CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Environmental Services Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	November 13, 2017
SUBJECT/REPORT NO:	Gypsy Moth Infestation Control Program (PW17088) (City Wide)
WARD(S) AFFECTED:	(City Wide)
PREPARED BY:	Le' Ann W. Seely, 905-546-2424, Extension 3919 Steve Robinson 905-546-2424, Extension 5495
SUBMITTED BY: **SIGNATURE:**	Craig Murdoch, B. Sc. Director, Environmental Services Division Public Works Department

RECOMMENDATION

In an effort to preserve the City's tree assets, and subsequently maintain the health and well-being of the environment and public, staff is requesting approval of the following recommendations:

(a) That staff be directed under By-law 08-070 Respecting Gypsy Moth Infestation, to implement a Gypsy Moth Control Program involving aerial application of the biological control agent *bacillus thuringiensis 'kurstaki'* (Btk), to control the larval stage of *Lymantria dispar dispar* (European Gypsy Moth);

(b) That infested areas which exceed 2,500 egg masses per hectare, as identified in By-law 08-070 as the treatment threshold, be the areas to receive aerial application of the biological control agent *bacillus thuringiensis 'kurstaki'* (Btk), as estimated in maps attached as Appendix E to Report PW17088 and that staff report back on actual areas of application upon completion of 2017 fall monitoring prior to treatment;

(c) That By-law 08-070 Respecting Gypsy Moth Infestation be amended to remove reference to PW08028a and its appendices;

(d) That the anticipated capital cost of $1,950,000 in 2018 and $550,000 in 2019 be referred to the 2018 capital budget process;

(e) That a follow up survey be performed in the Fall of 2018, following treatment, to provide an assessment of the Gypsy Moth population size in the areas that were treated;

(f) That the costs associated with the follow up survey be included in the total anticipated capital costs identified for the Gypsy Moth Infestation Control Program detail sheet to be submitted through the 2018 capital budget process;

(g) That correspondence be sent to the Minister of Natural Resources and Forestry, requesting financial assistance from the province in dealing with Gypsy Moth infestations, and that any received funds will be used to offset the capital impacts identified through this program.

EXECUTIVE SUMMARY

In 2007, severe levels of Gypsy Moth activity were observed in isolated areas across the City, causing city-wide concern over impacts to tree canopy. An assessment of the situation was undertaken, resulting in recommendations in 2008 to implement a control strategy. The primary control method was aerial application of the biological control agent *bacillus thuringiensis 'kurstaki'* (Btk). The assessment done after Btk application found that Gypsy Moth populations had dropped within levels deemed non-threatening to our tree canopy, suggesting the control method was successful.

Gypsy Moth cycles peak in population every 8-10 years. In 2016, localized severe levels of Gypsy Moth activity were observed, resulting in the initiation of various activities through the Forestry Section including consultation with outside agencies, and monitoring of trees for evidence of Gypsy Moth. Egg mass surveys completed in the winter of 2016/2017 identified approximately 2,690 hectares as exceeding the treatment threshold of 2,500 egg masses/ha. The 2,500 treatment threshold is identified in City of Hamilton By-law 08-070 Respecting Gypsy Moth Infestation. In order to verify the population was on the rise rather than a single year anomaly, Forestry staff continued to monitor throughout the Spring and Summer of 2017. Pheromone trapping, trunk banding, and defoliation surveys indicate that the Gypsy Moth population is increasing in areas already infested, as well as dispersing into new areas that provide an abundant food source. Based on the combined 2016 and 2017 data, a treatment area of 1,946 hectares has been identified as the recommended treatment zone for 2018. These 1,946 hectares are identified as the recommended treatment area due to the high likelihood of being severely infested again in 2018, which would be the second or third consecutive year (area dependent). Consecutive years of infestation over the 2,500 egg masses per hectare threshold are likely to result in tree mortality.

