELC Communities within the Bovaird Drive study corridor. Data provided by Credit Valley Conservation.

Figure 2. Potential constraint areas within the Bovaird Drive study corridor. The preliminary constraint ratings were based on area and feature designations. High constraint areas included those designated as Greenbelt Protected Landscape, ESA, wetland, core valley, and core woodland. Potential constraint areas include those identified as potential linkages and other natural features that will be investigated during the 2010 field season. Numbers bolded in blue are for reference to tributaries and subwatersheds of the Credit River Watershed. Numbers bolded in black are for reference to woodlands.



- Legend**
- Study Area (Approximate)
 - Road
 - Watercourse
 - Lot/Con
 - Parcel
- Vegetation Communities**
- Active aggregate, AA
 - Non-intensive agriculture, AGN
 - Intensive agriculture, AGI
 - Cultural meadow, CUM, CUP3, CUS, CUW, MOS
 - Cultural savannah, CUS
 - Cultural thicket, CUT, CUM, CUW
 - Coniferous plantation, CUP3, CUP3-1, RD
 - Deciduous plantation, CUP1
 - Cultural woodland, CUW
 - Coniferous forest, FOC
 - Deciduous forest, FOD
 - Mixed forest, FOM
 - Treed beach/bar, BBT
 - Open Bluff, BLO
 - Marsh, MA_
 - Deciduous swamp, SWD
 - Coniferous swamp, SWC
 - Wet meadow, WET
 - Aquatic, Lake, Pond, Watercourse, OAO
 - Manicured open space, MOS
 - Urban, URB
 - Rural development, RD

**Bovaird Drive Study Corridor
Vegetation Communities**

DOUGAN & ASSOCIATES
ECOLOGICAL CONSULTING & DESIGN

77 Wyndham Street South • Guelph, ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

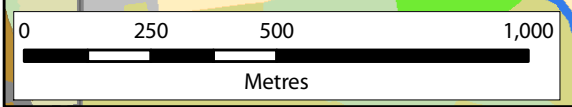
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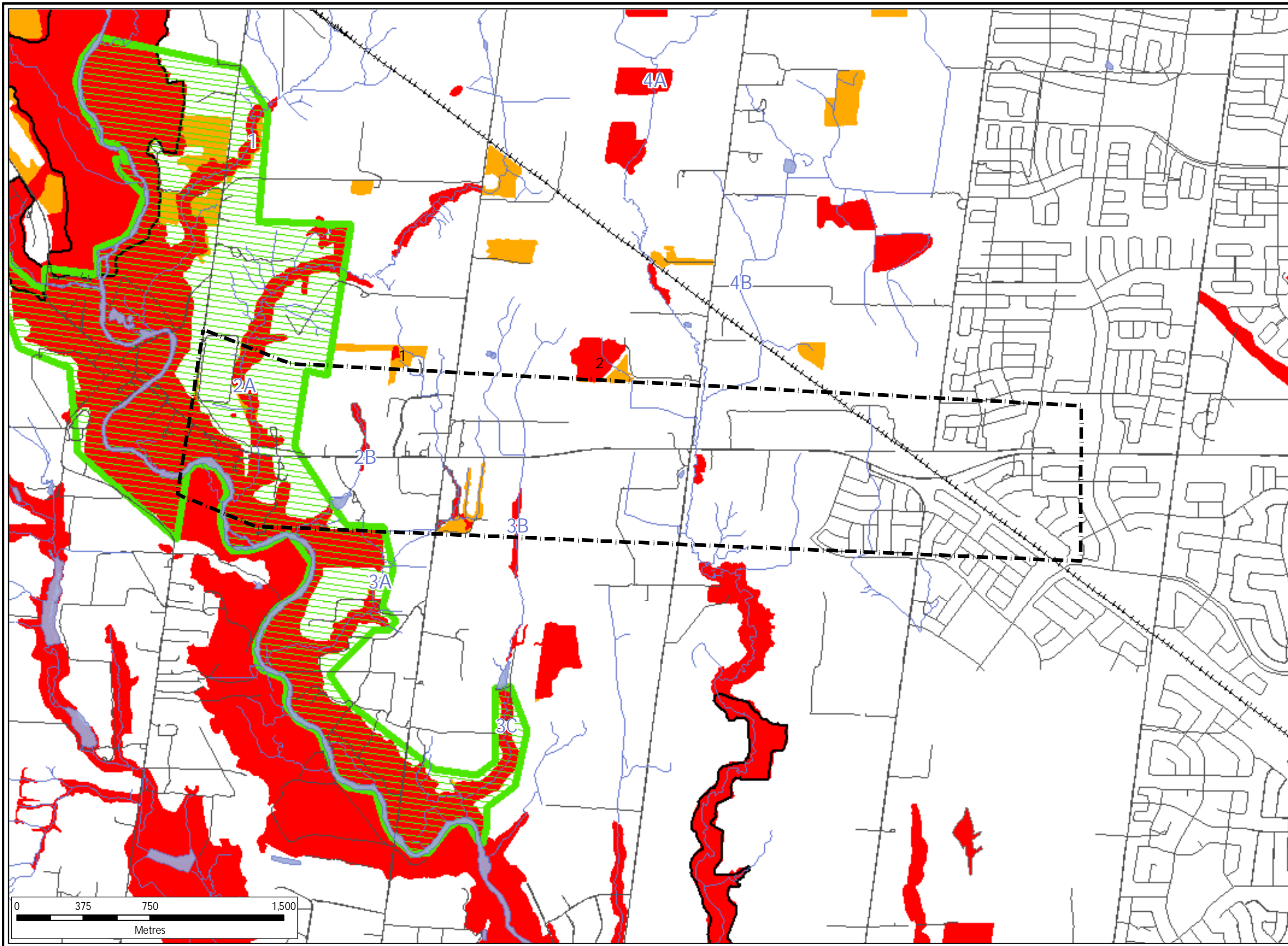
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FIGURE:
1

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- Legend**
- Study Area
 - Surface Drainage Features
 - Roads
 - Railway
 - Greenbelt *
 - Environmentally Sensitive Area
 - High Constraint
 - Potential Constraint

* Note that this is an estimation of the boundary specific to the Bovaird Drive Study Area and does not reflect the true (or total) boundary of the Greenbelt protection area. The current polygon was interpreted from "Plan of the Boundary of The Protected Countryside", Ontario Regulation 59/05, Sheet 25 of 57, Ontario Ministry of Natural Resources (2005).

**Bovaird Drive Study Corridor
Terrestrial Constraints**



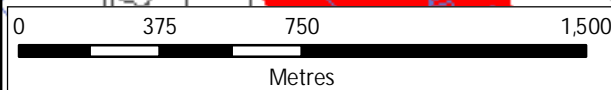
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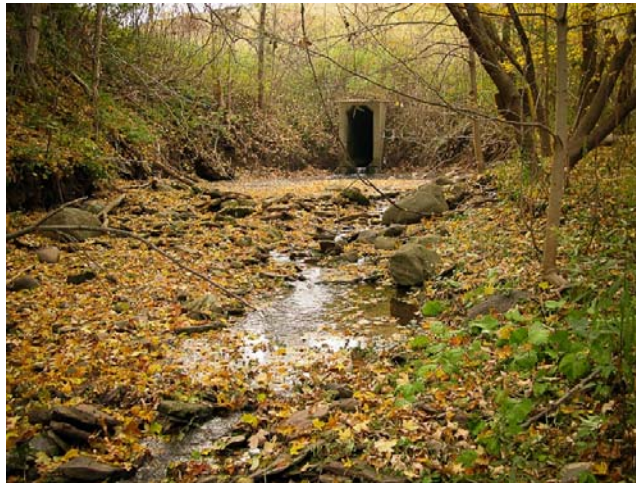
FIGURE: 2

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Bovaird Drive

Environmental Impact Study for Terrestrial Resources



Dougan & Associates – Ecological Consulting and
Design

March 2012



77 Wyndham Street South • Guelph ON N1E 5R3
T 519.822.1609 • F 519.822.5389 • www.dougan.ca

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1 INTRODUCTION

As outlined in the RFP for the Bovaird Drive reconstruction project, the objectives are to review current and future level of service on the west section of Bovaird Drive in the City of Brampton. The study corridor is located along Bovaird Drive, directly east of the Peel/Halton boundary, east of the town of Norval. The section of Bovaird Drive to be studied is 4.8 kilometers long, and bound by Caseley Drive on the west limit, and Lake Louise Drive / Worthington Drive on the east limit.

A preliminary assessment of terrestrial resources was prepared in March 2010 to review the context of terrestrial resources from background sources, and associated policy constraints for the Bovaird Drive study corridor.

This report follows up on the preliminary report, by providing a refined summary of terrestrial resources within the Bovaird Drive study area, estimates areas of disturbances, evaluating potential impacts, and recommending appropriate approaches for avoidance, mitigation and compensation.

2 ENVIRONMENTAL IMPACT ASSESSMENT (TERRESTRIAL RESOURCES)

2.1 METHODS

2.1.1 SITE CHARACTERIZATION

2.1.1.1 BACK GROUND REVIEW

The Northwest Brampton Environmental Open Space Study (EOS) (D&A et al. 2005) was reviewed for terrestrial natural heritage information. Information used for this report focused primarily on the synthesis of the EOS data presented as the proposed Environmental Feature Schedule "D" (Figure 2.5.4 within the report). This included the wetlands, woodlands, hedgerows, valleylands/floodplains, and potential important linkages. Ecological Land Classification data from the EOS report was used to supplement field information for features that were not visited as part of the field surveys.

Rare species and Species at Risk screening was conducted on March 4 2010 using the Natural Heritage Information Centre's Biodiversity Explorer Software (NHIC 2010). Species that were listed as endangered or threatened were highlighted, and an evaluation of the likelihood of their presence was conducted based on the vintage of the observation record, and the habitat in the study area that have potential to be disturbed given the plans for the preferred road improvements.

Secondary plans for lands that overlapped within the Bovaird Drive study area were also reviewed to provide the context of future urban development.

