Gypsy Moth Management Plan, Survey Results and 2021 Defoliation Projection

April 6, 2021

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1.0 GYPSY MOTH BACKGROUND

Gypsy moth (*Lymantria dispar dispar*) is a Eurasian silkworm moth species bred in captivity in Europe. It was initially introduced to North America in 1869 with the intent to establish silk industries in North America. Gypsy moth has been known to be present in Ontario since its detection in 1969 (MNRF 2021). In Canada there are documented infestations in southern Ontario, southern Quebec, New Brunswick, Nova Scotia, and Prince Edward Island. The Canadian Food Inspection Agency (CFIA) has a mandate to prevent the introduction and spread of invasive species in Canada and regulates areas where gypsy moth is established (CFIA 2021). The Municipality of Middlesex Centre is within the CFIA regulated area.

1.1 SYMPTOMS, PHASES, AND IMPACTS OF INFESTATION

Gypsy moth larvae predate on the leaves of host trees which results in holes in mature leaves or complete defoliation in extreme cases. Feeding often occurs overnight and ceases when the caterpillars mature (typically in July). In late summer tan coloured egg masses are deposited on the trunks and stems of infested trees. Mature moths are capable of flight but are not thought to fly for significant distances. During severe infestations defoliation can be complete within a wooded area and may include understory species. Preferred host species for the gypsy moth include oak (*Quercus*), maple *(Acer*), poplar (*Populus*), and willow (*Salix*) (Mauffette et al. 1983). The Ontario distribution of gypsy moth is similar to that of oak species; however, the selection of host species is more variable than that of some other forest pests such as emerald ash borer.

Gypsy moth outbreaks are cyclical in nature with year-to-year populations varying significantly. As a significant forest pest, the Ontario Ministry of Natural Resources and Forestry (MNRF) monitors province-wide populations. According to MNRF monitoring, gypsy moth populations have peaked in 1985, 1991, 2002, 2008, and 2014 (MNRF, 2021). Based on these observations the MNRF projects large outbreaks to occur in approximately 7-to-10-year cycles; similar to the United States Department of Agriculture Forest Service model of outbreaks every 5-to10-years (USDA, 2015).

A four phase model was proposed by Elkinton and Liebhold (1990) to characterize the cyclical nature of gypsy moth populations, consisting of: innocuous, release, outbreak, and decline. During the innocuous phase population levels are low and defoliation is insignificant. The release phase is characterized by rapid population growth of several orders of magnitude. Due to the significant population increase the infestation reaches the outbreak phase where severe defoliation is observed. The outbreak is typically short-lived and followed by a significant population crash in the decline phase. Cloyd and Nixon (2001) observed that localized populations typically sustain outbreak phases for 2 to 3 years.

The circumstances for the decline phase are complex and likely involve several factors including weather conditions, predation, parasites, pathogens, and anthropogenic intervention. Prolonged periods of cold can kill egg masses while warm, dry conditions can correlate with higher populations. Precipitation has been hypothesized to play a major role in population control particularly during the period of emergence from the egg mass. The impacts of predation are not thought to be significant during the outbreak phase as the relative abundance of caterpillars is so high. Most outbreaks are thought to decline because of

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significant impacts of pathogens in combination with additional factors (USDA, 2015). It is common for outbreaks to be sustained for 2-3 years as this period acts as lag time for predation and pathogen abundance to increase and overtake the number of pests. It should be noted that several trends may be possible at once depending on the geographic scale of measurement with small sub populations expanding in number while others are in decline.

The primary concern of gypsy moth outbreaks is the impacts caused by defoliation to trees and shrubs. This defoliation and the adverse health impacts on host trees can have impacts on the environment, health, and economic interests beyond the scope of this report. In general, healthy trees can withstand intense defoliation events without mortality. However, successive years of defoliation deplete energy stores within trees and can cause branch or entire tree mortality. The presence of additional environmental and physical stressors such as root zone compaction or drought can exacerbate the impacts of defoliation and hasten tree decline.

1.2 GYPSY MOTH INFESTATION 2020

The MNRF conducted aerial surveys in July 2020 to monitor gypsy moth outbreaks. Defoliation reports were verified with field surveys and laboratory analysis. Defoliation was observed to have increased substantially in 2020 (586,325 ha) over 2019 (47,203) (MNRF, 2021). This increase appears to have been widespread with all MNRF regions reporting increases. Middlesex Centre is located within the Aylmer MNRF district which reported an increase in defoliation from 37,551 ha in 2019 to 99,387 ha in 2020 (MNRF, 2021).

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2.0 GYPSY MOTH POPULATION ASSESSMENT

As a result of defoliation in several noticeable areas within Middlesex Centre, the municipality undertook an aerial spraying program aimed at reducing the gypsy moth caterpillar populations. The program focused on Westbrook Park and was executed by The Davey Tree Expert Company. In January 2021, Stantec was retained to complete a population assessment on Westbrook Park to assess the efficacy of the spraying program. To assess the population more generally, three additional control sites were selected. Plot sample locations are available in Appendix A.

2.1 ASSESSMENT SITES INTRODUCTION

2.1.1 Site 1A – Westbrook Park

Sites 1A and Site 1B were designated as such because they are near one another (less than 500 m) which was assumed to increase the chance of population crossover. Site 1A is a woodlot within Westbrook Park. The park and the surrounding residential lots were subject to aerial spraying in 2020 as the outbreak was observed to be severe there wea concern for tree impacts to public and private trees. Westbrook Park is predominantly open space consisting of turfgrass, however the small woodlot in the park shares a boundary with several wooded residential lots.

Figure 1: Westbrook Park and Surrounding Residential Lots

2.1.2 Site 1B Jefferies Road Pump Station and Thames Riverbank

Site 1A is surrounded by suburban residential streets, however the Thames River riparian area (Site 1B) is less than 500 m away from the site. This area was selected for study as a potential gypsy moth population reservoir where elimination of the satellite population in Site 1A would have little impact on the local population. The riparian area has potential to provide a corridor of consistent treed habitat to access new treed areas.

Figure 2: Jefferies Road Pump Station and Thames Riverbank

2.1.3 Site 2 – Private Woodlot, Komoka

Access to a private woodlot was granted where the landowner employed several gypsy moth control techniques but did not utilize aerial spraying. Controls including adhesive and non-adhesive bands were observed. This site was selected as a control to compare alternative control techniques to aerial spraying deployed on Site 1A.

Figure 3: Private Woodlot, Komoka

2.1.4 Site 3 – Ilderton Trail

Site 3 was selected as a control site on University of Western Ontario lands where a gypsy moth outbreak was known to have occurred, but no known controls were deployed.