Alternatives for Consideration – See Page 9

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: Table 1 below shows a breakdown of costs associated with treatment of Gypsy Moth. Funds already committed in 2016 and 2017 have come from the Forestry operating budget, which is insufficient for Btk treatment. Funds in 2018, of $1,950,000 are for aerial application of Btk, continued monitoring, and follow up data analysis to assess efficacy of the treatment. Funds in 2019 are for continued monitoring, follow up data analysis, and additional spraying only if necessary. It would be deemed necessary if the follow up data analysis and/or monitoring result in an area exceeding the 2,500 egg masses per hectare.

Prior to going to market for quotations, costs are estimated at $955.00 per hectare. This per hectare cost was developed through consultation with Forestry colleagues in neighbouring municipalities.

Table 1: 2018 Aerial Application of Btk (000's)

Item	2016, 2017 Funds Already Committed	2018	2019	TOTALS (2016-2019)
Monitoring	$16	$40	$40	$96
Data Analysis & Reporting	$35	$50	$50	$135
Non-aerial application of pesticide	$4	-	-	$4
Aerial Application of pesticide	-	$1,860	$460	$2,320
TOTALS	$55	1,950	$550	$2,555

Staffing: There are no staffing implications from the recommendations of this report.

Legal: Recommendation (e) of Report PW08028a resulted in Legal Services developing nuisance By-law 08-070 Respecting Gypsy Moth Infestation, which applies to the recommendations within Report PW17088.

HISTORICAL BACKGROUND

Gypsy Moth (*Lymantria dispar dispar)* is an invasive species that is known to be a significant defoliator of hardwood tree species. The pest was introduced accidentally to North America in 1869, and it was first discovered in Canada in 1969 on Wolfe Island, Ontario.

Since that time, this pest has continued to move westward, and has impacted urban forests throughout Southern Ontario, with notable impact to the City of Hamilton in 2007, and 2017. As a result of the 2007 studies an aerial spray program was undertaken through the Forestry Section in 2008 to treat this pest with *Bacillus thuringiensis* 'kurstaki' (Btk).

Gypsy Moth populations are known to exhibit three phases of infestation: innocuous (low density), release (transition/growth phase), and outbreak (high density population). Data suggests that the City is currently in the release phase. Portions of the City's Urban Forest have been significantly defoliated two or three consecutive times, which can lead in some cases to tree mortality. If action is not taken now, over the next several years the Gypsy Moth population is expected to increase and there is a high likelihood that it will cause irreparable damage to the urban forest.

Bacillus thuringiensis 'kurstaki' (Btk) is a soil-borne bacteria that is applied to the leaves of affected trees while caterpillars are in their early instar stage (immature). Once ingested, the bacterium disrupts the caterpillars' digestive system with cessation of eating within 24-48 hours. Within days, caterpillars that have ingested Btk will succumb to its effects. Btk has very low residual qualities in the natural environment. Sunlight and fungi deteriorate the bio-pesticide within 1-4 days. Because Btk requires an alkaline environment in the gut in order to be effective, it does not have any detrimental effects to humans, birds, or bees. Btk will affect other caterpillar species (known as non-target species). Conservative and measured application will be undertaken with the goal of reducing the population below the 2,500 egg masses per hectare. This program is not intended to eradicate the pest entirely.

In 2008, approximately 1,950 hectares were treated with Btk, with a dual engine helicopter in urban areas, and a fixed wing aircraft in rural areas. Treatment areas are shown in Appendix A to Report PW17088. The program budget was $830,100 with actual costs reaching $914,000. Follow up study in 2009 indicated the spray program was a success. Average overall cost for treatment in 2008 was $460 per hectare. The average overall cost for 2018 is estimated at $955.00 per hectare.

The overall 2008 cost per hectare is lower than the overall 2018 estimates as approximately half of the treatment area in 2008 was completed with a fixed wing aircraft rather than a twin turbine helicopter, which is more costly. With the proposed

treatment area in 2018 being entirely urban, a twin turbine helicopter will be required for all treatment. Table 2 below shows a breakdown of 2008 costs per hectare of urban and rural areas and also shows the same 2008 costs with inflation factored in for comparison in 2018 dollars.