2.1.1.2 FIELD SURVEYS

2.1.1.2.1 VEGETATION

Vegetation communities and botanical surveys were conducted following methods outlined for Ecological Land Classification (ELC) (Lee et al. 1998). This included four site visits to capture seasonal variation in plant species occurrence (Table 1). Efforts were focused on features that were considered to have high potential for naturally occurring (versus culturally or anthropogenic) communities. Roadside surveys were conducted for anthropogenic, agricultural, and cultural communities.

Table 1. Summary of site visits to conduct fieldwork within the Bovaird Drive study area.

D&A Staff	Purpose	Comments
Steve Hill	Preliminary site visit, ELC	October 19, 2009
Ian Richards	Preliminary site visit, Birds	October 5, 2009
Steve Hill	ELC, Botanical Surveys	May 11, 2010
Steve Hill	ELC, Botanical Surveys	June 3, 2010
Steve Hill	ELC, Botanical Surveys	June 10, 2010
Ian Richards	Breeding Bird Survey 1	May 30, 2010; 0600 - 0900, 19°C, calm, clear
Ian Richards	Breeding Bird Survey 2	June 9, 2010; 0630 - 0930, 14°C, light northeast winds, cloudy
Steve Hill	Amphibian Call Surveys 1	April 20, 2010; 20:45 - 00:45; Temp 12.6-6.8C; light winds; hazy but no clouds
Steve Hill	Amphibian Call Surveys 2	May 19, 2010; 00:00 - 01:15; Temps 15-14C; winds 10km/h; mainly clear

2.1.1.2.2 BREEDING BIRDS

Two breeding bird surveys were conducted, on May 30 and June 9 2010, following the protocols outlined by the Ontario Breeding Bird Atlas (OBBA 2001).

2.1.1.2.3 AMPHIBIANS

Amphibian surveys were conducted following methods outlined in the Marsh Monitoring Program Handbook for Amphibians (BSC 2009). Surveys were conducted over two evenings, on April 20 and on May 19 2010. A June survey for Bullfrog (*Rana catesbeiana*) was not conducted, as it was determined that habitat within the study area was not suitable for this species.

2.2 ASSESSMENT OF ALTERNATIVES

The terrestrial study team provided input on the selection of road improvement alternatives, with a particular focus on areas such as watercourse crossings, and where there are concentrations of natural and cultural features. These rankings were combined with the input from other study disciplines to identify the preferred alternative. Special consideration has been given to the proposed alternatives for the Huttonville Creek crossing (Tributary 4 on Figure 1b).

2.3 IMPACT ASSESSMENT

2.3.1 EXTENT OF DISTURBANCE

Direct Impacts

Extent of disturbance was assessed on the lands directly affected by the preferred design for the proposed road improvements, and indirect impacts were assessed in the context of changes that would affect existing or future ecological functions. The estimate of area affected was based on cut and fill lines interpreted from the preferred preliminary design drawings provided by AMEC. These lines were converted from AutoCAD drawings to ArcGIS shapefiles, and imported into ArcMap for analysis.

Where multiple cut/fill lines were drawn for the same section of road (e.g. to represent differences in grade), the line that was the furthest from the existing road allowance was selected as the segment to represent extent of direct disturbance. The extent of disturbance line was overlain on the ELC and land use polygons to determine the area of disturbance for different land cover types.

To estimate the direct impact to different features within the Bovaird Drive study area, the areas of features that would be lost given the proposed preferred design were calculated in ArcMap, and exported to Excel to calculate the summed area affected for different land types.

Broad classifications for land types included:

- Existing road and road shoulder (Anthropogenic)
- Agricultural
- Anthropogenic
- Ditch
- Hedgerow
- Cultural Meadow (CUM)
- Cultural Savannah (CUS)
- Cultural Woodland (CUW)
- Shallow Marsh (MAS)

Indirect Impacts

Indirect impacts were assessed through a review of the direct changes to the physical conditions under the preferred alignment, and consideration of:

- Potential effects of removal or all or portions of natural and cultural features, and effect on observed biota and habitat conditions;
- Potential effects of increased road width and traffic on wildlife passage and road kills;
- Potential operational impacts such as the increased extent of exposure to road noise, road runoff, and road salt drift.

2.3.2 EVALUATION OF IMPACTS

Priority areas were identified where the proposed road improvements were adjacent to, or encroached on natural or cultural features and/or crossed watercourses. The assessment included an evaluation of potential impacts and suggestions for avoidance, mitigation, and or compensation.

2.4 RESULTS

2.4.1 SITE CHARACTERIZATION

2.4.1.1 BACKGROUND REVIEW

Proposed significant features that were identified in the EOS study (D&A et al. 2005) and that were within the Bovaird Drive study area included: one woodland, one hedgerow, two wetlands, and six potential linkage opportunities. These locations are presented in Figure 2.5.4 of the EOS.

Key Natural Features and Linkages

The identified woodland is located at the west end of the study area and is associated with the valley slopes and bottomland areas of Tributary 2a, south of Bovaird Drive (Figure 1a). The identified hedgerow was located along the east side of Heritage Road, south of Bovaird Drive. The two wetlands were located approximately 450m west of Heritage Road, on the north and south sides of Bovaird Drive. Five of the six potential linkage opportunities were associated with riparian areas of watercourses that cross Bovaird Drive; one was associated with an upland hedgerow. The following describes their relative locations (Figures 1a and 1b):

1. The first linkage is associated with Tributary 2a, located 1000m west of Heritage Road;
2. The second linkage, associated with the wetlands that are present on the north and south side of Bovaird Drive (where Tributary 2b crosses), is approximately 450m west of Heritage Road;
3. The third linkage is located at the intersection of Bovaird Drive and Heritage Road, where Tributary 3a crosses Bovaird Drive;
4. The fourth linkage is associated with an upland hedgerow feature 205m east of Heritage Road;
5. The fifth linkage is located 440m east of Heritage Road and is associated with Tributary 3b;
6. The sixth linkage is associated with the Huttonville Creek (Tributary 4) crossing just east of Mississauga Road.

Species at Risk

The NHIC query identified eight rare species and species at risk that may occur within the vicinity of the study area (Table 2).

Of the rare species with records in the vicinity of the study area, only Redside Dace was listed as Species at Risk (Endangered both federally (COSEWIC 2011) and provincially (OMNR 2012)). Characterization of its presence, potential impacts, and mitigation is dealt with in the fisheries resources report for this project.

Table 2. Rare species records for areas in the vicinity of the Bovaird Drive study area.

Scientific Name	English Name	G-rank	S-rank	COSEWIC	SARO	Last Observed Date
<i>Crataegus dissona</i>	Northern Hawthorn	G4G5	S3			6/2/1982
<i>Gleditsia triacanthos</i>	Honey-locust	G5	S2			6/17/1911
<i>Lestes eurinus</i>	Amber-winged Spreadwing	G4	S3			N/A
<i>Arigomphus furcifer</i>	Lilypad Clubtail	G5	S3			N/A
<i>Somatochlora tenebrosa</i>	Clamp-tipped Emerald	G5	S2S3			1941-PRE
<i>Clinostomus elongatus</i>	Redside Dace	G3G4	S2	END	END	8/29/1995
<i>Myotis leibii</i>	Small-footed Bat	G3	S2S3			9/2/1948
<i>Carex torta</i>	Twisted Sedge	G5	SX			6/3/1910

The remaining species have potential to be present within the study area (although not detected during field surveys; see below), but based on habitats present, are unlikely to be present in the lands directly adjacent to Bovaird Drive where road improvements are proposed to occur. It should be noted that some Species at Risk, such as Bobolink (*Dolichonyx oryzivorus*), are found in open agricultural areas so are likely present in the general vicinity of the study area. However, since they have been designated as Species at Risk only recently (e.g. Bobolink was added in 2010), the NHIC database does not yet contain any element occurrences.

2.4.1.2 FIELD SURVEYS

2.4.1.2.1 VEGETATION

Species

In total, 170 species of plants were recorded during botanical surveys of the study area (Appendix A). Of these, 157 were identified to species, the remaining 13 to genera. Of the 157 that were identified to species, 94 are native to Ontario, the remaining 64 are introduced. None of the native species were designated as species at risk by COSEWIC or COSARO. All native species had a provincial status of secure (S5) or apparently secure (S4). Eleven species were considered locally uncommon or rare (Appendix A) (Varga et al. 2005, Kaiser 2000).

ELC Communities

Ecological Land Classification communities and land use types are presented in Figures 1a and 1b.

West of Heritage Road

Natural and cultural features within the study area, west of Heritage Road totaled 25.8 hectares (Table 3). This included deciduous forest (FOD), meadow marsh (MAM), open water (OAO), cultural meadow (CUM), cultural plantation (CUP), cultural savannah (CUS), cultural thicket (CUT), cultural woodland (CUW), ditches and hedgerows. The remaining lands were composed of Anthropogenic features (12.2 ha) and farmland (27.0 ha).

Deciduous forest features were associated with the valley slopes and bottomland areas of the Credit River, and a Credit River Tributary. The feature north of Bovaird Drive was composed of a mixed deciduous Bitternut Hickory forest, grading from a Dry-Fresh Hickory Deciduous Forest Type (FOD2-3) on the upper slopes to a Fresh-Moist Hickory Deciduous Forest Type (FOD9-5) in the bottomland areas. The forest south of Bovaird Drive and associated with the slopes of Tributary 2a was primarily a Fresh-Moist Lowland Deciduous Forest Ecosite, with a mix of Black Walnut (*Juglans nigra*) and Green Ash (*Fraxinus pennsylvanica*) as dominants.

Cultural woodland was associated with a small swath of roadside forest along the south side of Bovaird Drive on the hillside leading east out of the Credit River Valley, the valley slopes of Tributary 2a, and the small American Elm / Black Walnut cultural woodland located at the northwest corner of Heritage Road and Bovaird Drive.

A coniferous cultural plantation was present on the north side of Bovaird Drive, on the slopes and adjacent tableland areas west of the Tributary 2a valley.

A cultural thicket community was present along the north side of Bovaird Drive leading out of the Credit River Valley. The hillside here was very steep, and groundwater seepage was observed that supported a small sedge-dominated inclusion.