Figure 4: Ilderton Trail

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2.2 POPULATION ASSESSMENT METHODS

Gypsy moths deposit eggs in masses of up to 1,000 eggs in mid-to-late summer. Preferred locations for eggs include tree stems, branches, logs, fences, and many surfaces in the landscape. The egg masses remain in-situ until emergence the following spring. This provides a long window of time to assess the population and is reliable as old and new egg masses are easily differentiated by colour. Egg mass length along the longest axis is another reliable measurement with larger egg masses indicating an increasing population and smaller masses indicating population decline (Nealis and Erb 1993).

Gypsy moth populations were assessed using a two-step observation technique consisting of a walkthrough of the site followed by plot sampling. The collected data was entered into a Microsoft Excel database for analysis. Predicted defoliation values for 2021 were developed based on the United States Department of Agriculture (USDA) defoliation prediction model using egg mass counts as the primary input (Ganser et al., 1985). Plot locations were recorded using a Trimble R1 GNSS unit relaying to an Apple iPhone and saved in ESRI Collector. The resultant shapefiles were downloaded and placed on drawings created in AutoCAD. Observations were made on February 22 and February 24, 2021 at the four sites.

2.2.1 Walkthrough (Meander) Survey

The objective of the walkthrough was to qualitatively assess the general population of gypsy moths and to understand the distribution of potential host species. During the walkthrough, observers counted visible egg masses, and recorded the host tree species as well as the dominant canopy tree species in the woodlot. Upon arrival to a site, Stantec Staff conducted a walkthrough and recorded general information pertaining to the site including the following:

- Species of canopy trees observed
- General size ranges of trees observed
- General presence or absence of gypsy moth egg masses

2.2.2 Modified Kaladar Plot (MKP) Survey

Following the walkthrough, Stantec staff selected plot areas for MKP observations. Selection of MKP sites was based on the presence of preferred host species as identified in the literature. Oak species were used where they were present followed by other angiosperms including apple (*Malus*), beech (*Fagus*), poplar (*Populus*), birch (*Betula*), walnut (*Juglans*), and maple (*Acer*).

The MKP areas were marked out as 10 m x 10 m plots (100 m^2) (MNRF 1999). Within each 100 m^2 plot all egg masses were counted. Plot trees were surveyed by examining the trunk and scanning the entire tree, from base to crown, using binoculars. All egg masses observed on the tree, both old and new, were recorded. Data collected included:

- Egg Mass Size (where accessible for measurement)
- Egg Mass Location on Host
- Host Species
- Host Size and Health
- Host Location

A total of 3 MKPs were sampled at Site 1A, 2 at Site 1B, 4 at Site 2, and 2 at Site 3. Oak species were observed and sampled as hosts at Site 1A and Site 2. Alternate preferred angiosperm species were sampled in each site with one gymnosperm (pine – *Pinus* genus) sampled at Site 2. Host species used for MKP samples are listed in Table 1. Egg masses that were accessible were measured along the longest axis and categorized based on the following criteria: large = greater than 30 mm, medium = 30 mm to 20 mm, small = less than 20 mm (Nealis and Erb, 1993). MKP plots are 1/100th of a hectare and the egg masses per hectare numbers noted in Table 2 are extrapolations based on this standard size.

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Table 1: MKP Plot Host Species

Family	Genus
Fagaceae (beech family)	*Quercus* (oak)
Pinaceae (pine family)	*Pinus* (pine)
Rosaceae (rose family)	*Prunus* (cherry)
Sapindaceae (soapberry family)	*Acer* (maple)

2.3 POPULATION ASSESSMENT RESULTS

2.3.1 Site 1A, Westbrook Park

Three (3) MKPs were created for this site. The MKPs were dominated by cherry *(Prunus)* and oak *(Quercus)* trees as hosts. Plot 3 recorded the highest number of egg masses (160) and Plot 1 recorded the lowest (15). Most egg masses in all plots appeared old, as they were bleached and frail to the touch, indicating they were likely from previous years. However, most of the egg masses were large (greater than 30mm on the longest axis). Six (6) egg masses that appeared new based on colour and texture were observed in plot 3 and one (1) egg mass was observed in plot 2.

2.3.2 Site 1B, Jefferies Pumphouse

Two (2) MKPs were created for Site 1B. After the initial walkthrough, a maple *(Acer)* and aspen *(Populus)* dominated stand was selected for MKP sampling. Most of the egg masses observed were less than 15 mm. This site recorded the lowest number of egg masses for both plots at all sites. Based on colour and texture, the three (3) egg masses observed on both plots appeared to be old.

2.3.3 Site 2, 9637 Glendon Drive

Site 2 had pheromone traps established in summer 2020. The traps attract gypsy moths which impact egg mass survey results, as most insects prefer the tree with the trap. However, the woodlot is large and dominated by oak trees, therefore 4 MKPs were created on site. Oak was the dominant host for plots 1, 2 and 3, while plot 4 was dominated by pines *(Pinus)*. Most of the accessible egg masses on site were greater than 30 mm on the longest axis the highest egg masses (180) of any plot of all sites were observed on Plot 3 of this site. The site also showed most evidence of new egg masses. Eleven (11) of the total egg masses observed on this plot showed evidence of new eggs. All egg masses were inaccessible due to their location on the host. Plot 2 also recorded a large egg mass count (128). However, only two (2) egg masses observed appeared to be new. Plot 1 and Plot 4 recorded 48 and 35 egg masses, respectively. One (1) probable new egg mass was observed on plot 1 and no new masses were observed on plot 4.

2.3.4 Site 3, Ilderton Rail Trail

Two (2) MKPs were created for Site 3. The MKPs were dominated by cherry *(Prunus)* and maple *(Acer)* trees as hosts. Plot 2 recorded the highest number of new and old egg masses for the entire study area.

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Egg masses in plot 1 were 10-25 mm whereas egg masses in plot 2 were larger (greater than 30mm on the longest axis). Fourteen (14) egg masses that appeared new based on colour and texture were observed on plot 2 and six (6) egg mass were observed on plot 1.