Table 2: Cost Comparison, Urban vs Rural treatment, 2008:

Application Type	**2008 Cost ($/hectare)**	**2018 Comparative Cost ($/hectare) (Avg rate of inflation 1.36%)**
Twin Turbine Helicopter (Urban)	$628.00	$720.00
Fixed Wing Aircraft (Rural)	$187.00	$215.00

The average overall cost for 2018 estimates above as $955.00 per hectare (Urban) is based on industry investigation. Table 2 above shows what the 2018 cost escalation would be over 2008 actual costs, strictly considering inflation.

In 2016, West Hamilton, Ancaster, Dundas, and portions of Flamborough experienced notable defoliation of deciduous trees which generated great concern from the public. The Forestry Section, at that time, collaborated with the Ministry of Natural Resources and Forestry, and the Hamilton Conservation Authority to assess the infestation, which was determined to be Fall Cankerworm. Fall Cankerworm is a native insect that plays an important role in the ecology of our forests. Large populations of Fall Cankerworm are most likely to occur in years with warm, dry spring seasons, and most often do not result in tree mortality.

Conditions that favour an increase in the population of one pest often support an increased population in other pests as well. The Forestry Section therefore initiated monitoring for Gypsy Moth.

In the fall of 2016, the Forestry Section initiated egg mass surveys in the areas where defoliation had been witnessed. The objective of the survey was to forecast future Gypsy Moth population by counting egg masses. Areas of moderate to high infestation forecasts were identified across approximately 2,690 hectares.
In the spring and summer of 2017, the Forestry Section continued monitoring efforts to gain an understanding of the geographical distribution, overall fitness, and concentration of the pest; and to verify if the pest population is on the rise or a one-year anomaly. This was accomplished through the installation of 113 sticky bands, 49 pheromone traps, as well as visual defoliation surveys.

Refer to Appendix B to Report PW17088 for locations of 2016 egg mass surveys with forecasted defoliation in grids ranging from moderate to severe defoliation. Refer to

Appendix C to Report PW17088 for 2017 monitoring locations, results, and defoliation. These maps indicate that the Gypsy Moth population continues to grow in a concentrated manner in areas where the moth is already present, and appears to be dispersing into West Hamilton, the Hamilton Mountain and further into Ancaster.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

As per the recommendations, an amendment to By-law 08-070 Respecting Gypsy Moth Infestation is required to remove reference to PW08028a and its appendices. The current recommended aerial treatment locations are shown in Appendix E to Report PW17088.

If Alternative 3 is determined to be the preferred approach to Gypsy Moth control, in addition to the amendment of By-law 08-070 Respecting Gypsy Moth Infestation, an amendment to the User Fee and Charges By-law would be required to include the recovery fee as part of the By-law.

RELEVANT CONSULTATION

Through consultation with other municipalities throughout the Greater Golden Horseshoe Area, staff confirmed that methods employed to date are consistent.

The City of Burlington experienced localized infestation of cankerworm this year and has applied Btk via ground spray operations to one public park. They continue to monitor for the pest population. There is no indication that an aerial treatment program is required at this time.

The Town of Oakville has found that Gypsy Moth populations are on the rise and noted increased defoliation as a result. They will continue to monitor egg masses in the winter. The Town is considering an aerial treatment program of approximately 100 hectares for 2018, pending the findings of the fall monitoring.

The City of Mississauga has a robust monitoring program underway, predominantly finding Cankerworm, with low populations of Gypsy Moth. The City of Mississauga will be recommending an aerial application program through a council report in November 2017.

The City of Toronto has applied Btk through an aerial program, to approximately 130 hectares in 2017. Toronto may also spray in 2018, depending on the outcome of egg mass surveys to be done in the fall and winter of 2017/18.