There were a number of blocks of land existing as cultural meadow along this section of the Bovaird Drive corridor; the majority were abandoned agricultural lands present south of the road, and roadside verges adjacent to the road shoulder.

Hedgerows were also present although not abundant. One east-west hedgerow, set back from the north side of Bovaird Drive by 175m, was identified in the EOS, but only contained sparse tree cover. Another relatively intact hedgerow was present, running north-south along the west side of Heritage Road, south of Bovaird Drive.

The remaining lands in the west end of the study corridor were designated as anthropogenic, agricultural, or roadside ditch.

Heritage Road to Mississauga Road

Approximately 5.9 ha of land is contained within the study area between Heritage Road and Mississauga Road; cover was classified as natural or cultural (Table 3). Features included cattail shallow marsh, cultural savannah, cultural meadow, hedgerow, and ditch.

The majority of these features were present in the vicinity of the Heritage Road intersection. This included a cultural savannah on the northeast corner, a hedgerow on the southeast corner, shallow marsh adjacent to the southeast corner (associated with Tributary 3a), and two hedgerows within 250m of Heritage Road on the south side of Bovaird Drive.

Further east from Heritage Road, there was a small cattail marsh adjacent to the road shoulder on the north side of Bovaird Drive (where Tributary 3b crosses the road). As well, there were a number of hedgerows scattered between the agricultural fields. A small amount of roadside verge along this section of the corridor was either cultural meadow or ditch.

The remaining lands in this section were either anthropogenic or agricultural.

Table 3. Approximate areas of land uses and ELC features based on location along the study area of the Bovaird Drive corridor.

ELC/Land Use	West of Heritage Road (ha)	Heritage Road to Mississauga Road (ha)	East of Mississauga Road (ha)	Total (ha)
Agricultural	12.2	35.4	23.5	71.1
Anthropogenic	27.0	14.2	54.1	95.3
SWM	0.0	0.0	1.3	1.3
FOD	5.2	0.0	0.0	5.2
MAM	0.4	0.0	0.0	1.4
MAS	0.0	1.0	0.0	1.0
CUP	0.3	0.0	0.0	0.3
CUW	2.2	0.0	0.6	2.9
CUS	0.2	0.8	0.0	1.0
CUT	0.6	0.0	0.0	0.6
CUM	14.7	0.8	4.5	20.0
Hedgerow	0.5	1.9	0.2	2.6
Ditch	0.8	1.4	0.3	2.6
OAO	0.9	0.0	0.0	0.9
Total	65.1	55.4	84.6	205.1

Mississauga Road to Worthington Drive

Approximately 5.6 ha of land within the study area east of Mississauga Road was classified as natural or cultural (Table 3). This included features that were cultural woodland, cultural meadow, hedgerow, and ditch.

The most important vegetation features were those associated with the riparian areas and floodplain of Huttonville Creek (Tributary 4). This included the cultural woodland feature northeast of the Bovaird Drive and Mississauga Road intersection, and cultural meadow southeast of the intersection.

Hedgerows and ditches were associated with the edge of agricultural fields and the roadside verge areas of Bovaird Drive.

The remaining lands were agricultural, anthropogenic, or storm water management areas.

2.4.1.2.2 WILDLIFE

Breeding Birds

Thirty-nine (39) species of birds were detected during the surveys; of these, 36 were considered as possibly breeding or on territory. Great Blue Heron, Turkey Vulture, and Ring-billed Gull were detected within (and flying over) the study area, but would not be considered breeding in the vicinity based on available habitats. Of the 35 breeding species, three of them are introduced (non-native): Rock Pigeon, European Starling and House Sparrow. Of the remaining 33 species, only one species is considered a Species at Risk, both federally (COSEWIC 2011) and provincially (OMNR 2012): Barn Swallow (*Hirundo rustica*) has recently been designated as "Threatened" in Ontario and Canada. On a local level, most of them are considered either common or abundant, and widespread, within adjacent Halton County (McIlveen 2006), the City of Hamilton (Curry 2003) and the City of Toronto (TRCA 2008). The exceptions are as follows: Horned Lark, Northern Rough-winged Swallow and Eastern Bluebird are considered uncommon summer residents in Halton Region (McIlveen 2006), and Eastern Bluebird is considered uncommon (and very widespread) in the City of Hamilton (Curry 2006). At a regional level, three species – American Kestrel, Savannah Sparrow and Baltimore Oriole – have been designated by Partners in Flight as priority species in BCR 13 (Lower Great Lakes/St. Lawrence plain) (OPIF 2006); BCR 13, the Lower Great Lakes – St. Lawrence Plain, corresponds roughly with the area south of the Canadian Shield. The Ontario Landbird Conservation Plan, from which the list of priority landbird species was obtained, is a coalition of government agencies and organizations led by Environment Canada Ontario Region (EC) and the Ontario Ministry of Natural Resources (OMNR), in partnership with Bird Studies Canada (BSC).

The three priority landbird species fall into the following general habitat types:

- 1) Grass/Agriculture (American Kestrel)
- 2) Grass/Agriculture (Savannah Sparrow)
- 3) Other Habitats (Baltimore Oriole)

The highest level of breeding evidence obtained was confirmed breeding, as evidenced by fledged young observed of the following five species: Canada Goose, Mallard, American Robin, European Starling and Common Grackle. The second highest level of breeding evidence was of territorial males, which indicates probably breeding, based on being present singing at the same location on both surveys. This evidence was obtained for ten species: Warbling Vireo, Horned Lark, Gray Catbird, Yellow Warbler, Northern Cardinal, Chipping Sparrow, Savannah Sparrow, Song Sparrow, Baltimore Oriole and Red-winged Blackbird. The next highest level of breeding evidence was singing males; this evidence, which represents possible breeding, was obtained for 19 species. For additional details on the breeding bird surveys, see Appendix B.

Amphibians

During the nocturnal amphibian call surveys conducted, only American Toad (*Bufo americana*) was detected within the study area (Table 4). Generally this species was only present in low abundance, and located in areas well away from Bovaird Drive that will be disturbed during the proposed road improvement areas. This species is common and widespread throughout southern Ontario, and is very tolerant of anthropogenic activities and land uses.

Other locations surveyed such as creeks, wetlands, and roadside ditches resulted in only a few species being detected at low abundances. The lack of amphibian diversity reflects the limited wetland cover and lack of habitat structure (such as pools) in the study corridor.

Table 4. Amphibian nocturnal call survey summary. Locations are shown on Figures 1a and 1b.

Survey Location	Location	April 20 2010	May 19 2010	Notes
NCS 1	South of Bovaird Drive along Tributary 2a			No calls during either visit
NCS 2	North of Bovaird Drive along Tributary 2a	AMTO 1-1		Only one American Toad heard calling during the first visit, well into the valley (>100 m from paved roadway)
NCS 3	South of Bovaird Drive along Tributary 2b, small cattail marsh adjacent to toe-of-slope; no amphibians heard			No calls during either visit
NCS 4	North of Bovaird Drive along Tributary 2b; small cattail marsh	AMTO 1-1	AMTO 1-1	American Toad heard calling during both visits; well north of Bovaird Drive (>300m)
NCS 5	South of Bovaird Drive, east of Heritage; cattail marsh (associated with Tributary 3a)	AMTO 1-1		Only one American Toad heard calling during the first visit, located within 100m of Bovaird Drive
NCS 6	South of Bovaird Drive along Huttonville Creek (Tributary 4); no amphibians heard			No calls during either visit
NCS 7	North of Bovaird Drive along Huttonville Creek (Tributary 4); no amphibians heard			No calls during either visit
NCS 8	SWM Pond west of Wellington Ave	AMTO 2-10		American Toads were heard during the first visit; there were no calls during the second visit

2.4.2 EXTENT OF DISTURBANCE

In total, the cut/fill perimeter presented in the preferred design represented 7,447 m of proposed road improvements (Figure 2). Of this, 430 m of the existing road or road shoulder would remain the same as

the existing condition. The remaining 7,017 m interfaces or encroaches on land that currently consists of anthropogenic land uses (commercial, residential, etc), agricultural land, and cultural communities (including roadside ditches, hedgerows, and meadow communities) and to a minimal extent (0.03 ha), natural features.

Table 5. Area of disturbance based on land type within the Bovaird Drive study area.

Feature Type	Area Disturbed
Agricultural	1.27 ha (13.31%)
Anthropogenic	5.14 ha (53.88%)
Ditch	1.80 ha (18.87%)
Hedgerow	0.27 ha (2.83%)
Cultural Meadow (CUM)	0.49 ha (5.14%)
Cultural Savannah (CUS)	0.16 ha (1.68%)
Cultural Woodland (CUW)	0.38 ha (3.98%)
Wetland (MAM/MAS)	0.03 ha (0.31%)

The areal extent of proposed road improvements is expected to disturb a total of 9.54 ha of land. By land type, the resulting area of disturbance (percent of total disturbed area in brackets) is presented in Table 5.

2.4.3 IMPACTS, MITIGATION, AND COMPENSATION

Impacts to natural features within the Bovaird Drive study area are summarized in Table 6. The following sections describe in more detail the potential impacts, mitigation, and compensation for the proposed road improvements.

2.4.3.1 IMPACTS TO FEATURES IDENTIFIED IN THE EOS STUDY

The preferred design intersects with five potential linkage opportunities that were identified in the EOS (D&A et al. 2005). Four of the potential linkages are defined by watercourses and associated riparian vegetation, and therefore cross Bovaird Drive via culverts, the size of which varies based on watercourse size. Where feasible, consideration should be given to the improvement of these culverts to enhance wildlife passage opportunities. For example, this could involve integrating terrestrial benches above the level of base flow, to facilitate wildlife movement. The fifth potential linkage is bisected by Bovaird Drive 220m east of Heritage Road, where there is currently no culvert connection.

The preferred design will also encroach on a hedgerow that was identified in the EOS study on the southeast corner of the Heritage Road intersection. A number of large diameter trees along the east (and west) side of the intersection will need to be removed to widen Heritage Road at this location.

No other features identified as potentially significant in the EOS study will be impacted directly by the road improvements proposed as part of the preferred design.