Table 2: MKP Plot Observations

Site	Plot	Dominant Host Genus	Total Egg Masses	New Egg Masses	New Egg Masses / ha	Average Egg Mass Size
1A	1	*Prunus*	15	0	0	Large
	2	*Quercus*	101	1	100	Large
	3	*Quercus*	160	6	600	Large
1B	1	*Acer*	3	0	0	Small
	2	*Acer*	3	0	0	Small
2	1	*Quercus*	48	1	100	Large
	2	*Quercus*	128	2	200	Large
	3	*Quercus*	180	12	1200	Large
	4	*Pinus*	35	0	0	Medium
3	1	*Acer*	30	6	600	Medium
	2	*Prunus*	190	14	1400	Large

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3.0 POPULATION ASSESSMENT ANALYSIS

Only 4.7% of the total egg masses observed appeared to be new egg masses. This likely indicates a decrease in the population of Gypsy moth for 2021 in the areas observed. Due to the inaccessibility of many 2020 egg masses, the size of the new egg masses could not be compared statistically. A size comparison would have provided a second parameter for population vigour to verify the comparison of the proportion of 2020 to 2021 egg masses.

Lower numbers of new egg masses were observed at Site 1A, 2, and 3 compared to old egg masses. Site 1A was treated with aerial spraying, Site 2 was treated with pheromone traps and burlap strips, and Site 3 had no known controls. It is Control methods used may have been successful in reducing the number of new egg masses, however the sharp decline in the untreated plot indicates that there was likely a decline in population not caused by anthropogenic controls. This could be caused by a combination of weather conditions, predation, and pathogens.

The overall lack of either new or old egg masses at Site 1B could be interpreted as the site not having preferred habitat or that populations have not been established yet, but the habitat is suitable. In either case it does not appear likely that this area will act as a reservoir to repopulate Site 1A in the immediate future.

Conditions leading to gypsy moth outbreaks are more commonly found in hardwood stands on ridges with south and west exposure (Gottschalk, 1993). Oak and cherry trees appeared to be the preferred host species for the gypsy moth. Plots with oak or cherry as the dominant species had greater numbers of egg masses. Therefore, it is likely that Site 1B is not preferred habitat.

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Population Assessment Analysis
April 6, 2021

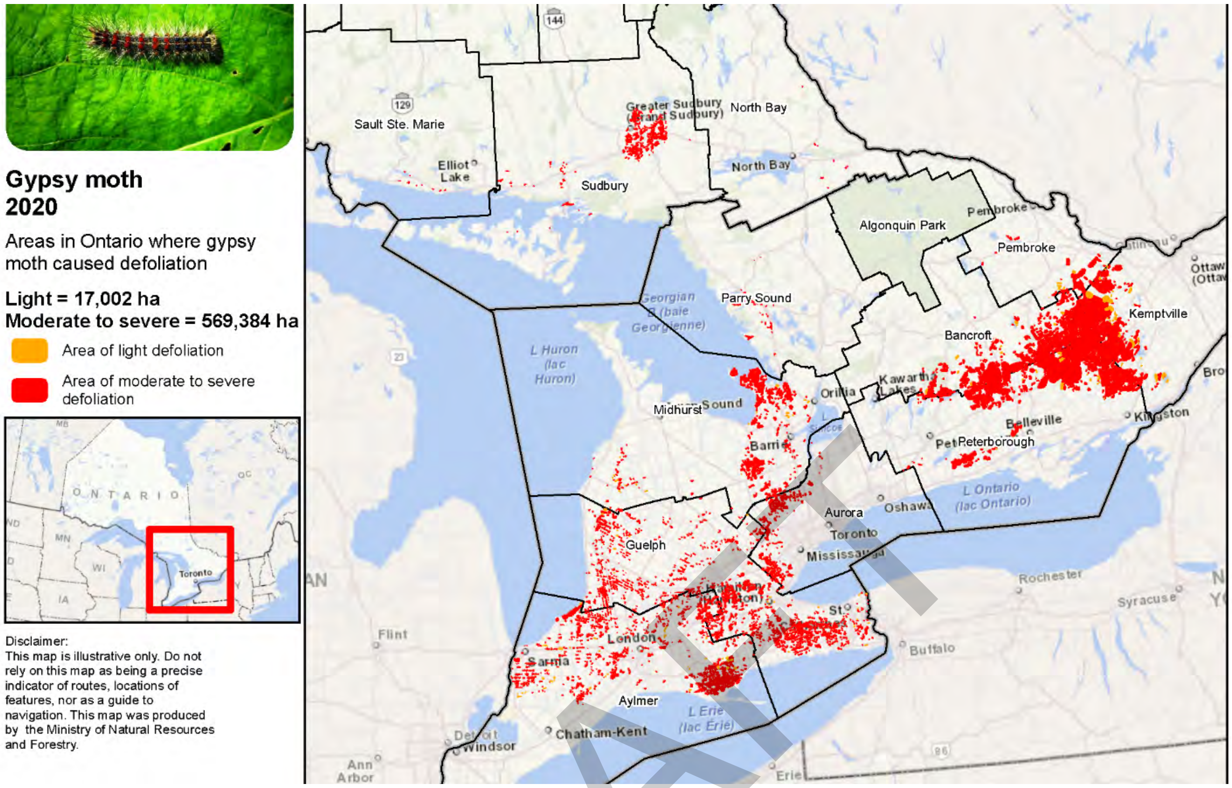

Figure 5: MNRF Gypsy Moth Monitoring Results 2020

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3.1.1 Defoliation Predictions for 2021

he data from the two best predicting factors – the proportion of new to old egg masses, and the size of egg masses – collected in this study are somewhat contradictory. The observation of a significant decline in egg masses year-over-year is a strong indicator of population decline. However, the presence of large egg masses is an indicator of population strength. The proportion of egg masses year-over-year is preferred in defoliation predictions because it is more robust given the inability to measure many of the older egg masses to a statistically significant degree. It is possible a decline in egg mass size would be observed if the 2020 egg masses were accessible for measurement.

This interpretation is in line with MNRF projections which show an overall reduction in projected defoliation in the Aylmer district. However, pockets of defoliation can occur during overall population decline as localized populations can fluctuate. Plot 2 of site 3 and plot 3 of site 2 had the highest number of new egg mass sightings and are projected to have light to moderate defoliation according to the USDA defoliation prediction model (Table 3).