The Hamilton Conservation Authority and Forestry staff has been working closely together on their monitoring programs, and intends to continue to share information on their findings. Hamilton Conservation is considering a spray program for 2018.

The Halton Conservation Authority is monitoring the activities of Hamilton and other neighbouring municipalities to assess how they may proceed.

The Ministry of Natural Resources and Forestry (MNRF) assesses that the infestations of Gypsy Moth currently being seen, have been seen before and anticipates that the Gypsy Moth population has not yet peaked. The MNRF has confirmed that the aerial application of Btk is the most economical means of controlling Gypsy Moth, as well as cankerworm, with no impacts to public health.

Natural Heritage Planning has no concern with the aerial application of Btk to naturalized areas, but does want to ensure that non-target impact of other Lepidopteran species (moth and butterfly) is minimized.

City of Hamilton, Public Health Section has indicated that they have no public health based objections to aerial spraying for Gypsy Moth using Btk, and that their position has not changed from what was presented in their 2008 position paper, which should therefore be retained as relevant. The 2008 position paper from Public Health is attached as Appendix F to Report PW17088.

City of Hamilton Legal Services has been consulted in regard to Alternative 3: Aerial Application of Btk with Private Tree Cost Recovery. They have recommended that if this was the approved alternative, that By-law 08-070, Respecting Gypsy Moth Infestation be amended to make it an obligation that owners have their properties sprayed as part of the City's spray program. Further, any payment would fall under the purview of the User Fees and Charges By-law which would also require an amendment.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

Average egg mass densities per hectare are used to group the forecasted defoliation into five categories, which are: nil, light, moderate, heavy, and severe. By-law 08-070 Respecting Gypsy Moth Infestation identifies that Gypsy Moth should be treated with an aerial application of Btk when egg mass quantities exceed 2,500 per hectare, which is categorized as moderate defoliation.

2016 Monitoring
Table 3 below shows results from monitoring done in 2016, where the forecasted defoliation was moderate or higher. These results are illustrated as Appendix B to Report PW17088.

Table 3: Areas Exceeding Treatment Threshold (2,500 egg masses/hectare), 2016

Forestry Grid / Location	Ward	Average Egg Mass Density per Hectare	Defoliation Forecast	Defoliation Forecast Range %
Grid T167 Dundas Driving Park	13	24,716	Severe	> 65%
Grid T168 Forestview Dr Fieldgate St Cammay Ave	13	2,540	Moderate	26 – 65%
Grid T169 Tweedsmuir Ave Robinhood Dr Old Ancaster Rd	13	5,496	Severe	> 65%
Grid T171 Lower Lions Club Rd	12	3,243	Moderate	26 – 65%
Grid T172 Turnbull Rd Pleasant Ave Sulphur Springs Rd Lovers Ln	12	5,487	Severe	> 65%
Grid T173 Lime Kiln Rd Briar Hill Cres Montgomery Dr	12	7,697	Severe	> 65%

2017 Monitoring

Monitoring completed in the Spring and Summer of 2017 indicated that the Gypsy Moth population was increasing in concentration in areas that are already infested, and is dispersing into new areas where a new viable food source can be found.

2018 Proposed Treatment Area

Based on the combined 2016 and 2017 data, and the two factors listed below, a treatment area of 1,946 hectares has been identified as the recommended treatment area for 2018.

1) Trees located in urban areas where the defoliation forecast for 2018 are to be categorized as moderate or higher. Trees growing in urban areas are exposed to harsher growing conditions and environmental stresses, and urban trees are therefore susceptible to mortality after one season of moderate defoliation.

2) Natural areas within the urban boundary (excluding conservation lands) where the 2018 defoliation is expected to be the second or third consecutive year with a defoliation

category of moderate or higher. Even in a favourable natural setting, multiple years of defoliation are likely to lead to tree mortality.