2.4.3.2 VEGETATION

Caseley Drive to Heritage Road

Proposed road improvements begin approximately 750m east of Caseley Drive. Encroachment along Bovaird Drive from this point east to Heritage Road will primarily affect agricultural and anthropogenic lands (Figure 2a and 2b).

The ditch feature running along the north side of Bovaird Drive will be encroached upon; this feature supported a plant community of graminoids and forbs typical of a cultural meadow ecosite. The field directly to the northwest contains an unevaluated wetland feature which was recognized as a potentially significant environmental feature in the EOS (also as part of Tributary 2b). During field visits in 2010, the wetland feature was being farmed, except for a very small patch of cattail marsh directly north of the edge of proposed grading along Bovaird Drive. Assuming the wetland area has been actively farmed in the past, and will continue to be farmed in the future, road improvements in the adjacent area will have negligible impact on the wetland features and functions. Drainage under Bovaird Drive at this location however, should be maintained to reduce downstream impacts that might occur if surface flows were obstructed. Erosion protection should be provided for the channel and wetland feature. The associated culvert will not be extended, however it may require improvements to mitigate structural deficiencies.

A small section of the cultural woodland on the northwest side of the Heritage Road intersection will be removed. This will include clearing some trees, shrubs, and understory habitat. Alteration of the small watercourse (Tributary 3a, Figure 1a) that flows southeast under Bovaird Drive will also be impacted.

The majority of the hedgerow along the west and east sides of Heritage Road (the latter as identified in the EOS), south of Bovaird Drive will be cleared. This will involve the removal of a number of mature trees. The watercourse mentioned above (Tributary 3a) will also be impacted by alterations between the culvert outlet draining the north side of Bovaird Drive, and the culvert inlet flowing east under Heritage Road.

Compensation for tree removal can be achieved through planting the same species in roadside verge areas along the Bovaird Drive corridor that currently have no or low tree density. Although compensation is not required by the City's Tree Bylaw, compensation is often recommended (S. Jorgenson, Senior Environmental Planner, pers. comm., June 19 2011). Compensation approaches that have been used in the past include replacement ratios ranging from 1:1, to 3:1 depending on the stature and maturity of the tree. Furthermore, compensation will help achieve urban tree cover targets for the Region.

The culvert that crosses Bovaird Drive just west of Heritage Road will be extended by 21m (11m on the upstream side, and 10 m on the downstream side). The corrugated steel pipe on the downstream section will also be replaced with a concrete open footing. It is not anticipated that the increase in length will have a negative impact on wildlife movement as constraints likely exist under the current condition (e.g. lack of connectivity to habitat, corrugated steel pipe present on downstream section). The replacement of the corrugated steel pipe will likely improve conditions for smaller wildlife (such as amphibians and small mammals). Terrestrial impacts of extending the culvert for the watercourse adjacent to the Heritage Road intersection (Tributary 3a, Figure 1a), will be negligible as the

surrounding community is a mix of cultural woodland, hedgerow and cultural meadow. If channel reconstruction is considered, it might result in minor improvements to the existing condition by reducing erosion/sedimentation, and providing more diversity of riparian habitats.

Heritage Road to Mississauga Road

The majority of this alignment will encroach on cultural meadow and ditch features in the roadside verges and existing anthropogenic lands.

The southeast side of the intersection at Bovaird Drive and Heritage Road will involve the removal of mature trees that make up the roadside hedgerow, and a section of the cattail marsh (associated with Tributary 3a) that extends to the southeast between two agricultural fields.

The culvert that conveys flows under Heritage Road, just south of Bovaird Drive will be removed and replaced with a longer structure (14m to 36m respectively). Although this represents a significant increase in length, impacts to wildlife movement are likely to be minimal given that wildlife movement is likely constrained under existing conditions (i.e. 0.91 m diameter corrugated steel pipe).

Expanding the northeast section of the Heritage Road intersection will involve removal of vegetation within and adjacent to the cultural savannah feature. Compensation for community types and species removed can be accommodated through the preparation and implementation of a suitable landscape design in adjacent areas, or elsewhere within the study area.

Approximately 205m east of the intersection, expansion of the road on the south side of Bovaird Drive will encroach on a hedgerow with a predominantly deciduous tree composition. The interface of impact is relatively short (~20m) and shallow (~2m), therefore impacts will be minimal. Staking of the feature during detailed design, and minor adjustments to local grading design, may reduce or prevent disturbance to this feature.

Approximately 440m east of the intersection, widening of the road right of way on the north and south side of Bovaird Drive will impact a small watercourse (Tributary 3b, Figure 1a) and the associated vegetation. A small cattail marsh directly northeast of this feature will also be impacted, albeit indirectly via changes in roadside drainage. Although the ditch on the north side of Bovaird Drive will be filled at this location, there will be no alteration to the drainage received from lands to the north. Additionally, the culvert at this location will be replaced with a larger structure (6m span, 1 m height, with an open footing); this will provide an improved opportunity over existing conditions (1.2m width concrete structure) for movement of small wildlife. This location is also within lands that have been proposed as part of the regional Natural Heritage System (NHS); increasing the size of the culvert at this location will support the proposed NHS crossing, offering an improvement to linkage between natural features on the north and south sides of Bovaird Drive. On the south side, the watercourse drains into the Credit River; on the north side, there are two woodland features that will likely be preserved, and other features associated with the East branch of Huttonville Creek (Tributary 4, Figure 1a). Therefore, appropriate design of the culvert structure at this location will facilitate movement by various types of wildlife, improving the connectivity of a number of important natural features in the area.

The section directly west of Mississauga Road is primarily anthropogenic and includes a commercial

property on the north side of Bovaird Drive, and a driving range and gas station on the south side. Terrestrial impacts of road widening along this section will be negligible.

Mississauga Road to Worthington Drive

Encroachment of road improvements east of Mississauga Road will primarily occur within existing anthropogenic lands, agricultural lands, and roadside drainage ditches. Areas that were identified as high priority included features along Huttonville Creek (Tributary 4, Figure 1a), and the hedgerow/swale (associated with Tributary 5, Figure 1b) in the vicinity of the intersection of Bovaird Drive and the proposed James Potter Drive extension.

Widening the northeast corner of the Mississauga Road and Bovaird Drive intersection will result in the loss of small section of cattail / reed canary grass marsh and a section of cultural woodland. Widening the southeast corner of the intersection will result in a small loss of cultural meadow. Overall, the reduction in area of these natural features will be negligible. Removal of trees on the northeast section of the intersection can be compensated within the same feature, or elsewhere within the study area. Cultural meadow is a common vegetation type within and beyond the study area; the species present within this community are also very resilient to disturbance and can quickly re-colonized areas that have been cleared.

The location of the proposed James Potter Drive intersection will involve encroachment on a narrow hedgerow/swale (associated with Tributary 5, Figure 1b) that runs south to a cultural woodland that is located southwest of the existing intersection of James Potter Drive and Ashby Fields Drive. Although the cultural woodland feature is currently isolated from other important natural heritage features, in the future it may function as a node for wildlife movement between the Huttonville Creek (Tributary 4) valley, green space / SWM areas south of James Potter Drive. Lands west of the proposed James Potter Drive and south of Bovaird Drive are designated as community park (Schedule SP45[A] in the Credit Valley Secondary Plan area), however the current plan for the Bovaird Drive road improvements identifies this area as being developed as residential lots. Long-term impacts to connectivity resulting from the Bovaird Drive road improvements will be minimal given that reconstruction of the existing infrastructure and removal of the hedgerow/swale will occur as a result of development in the area. The construction of a community park in the lands to the west, adjacent to Huttonville Creek, will provide linkage enhancements by directing localized wildlife movement to the Huttonville Creek corridor; this will ultimately provide a much better opportunity than existing conditions for connectivity to lands to the north of Bovaird Drive.

2.4.3.3 WILDLIFE

Birds

In general, it is recommended that impacts to breeding birds be avoided so as not to contravene the Migratory Bird Convention Act (1994). This requires clearing and grubbing outside the nesting period (generally April 15 to July 15), or completion of a nesting survey by a qualified avian ecologist if clearing or grubbing will occur within this period, to identify and temporarily protect active nests until nesting is finished. Areas of proposed disturbances are restricted to habitats immediately adjacent to Bovaird Drive, and will have limited impact on breeding migratory birds directly or indirectly though impacts to their habitat. Based on the small amount of area that will be impacted directly (9.54 ha), and that less than 50% of the affected lands provides potential habitat (i.e. 53% is anthropogenic, the remaining 47%

is agricultural, cultural, or natural) impacts to breeding birds will be minimal.

Although direct impacts to breeding birds are unlikely, there is the potential for indirect impacts that may result from construction activities (e.g. noise, increased presence of humans). These impacts can be mitigated by scheduling construction activities that will directly disturb existing habitats during the fall and winter.

Barn Swallow, a “Threatened” species in both Ontario (OMNR 2012) and Canada (COSEWIC 2011), was detected during the breeding bird surveys. Three birds were seen foraging over the open fields south of Bovaird Drive (east of Mississauga Road) on May 30 2010, and five birds were seen in the same general vicinity on June 9 2010. No signs of active breeding were observed, but considering the habitat in the area, and the presence of human-made structures (e.g. barns) that they attach their nests to (Lepage 2007), it is likely that they are breeding locally. However, since the proposed construction activities do not involve removing any such potential structures for nesting, there should be no negative impacts on their breeding activities.

Amphibians

Based on the relative lack of amphibian communities present within the study overall, and none being detected within the affected areas of the proposed road improvements, impacts will be negligible. Only 0.03 ha of wetland is expected to be impacted directly by the proposed road improvements. The majority of this wetland type was cattail dominated shallow marsh, which is unlikely to provide breeding habitat for amphibians. Therefore, we are confident that amphibians will not be impacted by the proposed road improvements along Bovaird Drive.

The treatment of watercourses should include consideration of additional structural elements, such as overflow pools and buffer plantings, to add habitat functionality, which will benefit ecological functions at the system level.

2.4.3.4 CONNECTIVITY (HUTTONVILLE CREEK CROSSING)

Given the location of the study area, White-tailed Deer (*Odocoileus virginianus*) would be the largest animal attempting to utilize the culvert at the Huttonville Creek (Tributary 4, Figure 1a) and Bovaird Drive location, and would pose the largest threat to human safety. Therefore, we assume that culvert dimensions that are adequate for White-tailed Deer (deer) will also facilitate usage by smaller animals.