Table 3: USDA Defoliation Prediction Model (Ganser et al., 1985)

Egg Mass Density (Em/Ha)	Defoliation Forecast	Defoliation Forecast Range (%)	Management Impacts
0	Nil	0 to 5	None
1 to 1,250	Light	6 to 25	Up to 20% Defoliation
1,251 to 3,750	Moderate	26 to 65	Nuisance and Aesthetics; Noticeable Defoliation
3,751 to 5,000	Heavy	66 to 90	Wildlife and Recreation; Growth Loss
> 5,001	Severe	91 to 100	Tree Mortality

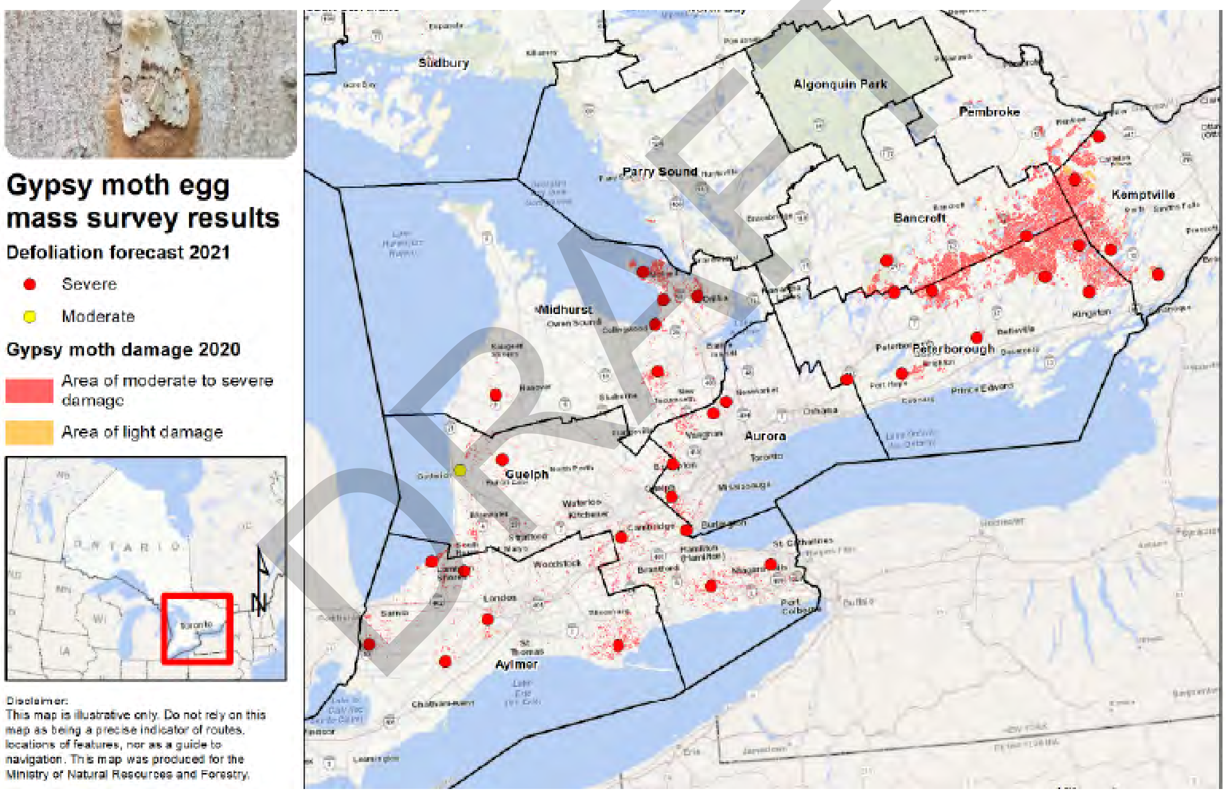

Figure 6: MNRF Gypsy Moth Projections 2021

3.1.2 Limitations

The intent of this study was to investigate area of gypsy moth infestation at four locations from 2020 and provide guidance on the infestation for 2021. To fulfill this objective Stantec investigated additional areas to contextualize the impacts of controls used infested areas. In terms of statistical representation, the areas investigated are not powerful enough to accurately model the entire Municipality. The results of the Stantec survey have been interpreted within a general understanding of gypsy moth infestation cycles and MNRF projections to apply the study results to the areas of the Municipality that were not studied.

Gypsy moth adults have limited mobility and are not considered likely to travel long distances. European gypsy moth (*Lymantria dispar* dispar) females are incapable of sustained flight; however, females of the Asian subspecies (*Lymantria dispar* asiatica) are (Srivastava et al. 2021). The subspecies can cross breed and produce varying levels of flight capability including gliding rather than sustained flight (Srivastava et al. 2021). The caterpillar stage of the moth is generally restricted to an immediate area though they are known to travel up and down trunks of trees to avoid direct sun exposure. This means that population levels can be localized and vary somewhat separately from the overall population. Therefore, it is likely that there will be pockets of more severe outbreaks despite the projection that the overall population is declining.

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4.0 MANAGEMENT IMPLICATIONS

Gypsy moth management is based on the tolerance levels of the municipality with respect to ecological, social, and economic considerations. The tolerance level of gypsy moth outbreaks in natural woodlots that are not heavily used recreationally and have lower impacts on private residents is typically higher than the tolerance of an outbreak in a residential area. As tolerance levels vary between areas, so should the management of these areas. Considering this range of priorities, several management options are available.

4.1 PASSIVE MANAGEMENT

Passive management is the most common response to pest outbreaks and involves only the actions necessary to ensure public safety in line with the general tolerances of the municipality. This typically involves felling dead trees on public lands that are deemed hazardous to persons or property. This action would typically be driven by hazard identification by the public or a municipal employee. Under a passive management regime action is limited to hazard reduction with no proactive or reactive controls are utilized to modify the outcomes of an infestation.

Passive management is recommended for public woodlots that are not intensively used for recreation by the public to the point where significant ecological impacts are likely with no intervention. Significant ecological damage is considered to occur at 66% to 90% defoliation under the USDA classification (Ganser, 1985). Therefore, if a woodlot is found to be experiencing a severe outbreak of gypsy moth approaching these levels, it would be recommended to monitor the situation to develop a forecast for the following season or rely on MNRF projections. If significant defoliation is projected to occur again, a switch in management response to active management is recommended.

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4.2 ACTIVE MANAGEMENT

In instances where the tolerance level for an outbreak is lower than current or projected levels, active management is recommended. Several options are available for effective active management and it is likely that a combination of methods is the best option.

4.2.1 Control Methods for Small Outbreaks

4.2.1.1 Manual Egg Removal

Egg masses are deposited in mid-to-late summer on tree trunks, branches, logs, fences, and other stationary surfaces. These egg masses will remain in-situ until emergence the following spring. Through this period egg masses may be scraped off surfaces they are attached to and destroyed. Scraping the masses off and leaving them where they fall is typically not sufficient as the eggs may remain viable. Water mixed with detergent, vinegar, and bleach are common ways for destroying the eggs.

This method of control is time consuming and limited to egg masses that are accessible by hand. As a result, this method is most appropriate for residents to care for single trees or relatively few trees on a lot. It may have some application for select landscape or street trees. Manual removal of egg masses does not require specialized equipment, permits, or leave anything behind on trees.