Table 4 below provides a breakdown of the areas where treatment is recommended for 2018. This breakdown is illustrated as Appendix E to Report PW17088.

Table 4: Proposed Aerial Treatment Zones, 2018

Forestry Grid / Location	Ward	Average Egg Mass Density per Hectare	Defoliation Forecast	Defoliation Forecast Range %
Grid T001 Whitney Ave Carwyn Cr	1	3,500	Moderate	26-65%
Grid T063 Ewen Rd Radford St	1	2,500	Moderate	26-65%
Grid T064 Rifle Range Rd Iona Av	1	3,000	Moderate	26-65%
Grid T161 (Partial) Delottinville Park	13	4,000	Moderate	26-65%
Grid T162 Huntingwood Ave Mercer St	13	4,000	Moderate	26-65%
Grid T163 Hatt St McNab St.	13	3,000	Moderate	26-65%
Grid T164 Park St. Melville St.	13	3,500	Moderate	26-65%
Grid T165 Albert St Princess St	13	3,000	Moderate	26-65%
Grid T166 Dundas Pool & Arena Central Park	13	2,500	Moderate	26-65%
Grid T167 Dundas Driving Park	13	25,000	Severe	> 65%
Grid T168 (Partial) Forestview Dr Fieldgate St Cammay Ave	13	3,500	Moderate	26 – 65%
Grid T169 (Partial) Tweedsmuir Ave Robinhood Dr Old Ancaster Rd	13	6,000	Severe	> 65%

Grid 170 Warren Park	13	6,000	Severe	>65%
Grid T171 (Partial) Lower Lions Club Rd	12	3,500	Moderate	26 – 65%
Grid T172 Turnbull Rd Pleasant Ave Sulphur Springs Rd Lovers Ln	12/13	10,000	Severe	> 65%
Grid T173 Lime Kiln Rd Briar Hill Cres Montgomery Dr	12	8,000	Severe	> 65%
Grid T175 Hiawatha Blvd Iroquois Ave	12	2,500	Moderate	26 – 65%
Grid T176 Orton Pl Seymour Dr	12	3,500	Moderate	26 – 65%
Grid T177 Somerset Park Lloymin Ave	12	10,000	Severe	> 65%

Monitoring will continue in the fall of 2017 in preparation for treatment in 2018 (if approved) to confirm the geographic distribution and concentration of the pest, which will inform actual spray areas at the time of treatment. Gypsy Moth growth is not linear and cannot be predicted with 100% certainty. Therefore, staff will continue to monitor their progress, and spray only where needed. Areas of continued monitoring are shown in Appendix D to Report PW17088.

There is no indication that the population will collapse naturally in 2018, and given the stress placed on host trees, the Forestry Section is recommending an aerial spray program to bring the Gypsy Moth population down to levels below the 2,500 per hectare threshold, which will reduce the probability of tree mortality.

ALTERNATIVES FOR CONSIDERATION

Alternative 1: Increased Monitoring capacity, No Aerial Program
An alternative to acting on by-law 08-070 with an aerial spray treatment of Btk is to ground spray public trees that can be reached with ground equipment, such as within the road allowance and public parks. The capital cost for this control method is estimated at $100,000 in 2018 and $75,000 in 2019, as summarized in Table 5 below. Multiple years of treatment would likely be required.

Monitoring would be continued, as well as a follow up analysis to assess the effectiveness of this approach in reducing the Gypsy Moth population.

This method of treatment is able to reduce the Gypsy Moth population to below threshold levels on a tree by tree basis, but will yield little effectiveness in the reduction of Gypsy Moth population below threshold levels on a community-wide basis. Furthermore, trees of significant size may not be able to be treated as effectively as the equipment used is restricted to approximately 12 m (40') in height. It is expected that with this approach, treated trees are at a high likelihood of being re-infested in subsequent years, and therefore multiple year treatments will likely be required.