To evaluate the adequacy of the existing and proposed culvert dimensions, we compared them to dimensions presented in a study on wildlife use of culverts in northern Pennsylvania (Brudin, 2004). The study presented dimensions (height, width, and length) and Openness Index (height x width / length) of nine box culverts, with confirmed deer use (Table 7). The culverts studied had similar dimensions to the existing and proposed culvert options for the Huttonville Creek culvert (Table 8).

We assume that if the dimensions and Openness Index of the existing or proposed options are consistent with those presented in Brudin (2004), that they will be adequate to facilitate use by deer. Where this is not the case and proposed culvert dimensions are more likely to constraint wildlife movement, changes that would increase potential use are presented.

Table 6. Summary of potential impacts of the proposed preferred design to natural features within the Bovaird Drive study area.

Feature	Location	Characteristics	Sensitivity	Amount of Disturbance	Impact	Mitigation/Compensation
<u>Caseley Drive to Heritage Road</u>						
Ditch and Adjacent Wetland (Polygons 39 & 41)	North and south sections of Bovaird Drive, approximately 450m west of Heritage Road (associated with Tributary 2b).	Ditch features are primarily composed of cultural meadow species. Adjacent wetland features are composed of cattails. Associated with proposed NHS.	Low. Species are relatively insensitive to disturbance, and would easily establish following any disturbances.	Less than 0.2 ha will be disturbed.	Impact will be minimal given the proposed extent of disturbance, and ability of species to reestablish following disturbance.	Replace culverts with those that have designs that facilitate wildlife movement (e.g. terrestrial benches above the typical baseflow level).
Cultural Woodland (Polygon 43)	Northwest corner of Bovaird Drive and Heritage Road intersection.	Woodland is relatively small (0.4 ha), and is composed of American Elm, Black Walnut, Ash, and Manitoba Maple.	Moderate. Some trees are relatively mature and would have to be removed given the proposed road improvements.	Disturbance would be relatively small. Only a section of the feature would be impacted by the proposed road improvements (0.1 ha).	Impact will be moderate, as some mature trees may have to be removed.	Compensate for tree removal with appropriate replacement ratios determined by the City and or Region.
Hedgerow (Polygon 46)	West side of Heritage Road, south of Bovaird Drive.	Hedgerow includes a number of large diameter Ash trees.	Moderate. Some trees would have to be removed given the proposed road improvements.	Disturbance would involve removing trees approximately 150 m south of the intersection.	Impact will be moderate as some mature trees may have to be removed.	Compensate for tree removal with appropriate replacement ratios determined by the City and or Region.
<u>Heritage Road to Mississauga Road</u>						
Hedgerow (Polygon 8)	East side of Heritage Road, south of Bovaird Drive.	Hedgerow includes a number of large diameter Shagbark Hickory and Bur Oak. Section of hedgerow is part of proposed NHS.	Moderate. Some trees would have to be removed given the proposed road improvements	Disturbance would involve removing trees approximately 150 m south of the intersection.	Impact will be moderate as some mature trees may have to be removed.	Compensate for tree removal with appropriate replacement ratios determined by the City and or Region.
Shallow Marsh (Polygon 10)	Southeast of Heritage Road and Bovaird Drive intersection (associated with Tributary 3a).	Cattail marsh occurs along watercourse from just south of the intersection, to where it crosses back under Heritage Road approximately 310 m to the south. Associated with proposed NHS.	Low. Species present would be relatively insensitive to disturbance and would easily reestablish following disturbance.	Approximately 0.2 ha will be disturbed given the current preferred design.	Impact will be minimal given the proposed extent of disturbance, and ability of species to reestablish following disturbance.	Measures to protect fisheries within the vicinity of this feature will also provide protection for terrestrial resources.
Shallow Marsh (Polygon 12)	North of Bovaird Drive approximately 440m east of the intersection (associated with Tributary 3b).	Cattail dominated marsh.	Low. Species present are relatively insensitive to disturbance.	Approximately 0.005 ha just north of Bovaird Drive will be disturbed.	Impact will be minimal given extent of disturbance based on the preferred design, and ability of species to reestablish following disturbance.	Appropriate placement of silt fencing to reduce unnecessary encroachment on the remainder of the feature, and to reduce sediment inputs. Replace culverts with those that have designs that facilitate wildlife movement (e.g. terrestrial benches above the typical baseflow level, or open footings where appropriate). Other mitigation measures to be determined based on culvert and crossing designs.
<u>Mississauga Road to Worthington Drive</u>						
Floodplain areas of Huttonville Creek (Polygons 19 & 20)	North and south of Bovaird Drive, just east of Mississauga Road (associated with Tributary 4).	North of Bovaird Drive is Cultural Woodland. South of Bovaird Drive is Cultural Meadow. Both areas are within the floodplain of Huttonville Creek. Associated with proposed NHS.	Low. Both feature are cultural, and composed of species that would easily reestablish following any disturbances involved with the construction of road improvements.	Disturbance would be associated with removal of existing culvert, grubbing and clearing of vegetation south of Bovaird	Impact will be minimal given the small area affected, and the culvert is not linked to natural features on the north side of Bovaird	During construction, appropriate placement of silt fencing will minimize erosion and sedimentation impacts. Avoid vegetation clearing and grubbing during the breeding bird nesting period (generally April 15 th – July 15 th); if not feasible, conduct nest surveys and protect active nests.
Hedgerow / Swale (Polygon 100)	West of proposed James Potter Drive intersection (associated with Tributary 5).	Drainage feature with sparse woody vegetation cover and in some areas a vegetated swale.	Low. Feature is composed of species that would easily reestablish following any disturbances involved with the construction of road improvements.	Approximately 0.05 ha will be disturbed.	Impact will be minimal given the small area affected, and the ability of species to reestablish following disturbance.	Generally, impacts such as loss of vegetated cover and connectivity could be compensated for if the lands in the vicinity are developed as community park (as outlined in the Secondary Plan for the area).

Table 7. Summary of reinforced concrete box culverts with confirmed deer use (from Brudin 2004).

Culvert	Length (m)	Width (m)	Height (m)	Openness Index
A	39.32	5.49	3.05	0.43
B	43.28	3.96	2.13	0.19
C	71.93	3.66	2.74	0.14
D	34.14	5.79	2.59	0.44
E	35.36	5.79	2.44	0.40
F	27.13	3.96	1.98	0.29
G	24.69	3.66	2.13	0.32
H	87.17	4.88	2.74	0.15
I	87.17	4.88	2.74	0.15
Mean	50.02	4.67	2.50	0.28
SE	8.36	0.30	0.12	0.04
Minimum	24.69	3.66	1.98	0.14
Maximum	87.17	5.79	3.05	0.44

Table 8. Existing and proposed dimensions for the Huttonville Creek (Tributary 4) culvert. Bolding and italics indicate dimensions that are higher and lower, respectively, than the range presented in Brudin (2004). The preferred option is identified with grey shading.

Options	Length (m)	Width (m)	Height (m)	Openness Index
Existing	60	5.53	<i>1.65</i>	0.15
Option 1	84	5.53	<i>1.65</i>	<i>0.11</i>
Option 2	83	10.5	<i>1.65</i>	0.28
Option 3	60	5.53	<i>1.65</i>	0.15
Option 4*	71	21	3.18	0.94
Option 5	60	5.53	<i>1.65</i>	0.15
Option 6	83	14.6	<i>1.65</i>	0.29

*Note Option 4 involves a structure with a variable span and length. The width used is the minimum distance between interior walls, and the length used is the estimate of the approximate centerline of the culvert.

Existing: Length is within the range studied, width is within the range studied, height is less than the minimum studied, Openness Index is within the range studied. Movement of deer may be constrained by height (1.65m).

Option 1: Length is within the range studied, height is less than the minimum studied, width is within the range studied, Openness Index is less than the range studied (Table 8). Use by deer may be constrained by height. There is an increase in length without a corresponding increase in width or height, which decreases the Openness Index. To meet the minimum Openness Index of 0.14 observed in Brudin (2004), the increase in length would require a corresponding increase in height of approximately 0.48 m. This height adjustment represents the maximum required increase, and could be reduced by an increase in width (e.g. see comments under Option 2).

Option 2: Length is within the range studied, width is larger than the range studied, height is less than the range studied, Openness Index is within the range studied (Table 8). Although height may constrain use by deer, the extension of the culvert may be compensated for as the width will be increased by approximately 5m, maintaining an Openness Index within the range observed in Brudin (2004). Improvements under this option will provide additional linkage benefits if the increase in width is designed with terrestrial benches (minimum recommended 1m) on both sides of the culvert.

Option 3: Proposed dimensions are the same as the existing condition. Length is within the range studied, width is within the range studied, height is less than the minimum studied, and Openness Index is within the range studied. Movement of deer may be constrained by height of the culvert. Increasing height to 1.95m would result in a height being closer to the lower bound (1.98 m) of the range observed in Brudin (2004).

Option 4: Length is within the range studied, width is wider than the range studied, height is higher than in the range studied, and Openness Index is higher than the range studied. The proposed spanning structure is wide enough that it will be functionally similar to a bridge. This, combined with a clearance of over 3m will provide the largest dimensions and Openness Index, and will include terrestrial habitat as part of the meander belt.

Option 5: Will maintain the existing conditions (see discussion in Option 3), with the added improvement of providing a supplementary culvert that will facilitate movement of small terrestrial animals.

Option 6: Length of the culvert is within the range studied, width is wider than the range studied, height is less than the range studied, and Openness Index is within the range studied. Although limited height may constrain use by deer, the extension of the culvert may be compensated for as the width will be increased by approximately 9m, maintaining an Openness Index within the range observed in Brudin (2004).