4.2.1.2 Adhesive Barriers

The objective of adhesive barriers is to intercept larvae (caterpillars) as they traverse the trunk of an infested tree. During the development stage where larvae are nocturnal feeders, and they will sometimes crawl into the leaf litter at the base of a tree to avoid direct sunlight. An adhesive barrier is created by wrapping duct tape tightly to a tree - so that caterpillars cannot crawl between the tape and the trunk – and covering the non-tacky side of the tape with a tacky substance. Avoid applying the tacky substance directly to the bark of the tree and ensure that the substance is not toxic.

This control method is less time consuming than manual removal and may allow for greater capture if many egg masses are inaccessible. However, the downsides are that the window of effectiveness is much shorter, and the barrier must be left on the tree and changed periodically to ensure it remains tacky. This method is most appropriate for residents to care for single trees or relatively few trees on a lot. It may have some application for select landscape or street trees.

4.2.1.3 Non-Adhesive Barriers

The objective of this control method is the same as that of the adhesive barriers, however the caterpillars take refuge under the barrier rather than becoming stuck to it. A 30 – 60 cm burlap strip is wound around a tree at breast heigh allowing some space between the burlap and the bark. In midday the burlap is removed and the caterpillars using it as refuge are destroyed.

For this control method to be effective the burlap must be monitored daily, and this can be time consuming to complete with many trees. However, non-adhesive barriers are easier to set up than adhesive barriers and will not leave any residue behind. As such this method is most appropriate for residents to care for single trees or relatively few trees on a lot. It may have some application for select landscape or street trees.

4.2.2 Control Methods for Moderate to Large Scale Outbreaks

4.2.2.1 Pheromone Traps

Pheromone traps are deployed during the adult (moth) stage of the gypsy moth life cycle to disrupt breeding. Male moths are capable of flight and follow pheromones to the flightless females. Pheromone traps mimic females and prevent breeding by capturing males. Pheromone traps can be deployed alongside a spraying program or utilized as an indicator to commence spraying when the density of males captured reaches an established threshold.

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4.2.2.2 Targeted Insecticide

Targeted insecticide application to the foliage of individual plants can be an effective treatment. Several insecticides are registered in Canada for the control of gypsy moths. All manufacturer recommendations, procedures, and regulations should be followed when applying insecticides. It is recommended that licensed applicators perform the application. Targeted insecticide is possible for smaller landscape trees and shrubs but impractical for large canopy trees without specialized equipment. Targeted insecticide can be partnered with adhesive and non-adhesive barrier controls.

4.2.2.3 Aerial Insecticide

Aerial insecticide control is the only control that is effective for outbreaks over significant area. *Bacillus thuringiensis var. kurstaki* (BTK) is the most common aerial application insecticide for gypsy moth in Canada. BTK is popular because of its effectiveness and highly targeted nature as it is non-toxic to most other insects (Perez et al., 2015). As an environmental bacterium rather than a chemical it has been considered safe for use in Canada. The application window is critical, and application must occur while larvae are actively feeding on foliage; this is typically in mid-to-late May in southwest Ontario.

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5.0 RECOMMENDATIONS

Several recommendations have been developed to manage gypsy moth populations in Middlesex Centre. These recommendations are based on the outcomes of the study and common management practices. These recommendations may change based on factors including changes in gypsy moth populations, environmental conditions, and public expectations. As a result, it is recommended that objectives and recommendations be revisited periodically.

1. The Municipality establish a hierarchy of public lands regarding gypsy moth tolerance. Such a hierarchy should establish tolerable levels of infestation based on defoliation levels (using the USDA guideline or similar) based on ecological, social, and economic inputs.
    a. Passive management is recommended as the default with active management being undertaken when the infestation tolerance levels are surpassed or projected to be surpassed.
2. The Municipality monitor the annual MRNF published gypsy moth monitoring and projections to the degree that data is available.
    a. Data should be used to monitor the overall population trends within Ontario and the Aylmer District.
    b. Year-over-year increases in defoliation projections should be assumed to indicate potential for severe outbreaks.
3. The Municipality assess the effectiveness of treatments where active management of gypsy moths has occurred.
    a. The assessment should be conducted such that a defoliation projection for the outbreak area can be established. This defoliation projection will be weighed against the tolerance levels for the location to inform management.
4. The Municipality continue to provide information to the public regarding options for treatment of private trees.
    a. A database could be created for private citizens to input egg mass counts. With enough input these counts could supplement the MNRF data and monitor population dynamics.

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APPENDIX A

Gypsy Moth Survey Sites

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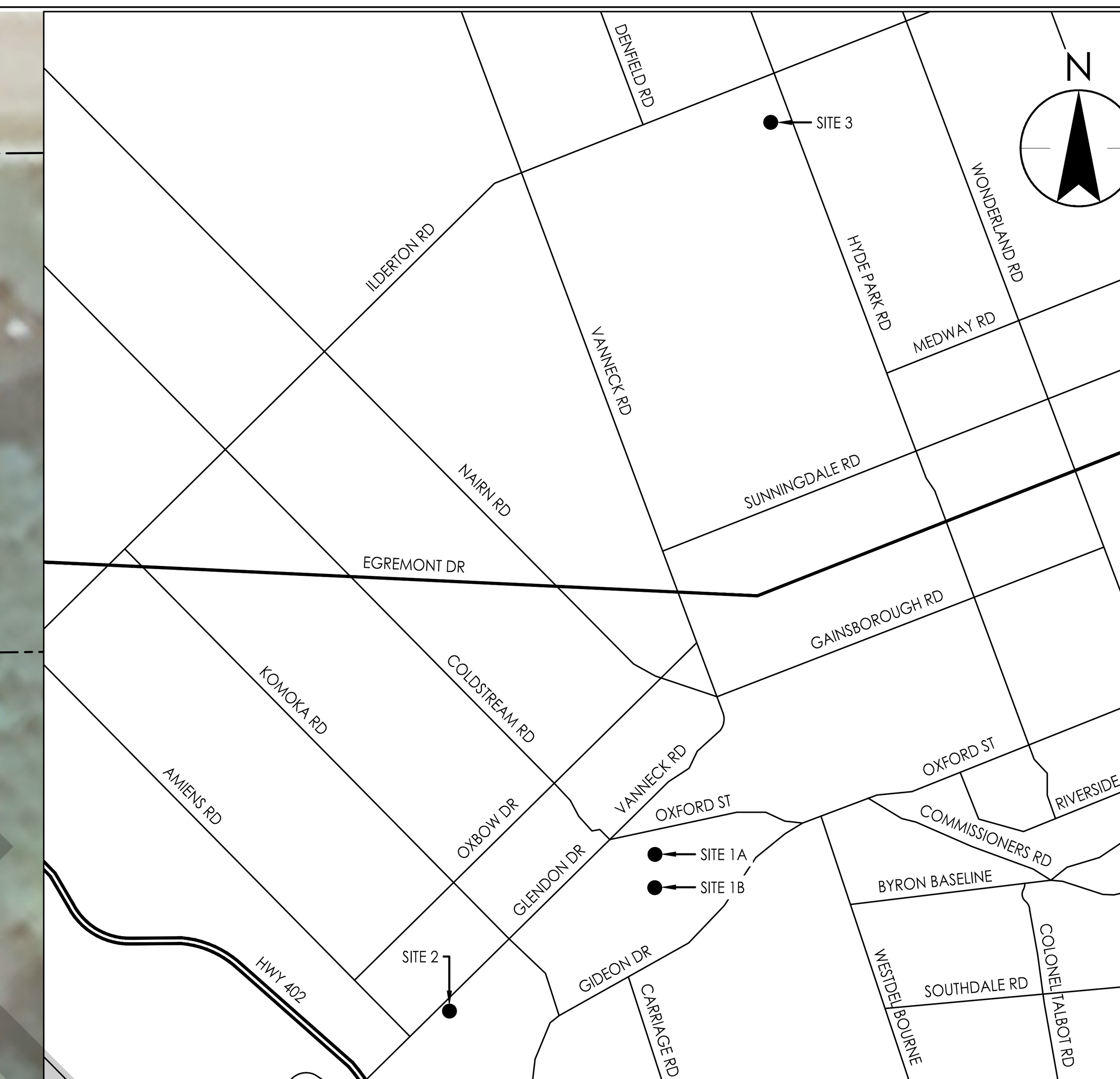