Table 5: Treatment of Public Trees only, Ground-spray Program, (000's)

Item	2016, 2017 Funds Already Committed	2018	2019	TOTALS (2016-2019)
Monitoring	$16	$40	$15	$71
Data Analysis & Reporting	$35	$10	$10	$55
Non-aerial application of pesticide	$4	$50	$50	$104
TOTALS	$55	$100	$75	$230

Alternative 2: Modified Aerial Application Program:
Reduce the amount of aerial application to include only areas where monitoring found egg mass quantities per hectare to exceed 2,500 in both 2016 and 2017 (Wards 12 and 13), and remove the provision to treat areas where egg mass quantities per hectare are expected to exceed 2,500 within (Ward 1). This will reduce the approximate spray area by 174 ha, and result in a savings of approximately $174,000.

Based on the information that has been gathered, it is anticipated that populations of Gypsy Moth are on the rise and will continue to increase into areas of West Hamilton, including the West Mountain. Reducing the spray program in this area may allow Gypsy Moth populations to increase in this area, re-infest areas of Dundas and Ancaster, and spread farther into the Hamilton Mountain and the downtown core.

Table 6, Modified Aerial Application Program, (000's)

Item	2016, 2017 Funds Already Committed	2018	2019	TOTALS (2016-2019)
Monitoring	$16	$40	$40	$96
Data Analysis & Reporting	$35	$50	$10	$95
Non-aerial application of pesticide	$4	$0	-	$4
Aerial Application of pesticide	-	$1,686	$500	$2,186
TOTALS	$55	$1,776	$550	$2,381

Alternative 3: Aerial Application of Btk with Private Tree Cost Recovery:

If an aerial spray program is approved, Council may consider the imposition of a mandatory cost recovery program for affected property owners within the spray zone. This would help to off-set some of the City's capital costs associated with the aerial spray program.

Approximately 27% (519 hectares) of the proposed treatment area is Public Land (City-owned parks, street right of ways) and an additional 6% (120 hectares) considered Conservation Lands, with an overall total of 33% (638 hectares) considered publically owned. If the City were to invoke a cost recovery program through a fee bylaw, this would reduce the cost of aerial treatment incurred by the City in 2018 to an estimated $609,300.00. The remaining $1,250,700.00 fee would be charged to business owners and residents.

Calculations for the cost recovery fee to the property owner would be based on the actual per hectare cost of the contract once awarded. This alternative would require amending the Gypsy Moth Infestation By-law 08-070 as well as approving the fee as an addition to the User Fee and Charges By-law.

Table 7, 2018 Aerial Application of Btk with Cost Recovery (000's)

Item	2016, 2017 Funds Already Committed	2018	2019	TOTALS (2016-2019)
Monitoring	$16	$40	$40	$96
Data Analysis & Reporting	$35	$50	$50	$135
Non-aerial application of pesticide	$4	-	-	$4
Aerial Application of pesticide	-	$610	$460	$1070
TOTALS	$55	$700	$550	$1,305

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Community Engagement & Participation
Hamilton has an open, transparent and accessible approach to City government that engages with and empowers all citizens to be involved in their community.

Healthy and Safe Communities
Hamilton is a safe and supportive city where people are active, healthy, and have a high quality of life.

Clean and Green
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure
Hamilton is supported by state of the art infrastructure, transportation options, buildings and public spaces that create a dynamic City

Our People and Performance
Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Appendix A: 2008 Spray Locations
Appendix B: 2016 Egg Mass Survey with Defoliation Forecast
Appendix C: 2017 Spring Monitoring and Defoliation Survey
Appendix D: 2017 Proposed Fall Monitoring Locations

Appendix E: 2018 Proposed Aerial Spray Locations
Appendix F: City of Hamilton Public Health Services' 2008 Position Paper on the City of Hamilton's Proposed Spring 2008 Gypsy Moth Control Program using Foray 48B (*Btk- Bacillus thuringiensis* ssp *kurstaki*)