The existing dimensions of the Huttonville Creek (Tributary 4) culvert, and those proposed for Options 2, 3, 4, 5, and 6 (Table 8) are expected to result in Openness Index values that are adequate for use by deer (Brudin 2004). Openness Index however, isn't the only consideration of whether deer will use the Huttonville Creek (Tributary 4) culvert. For example, a minimum height may be necessary before

Openness Index provides a reliable estimate of potential usage. Physical aspects of surrounding environment can also affect use by wildlife. For example, guiding structures (such as fences and berms), sight lines, culvert substrate and vegetation composition can influence culvert use by deer and other animals (Brudin 2004, Donaldson 2011). Additionally, seasonal conditions experienced during spring (increased flow of water) and winter (frozen creek surface and snow accumulations) may result in reductions of the culvert dimensions. This may result in the culvert being temporarily unsuitable for use by deer and other wildlife.

2.5 CONCLUSIONS & RECOMMENDATIONS

Natural cover occurs primarily throughout the west sections of the Bovaird Drive corridor, most notably west of the Huttonville Creek (Tributary 4, Figure 1a) crossing and Mississauga Road. Additionally, the features that have been considered within the EIS are primarily associated with riparian sections of watercourse crossings, or forested areas that are adjacent and contiguous with these riparian areas.

Impacts to natural and cultural features are expected to be minimal. Of the expected 9.5 ha of disturbance, only 1.3 ha is within natural or cultural features; the remainder of the disturbed areas is in existing agricultural, road-side, or anthropogenic lands.

Where potential impacts have been identified, typical avoidance or mitigation measures will reduce the likelihood of negative impacts. For example establishment of silt fencing adjacent to wetland or riparian areas will reduce erosion and runoff of fill and other sediments; avoiding construction during breeding season will avoid or reduce impacts to breeding birds.

Special consideration was made for the crossing of Huttonville Creek (Tributary 4). The consideration of various alternatives suggested that a structure that spanned the meander belt of the creek would be the most suitable from a terrestrial standpoint. Given other considerations however, the preferred solution of installing a pre-cast concrete box culvert (measuring 83m in length, 1.65m height, and 14.6m in width) although not optimal, would improve upon existing conditions. The dimensions of the proposed culvert (e.g. Openness Index) may also be sufficient to support movement of large mammals such as deer.

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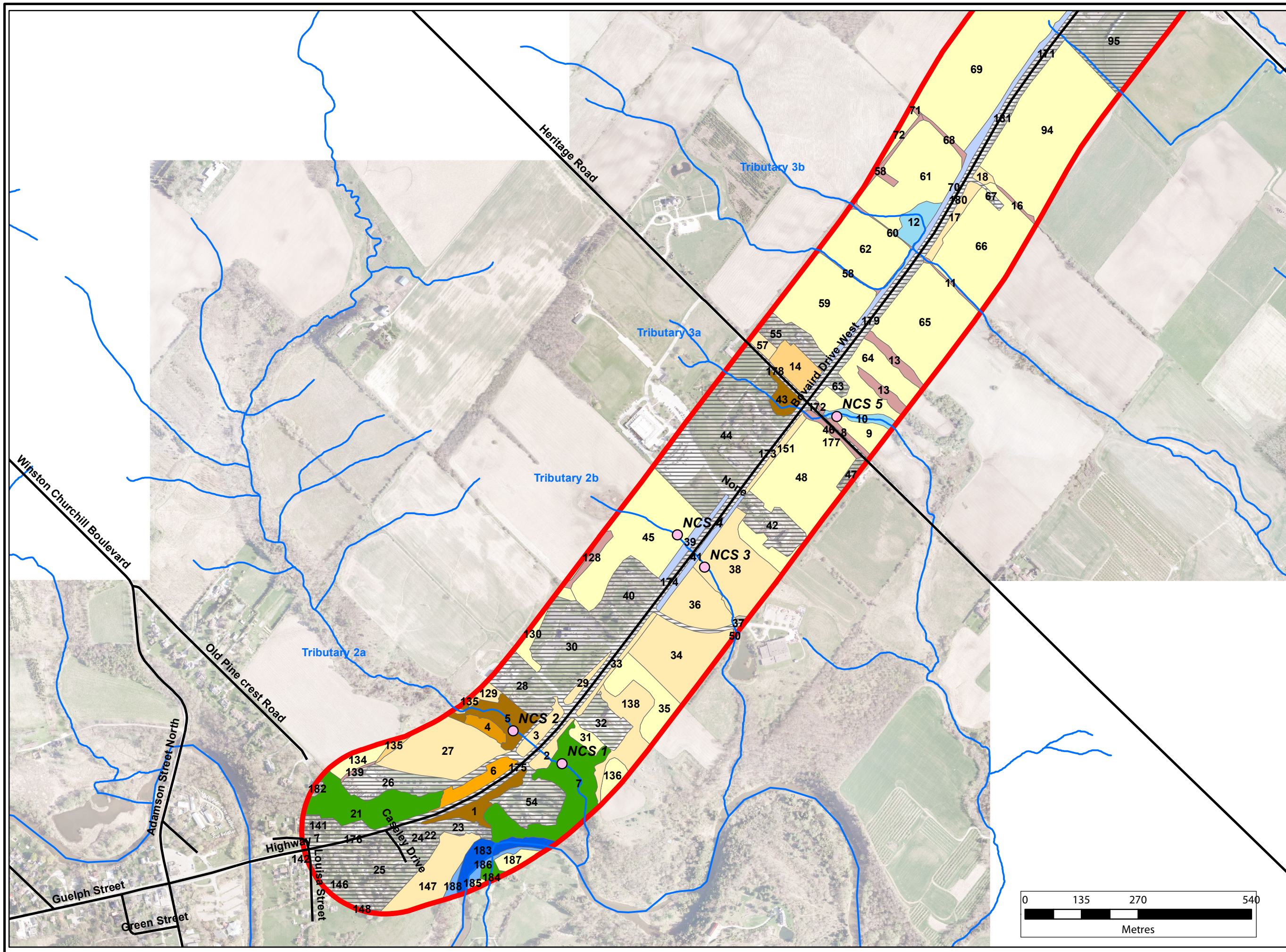
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4 FIGURES



- Legend**
- Study Area
 - ROADCLASS**
 - Roads
 - Watercourse
 - Amphibian Survey Locations
 - ELC**
 - Agricultural
 - Anthropogenic
 - SWM
 - Open Water (OAO)
 - Ditch
 - Hedge
 - Cultural Meadow (CUM)
 - Cultural Plantation (CUP)
 - Cultural Savannah (CUS)
 - Cultural Thicket (CUT)
 - Cultural Woodland (CUW)
 - Deciduous Forest (FOD)
 - Meadow Marsh (MAM)
 - Shallow Marsh (MAS)

ELC and Land Type

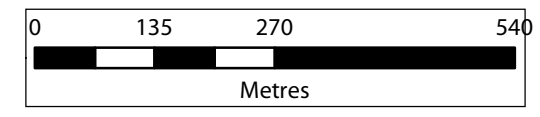


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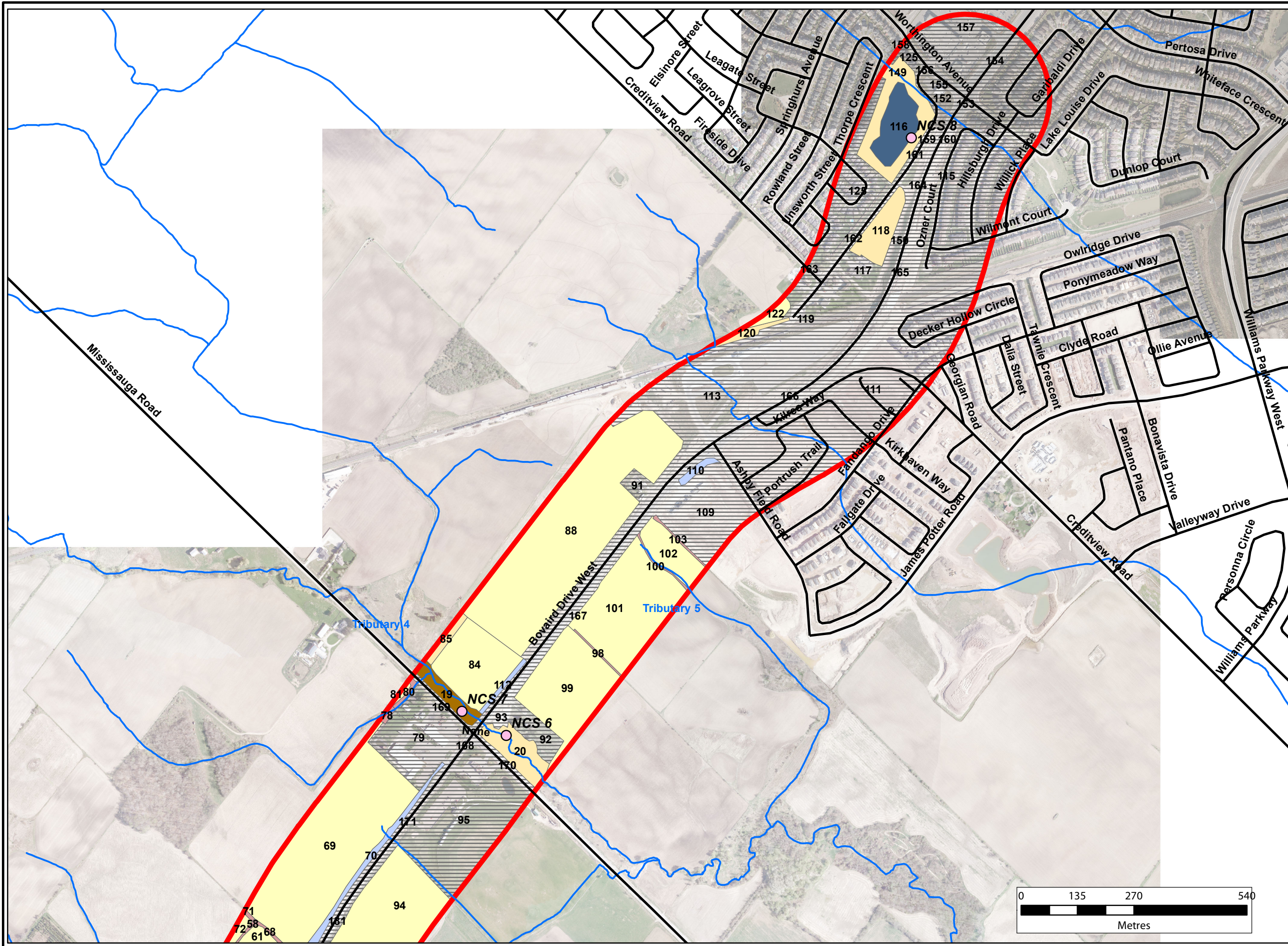
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	CHECKED BY:

FIGURE:
1a



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ELC and Land Type



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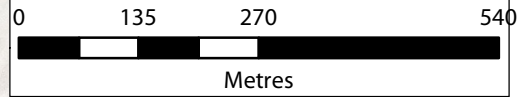
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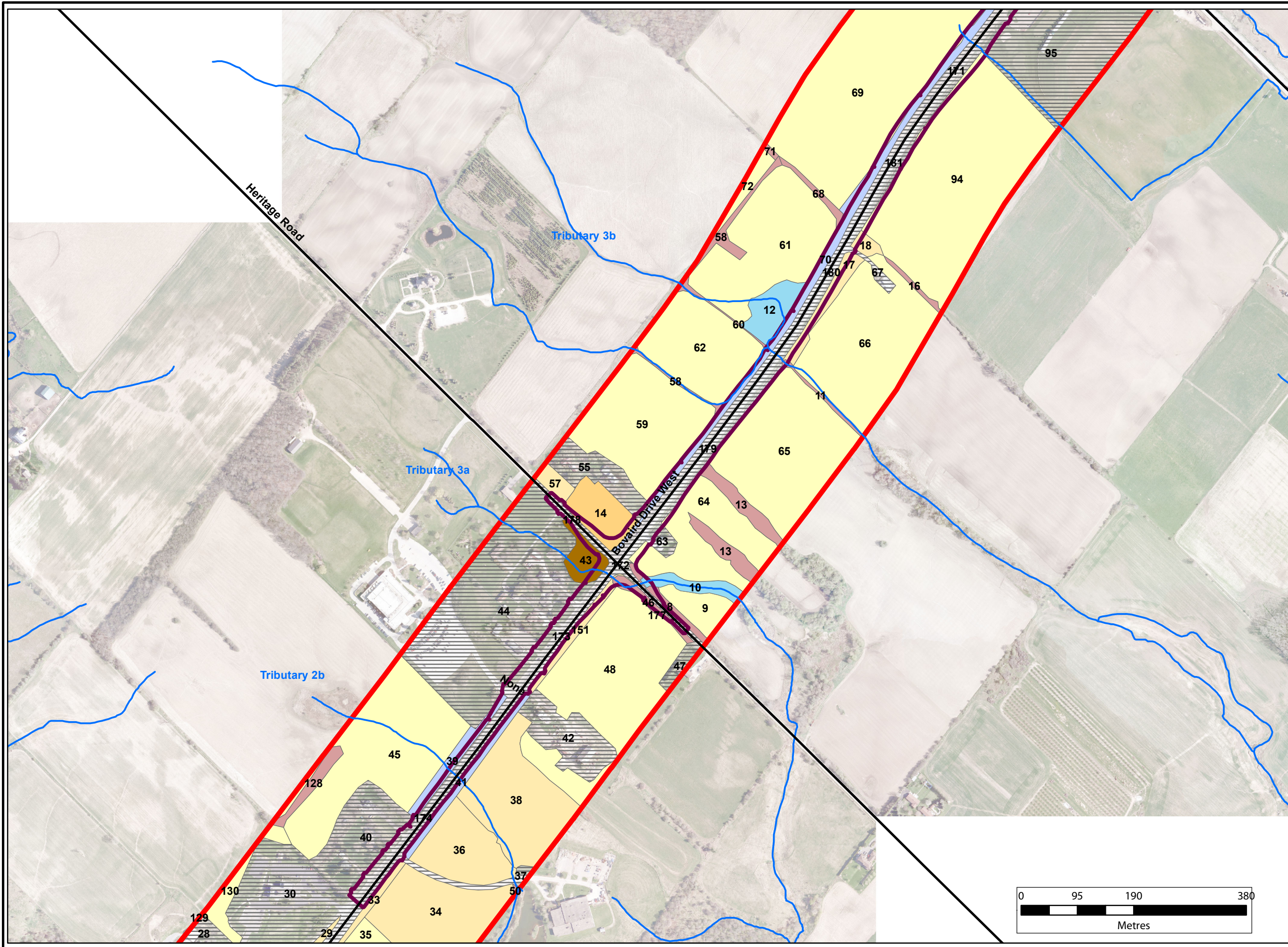
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FIGURE: 1b

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Legend

- Study Area
- Cut/Fill Boundary
- ROADCLASS**
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- Watercourse
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Cut/Fill Boundary



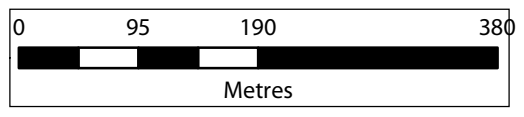
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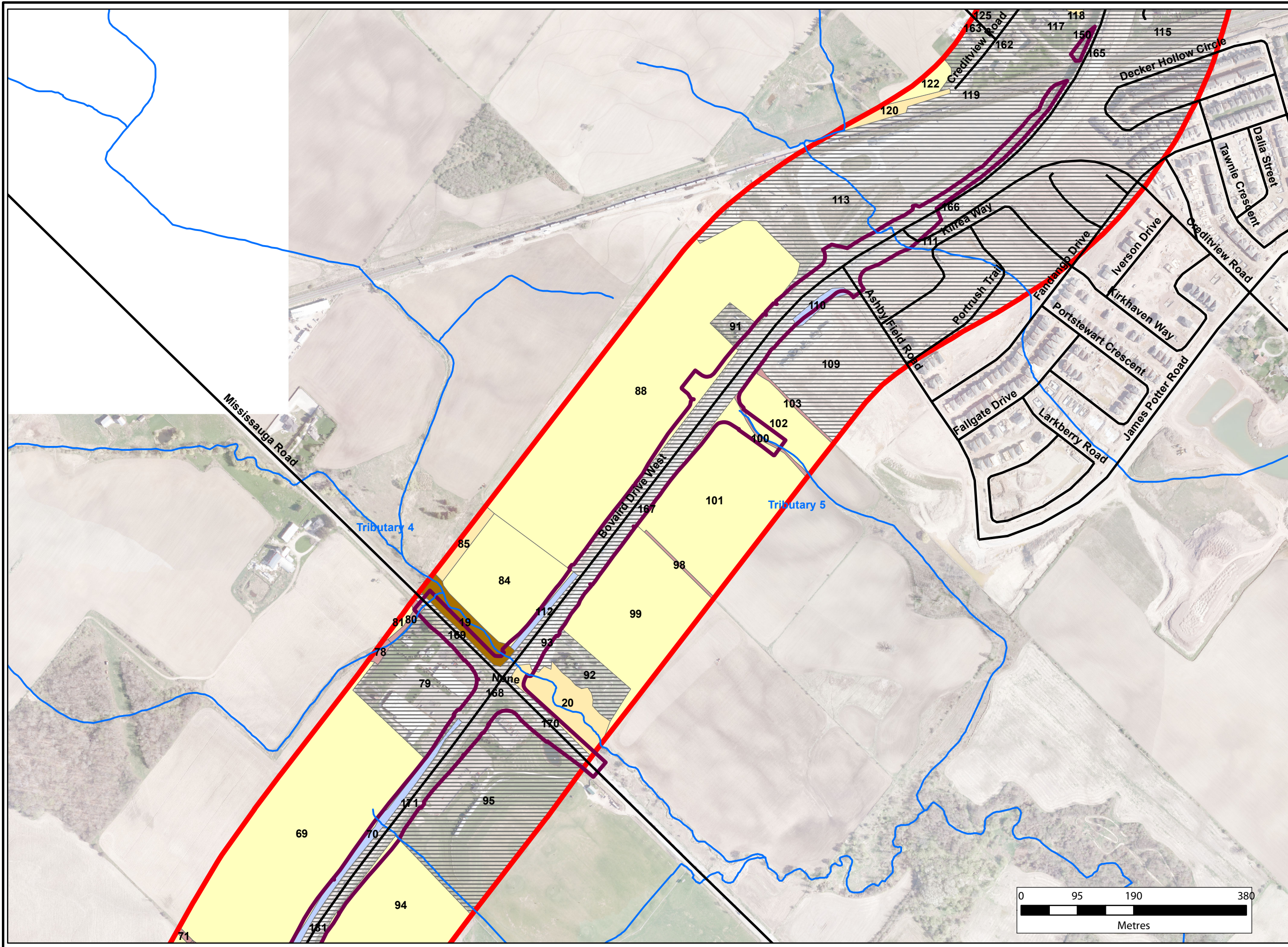
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FIGURE: 2a

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Legend

- Study Area
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Cut/Fill Boundary



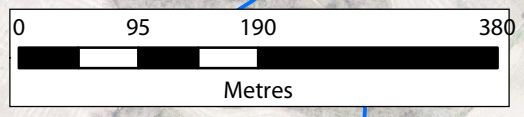
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PROJECT:DA09-021-01

CLIENT:

	DATE: September 2011
	SCALE: 1:6,000
	DRAWN BY: LW & SH
	CHECKED BY:

FIGURE:
2b



The information displayed on this map has been compiled from various sources. While every effort has been made to accurately depict the information, this map should not be relied on as being a precise indicator of locations, features, or roads, nor as a guide to navigation. MNR data provided by Queen's Printer of Ontario. Use of the data in any derivative product does not constitute an endorsement by the MNR or the Ontario Government of such products.