KEY MAP

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Consultants

Legend

- PROPERTY LINE
- LIMIT OF SITE OBSERVATIONS
- TREE GROUPING SAMPLE LOCATION

Notes

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 161414073_l-tm	SU	GG		21.03.01
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal

Client/Project

Municipality of Middlesex Centre

Gypsy Moth Survey

Middlesex Centre, ON Canada

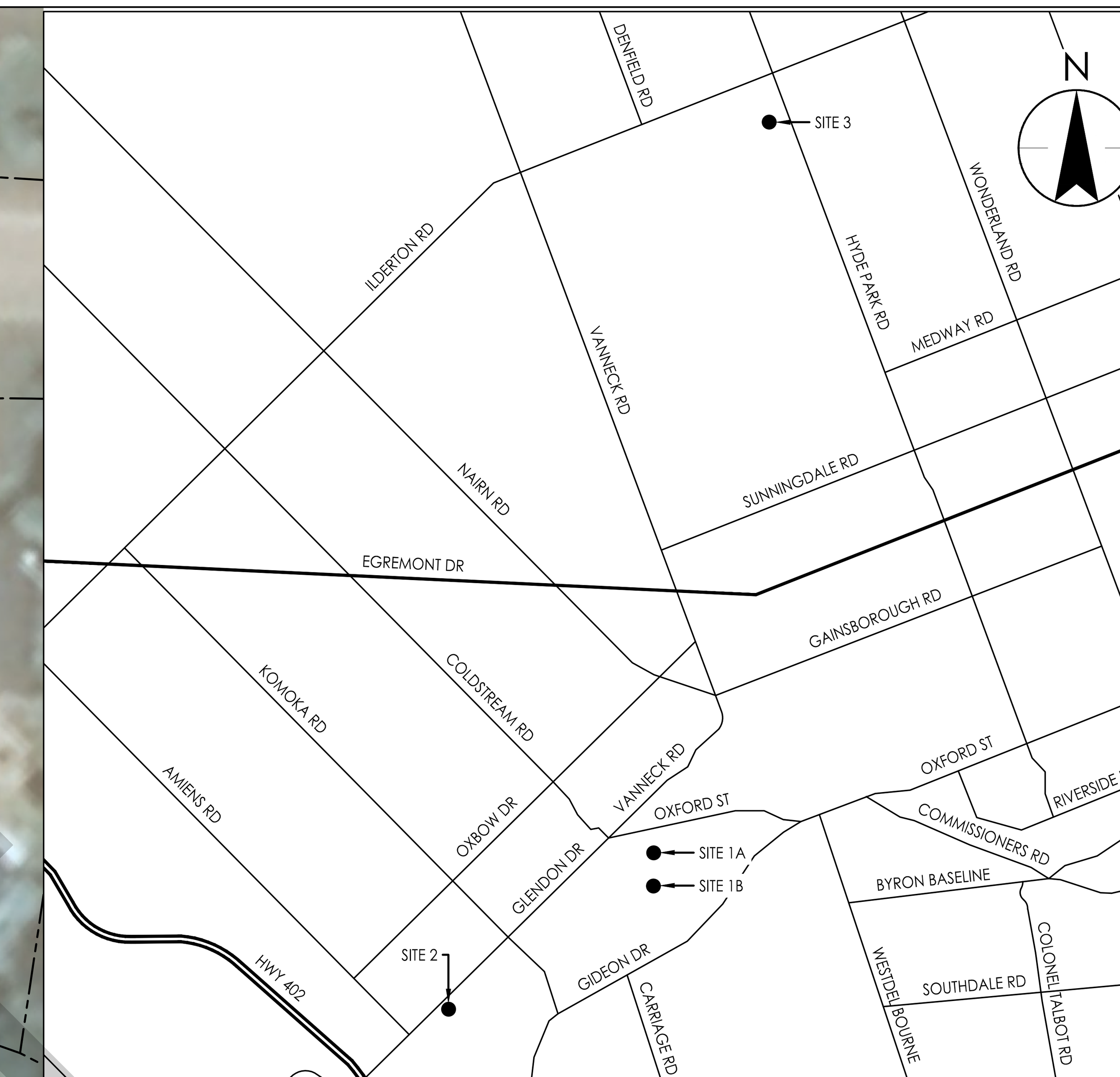
Title

SITE 1A:
WESTBROOK PARK

Project No.	Scale
161414073	HORZ — 1 : 500 (5 0 10m)

Drawing No.	Sheet	Revision
TM-1	1 of 4	0

ORIGINAL SHEET - ANSI D



KEY MAP

N.T.S.

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600-171 Queens Avenue
London ON N6A 5J7
Tel. 519-645-2007

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	SU	GG		21.03.01

Permit-Seal

Client/Project

Municipality of Middlesex Centre

Gypsy Moth Survey

Middlesex Centre, ON Canada

Title

SITE 1B:
JEFFERIES ROAD PUMP STATION/
THAMES RIVERBANK

Project No. 161414073

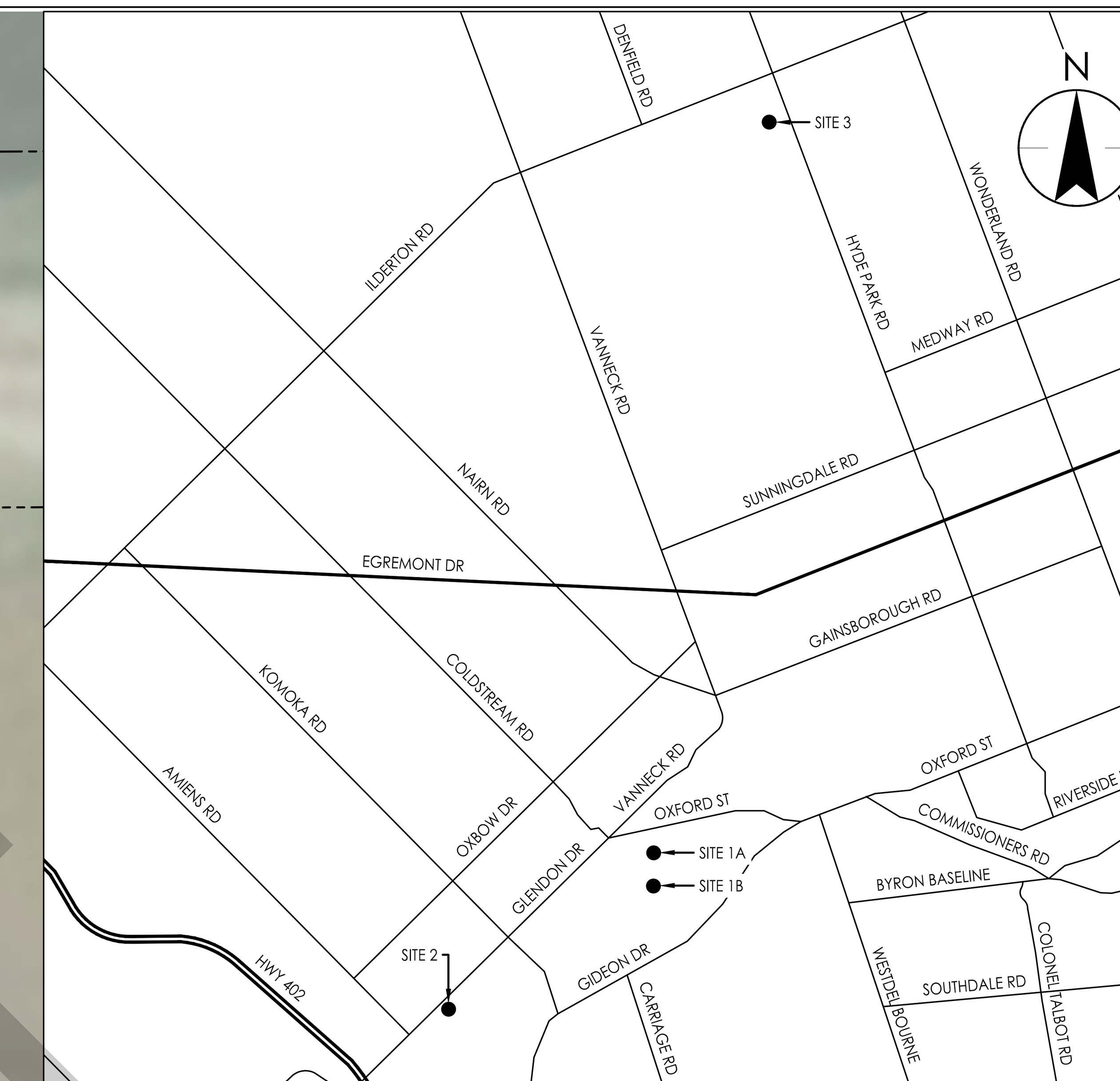
Scale HORZ — 1 : 500 (5 0 10m)

Drawing No. TM-2

Sheet 2 of 4

Revision 0

ORIGINAL SHEET - ANSI D



KEY MAP

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Issued	By	Appd.	YY.MM.DD

File Name: 161414073_l-tm	SU	GG		21.03.01
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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Client/Project