5 APPENDIX A: SPECIES LIST AND STATUS

6 APPENDIX B: BREEDING BIRD SURVEY RESULTS

Appendix B - summary of 2010 breeding bird surveys

Common Name	Scientific Name	COSEWIC	MNR	Sranks	PIF BCR 13 Priority Species	Survey 1 - May 30, 2010	Survey 2 - June 9, 2010
Canada Goose	<i>Branta canadensis</i>	---	---	S5	---	20H	15H, 10FY
Mallard	<i>Anas platyrhynchos</i>	---	---	S5	---	1P, 3H, 5FY	3H, 4FY
Great Blue Heron	<i>Ardea herodias</i>	---	---	S5	---	3X	1X
Turkey Vulture	<i>Cathartes aura</i>	---	---	S4	---		1X
Red-tailed Hawk	<i>Buteo jamaicensis</i>	NAR	NAR	S5	---		1H
American Kestrel	<i>Falco sparverius</i>	---	---	S5	PLS		1H
Killdeer	<i>Charadrius vociferus</i>	---	---	S5	---	1P, 2S	1H
Ring-billed Gull	<i>Larus delawarensis</i>	---	---	S5	---	4X	13X
Rock Pigeon	<i>Patagioena livia</i>	---	---	SE	---	10X	
Mourning Dove	<i>Zenaida macroura</i>	---	---	S5	---	1S, 2H	5H
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	---	---	S5	---		1H
Downy Woodpecker	<i>Picoides pubescens</i>	---	---	S5	---		1H
Warbling Vireo	<i>Vireo gilvus</i>	---	---	S5	---	1S	1T
Blue Jay	<i>Cyanocitta cristata</i>	---	---	S5	---	9H	4H
American Crow	<i>Corvus brachyrhynchos</i>	---	---	S5	---	1H	2H
Horned Lark	<i>Eremophila alpestris</i>	---	---	S5	---	1S	1T, 1S
Tree Swallow	<i>Tachycineta bicolor</i>	---	---	S5	---	1H	2H
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	---	---	S5	---		4H
Barn Swallow	<i>Hirundo rustica</i>	THR	THR	S5	---	3H	5H
Black-capped Chickadee	<i>Poecile atricapilla</i>	---	---	S5	---	1S	
White-breasted Nuthatch	<i>Sitta carolinensis</i>	---	---	S5	---	1S	1P
House Wren	<i>Troglodytes aedon</i>	---	---	S5	---	1S	
Eastern Bluebird	<i>Sialia sialis</i>	NAR	NAR	S4S5	---	1H	
American Robin	<i>Turdus migratorius</i>	---	---	S5	---	1P, 3S, 2H	2T, 1S, 8H, 3FY
Gray Catbird	<i>Dumetella carolinensis</i>	---	---	S5	---	1S, 1H	1T, 2H
European Starling	<i>Sturnus vulgaris</i>	---	---	SE	---	20H, 4FY	31H, 7FY
Cedar Waxwing	<i>Bombycilla cedrorum</i>	---	---	S5	---	1P	
Yellow Warbler	<i>Dendroica petechia</i>	---	---	S5	---	4S	1T, 2S
Chipping Sparrow	<i>Spizella passerina</i>	---	---	S5	---	2S, 1H	1T, 2S
Savannah Sparrow	<i>Passerculus sandwichensis</i>	---	---	S5	PLS	1S	1T, 1S
Song Sparrow	<i>Melospiza melodia</i>	---	---	S5	---	4S	2T, 6S
Northern Cardinal	<i>Cardinalis cardinalis</i>	---	---	S5	---	5S, 2H	1T, 2S, 4H
Indigo Bunting	<i>Passerina cyanea</i>	---	---	S5	---		1S
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	---	---	S5	---	19S, 3H	6T, 11S, 13H
Common Grackle	<i>Quiscalus quiscula</i>	---	---	S5	---	9H	4H, 2FY
Brown-headed Cowbird	<i>Molothrus ater</i>	---	---	S5	---	2H	1S
Baltimore Oriole	<i>Icterus galbula</i>	---	---	S5	PLS	3S	1T, 1S, 1H
American Goldfinch	<i>Carduelis tristis</i>	---	---	S5	---	1S, 4H	15H
House Sparrow	<i>Passer domesticus</i>	---	---	SE	---		6H

WEATHER AND SURVEY TIMES:

Breeding Bird Survey 1 - May 30, 2010; 0600 - 0900, 19°C, calm, clear

Breeding Bird Survey 2 - June 9, 2010; 0630 - 0930, 14°C, light northeast winds, cloudy

CODES:

X – species observed in its breeding season (no evidence of breeding). Presumed migrants should not be recorded.

H – species observed in its breeding season in suitable nesting habitat.

P – pair observed in their breeding season in suitable nesting habitat.

T – permanent territory presumed on basis of territorial song on at least two days, a week or more apart, at the same place.

S – singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.

A - adult bird exhibiting agitated behaviour indicating nest or young present

FY - fledged young observed

N - active nest observed

COSEWIC: NAR - assessed and deemed to be not at risk; -- = not assessed as population secure

MNR: NAR - assessed and deemed to be not at risk; -- = not assessed as population secure

Provincial Sranks: S4 - apparently secure; S5 - secure; SE - exotic

PIF (Ontario Partners in Flight): PLS - Priority Landbird Species in BCR 13 (southern Ontario south of Canadian Shield).

7 APPENDIX C: ELC COMMUNITIES AND DESCRIPTION

Appendix C - ELC table with polygon reference

Polygon Number	ELC/Land Use	Inclusion Community	Area (m ²)	Notes
1	CUW		7006	
2	CUM		3230	
3	CUM	MAM	4630	
4	CUP		3153	
5	CUW	MAM	10806	
6	CUT	MAM	6433	
7	FOD		28858	
8	Hedge		1811	
9	Agricultural		5574	
10	MAS		3612	
11	Hedge		963	
12	MAS		6140	
13	Hedge		7266	
14	CUS		8187	
16	Hedge		913	
17	CUM		4286	
18	CUM		1330	
19	CUW	MAM	6497	
20	CUM	MAM	11613	
21	FOD		21853	
22	Anthro		4081	
23	Anthro		3356	
24	Anthro		5149	
25	Anthro		21325	
26	Anthro		15633	
27	CUM		27272	No data collected - looks like manicured lawn
28	Anthro		14413	
29	CUM		2161	Ditch
30	Anthro		30352	
31	Agricultural		3070	
32	Anthro		9054	
33	CUM		3181	Ditch
34	CUM		27367	Check to see if it's agricultural
35	Agricultural		14053	
36	CUM		14977	
37	Anthro		2565	
38	CUM	MAM	26322	Grass dominated cultural meadow with small MAM in NW corner
39	Ditch		4102	
40	Anthro		17987	
41	Ditch		4004	
42	Anthro		11946	
43	CUW		4286	

44	Anthro		64031	Maybe split into CUM for lawns etc
45	Agricultural		43276	
46	Hedge		1952	
47	Anthro		2158	
48	Agricultural		43695	
50	Hedge		108	
53	OAO		32	
54	Anthro		14367	
55	Anthro		8568	
57	CUM		2212	No data
58	Hedge		4156	
59	Agricultural		32087	
60	Hedge		341	
61	Agricultural		34040	
62	Agricultural		23907	
63	Anthro		1673	
64	Agricultural		21662	
65	Agricultural		38924	
66	Agricultural		39315	
67	Anthro		1173	
68	Hedge		1344	
69	Agricultural		87937	
70	Ditch		14187	
71	Hedge		290	
72	Agricultural		2848	
78	Hedge		702	
79	Anthro		31153	
80	Hedge		880	
81	Agricultural		796	
84	Agricultural		26179	
85	CUM	MAM	2799	Floodplain of East Huttonville Creek
88	Agricultural		109676	
91	Anthro		3251	
92	Anthro		8507	
93	Anthro		5526	
94	Agricultural		66694	
95	Anthro		59129	Driving Range
98	Hedge		714	
99	Agricultural		38646	
100	Hedge		832	
101	Agricultural		45514	
102	Agricultural		12043	
103	Hedge		799	
109	Anthro		32517	
110	Ditch		1745	
111	Anthro		120835	
112	Ditch		1615	

113	Anthro		93088	
115	Anthro		104290	
116	SWM		13021	
117	Anthro		5624	
118	CUM		10707	
119	Anthro		25564	
120	CUM		2805	
122	Agricultural		2822	
125	Anthro		31000	
128	Hedge		2628	
129	CUM		2017	Might be agricultural
130	Agricultural		4808	
134	Agricultural		4978	
135	CUS		2271	
136	Agricultural		4027	
138	CUM		14984	Likely CUM
139	Hedge		524	
140	CUW		45	
141	Anthro		7532	
142	Anthro		304	
144	Anthro		74	
146	Anthro		9878	
147	CUM		17642	May be anthro
148	CUM		129	Private property
149	CUM		17001	Cultural meadow surrounding SWM
150	Anthro		10751	
151	CUM		2893	
152	Anthro		5220	
153	Anthro		2199	
154	Anthro		6260	
155	Anthro		2015	
156	Anthro		328	
157	Anthro		24477	
158	Anthro		924	
159	Anthro		2351	
160	Anthro		4070	
161	Anthro		1299	
162	Anthro		7980	
163	Anthro		365	
164	Anthro		4616	
165	Anthro		9862	
166	Anthro		16785	
167	Anthro		11513	
168	Anthro		640	
169	Anthro		2666	
170	Anthro		3109	
171	Anthro		11793	

172	Anthro		921	
173	Anthro		5012	
174	Anthro		9347	
175	Anthro		11774	
176	Anthro		3539	
177	Anthro		1553	
178	Anthro		2437	
179	Anthro		12137	
180	Anthro		6070	
181	Anthro		3658	
182	Anthro		752	
183	OAO		8658	
184	FOD		1766	No Field Data, interpreted from Aerial Photo
185	Agricultural		626	No Field Data, interpreted from Aerial Photo
186	MAM		2390	No Field Data, interpreted from Aerial Photo
187	Agricultural		3389	No Field Data, interpreted from Aerial Photo
188	MAM		1418	No Field Data, interpreted from Aerial photo

LEGEND:

Anthro	Anthropogenic
CUM	Cultural Meadow
CUP	Cultural Plantation
CUS	Cultural Savannah
CUT	Cultural Thicket
CUW	Cultural Woodland
FOD	Deciduous Forest
MAM	Meadow Marsh
MAS	Shallow Marsh
OAO	Open Water
SWM	Stormwater Management