Municipality of Middlesex Centre

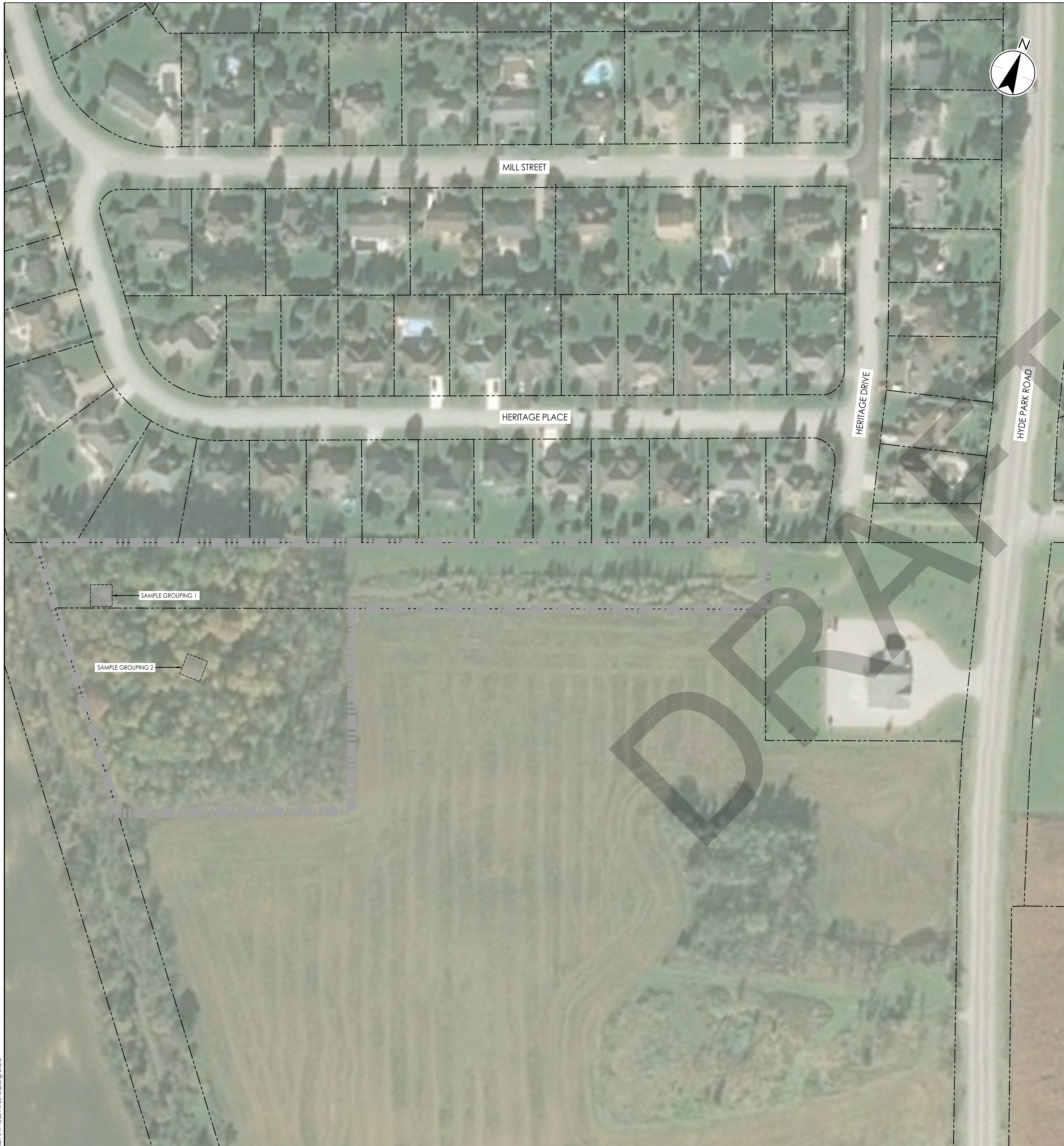
Gypsy Moth Survey

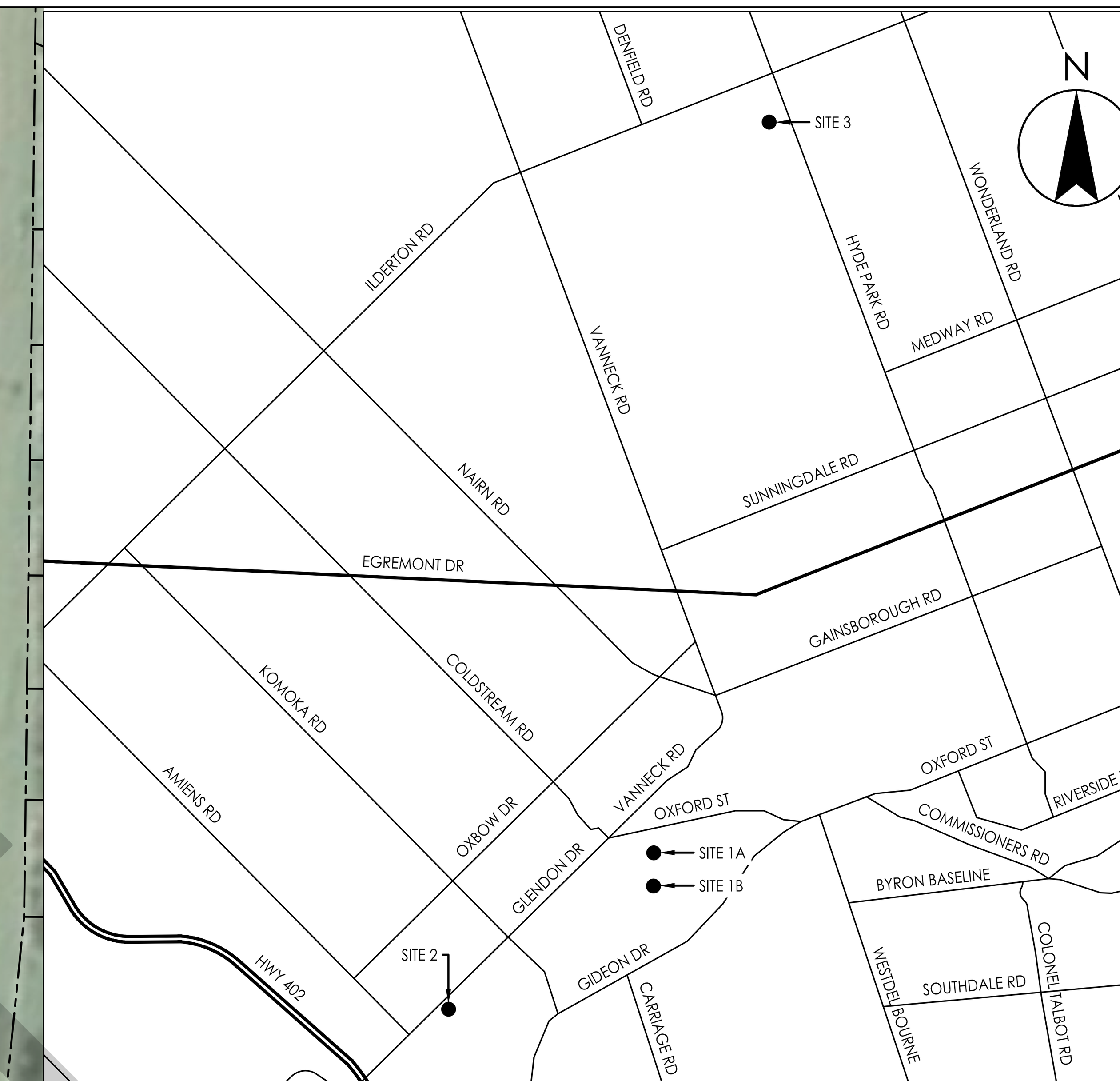
Middlesex Centre, ON Canada

Title

SITE 2:
KOMOKA PRIVATE WOODLOT

Project No.	Scale	
161414073	HORZ — 1 : 500 (5 0 10m)	
Drawing No.	Sheet	Revision
TM-3	3 of 4	0





KEY MAP N.T.S.

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Notes

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 161414073_l-tm	SU	GG		21.03.01
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Client/Project

Municipality of Middlesex Centre

Gypsy Moth Survey

Middlesex Centre, ON Canada

Title

SITE 3:
ILDERTON RAIL TRAIL TO FIRE DEPARTMENT

Project No. 161414073

Scale HORZ — 1 : 1000 (10 0 20m)

Drawing No. TM-4

Sheet 4 of 4

Revision 0

ORIGINAL SHEET - ANSI D