TORONTO **STAFF REPORT**

January 4, 2005

To: Economic Development and Parks Committee

From: Joe Halstead, Commissioner Economic Development, Culture and Toourism

Subject: Implementation of a full Integrated Plant Health Care program in City Parks. All Wards

Purpose:

To report as requested by Council on the costs of implementing a full Integrated Plant Health Care program in City parks including strategies to achieve beautiful pesticide-free parks using examples of best practices and to report on the use of corn gluten meal for weed control in parks.

Financial Implications and Impact Statement:

Implementation of a full and comprehensive Integrated Plant Health Care Program including Plant Health Care components, Integrated Plant Health Care and use of alternative weed control practices as detailed in this report and attachments has been estimated to require an increase to the base operational budget of approximately $18.5 Million, reducing and stabilising at $11.7 Million by the seventh year of implementation. In addition, related one-time equipment costs have been estimated at $2.4 Million. It is understood that in the current fiscal environment, such funding is not realistically achievable and that a phased, balanced approach is required. Parks & Recreation has begun to address the issue of funding for this program in the 2005 budget process as outlined below.

In the 2005 Capital Budget process, the Parks & Recreation item for the purchase of grass cutting equipment has been pre-approved in the amount of $2,061,000.

The EMT Recommended 2005 Operating Budget for Parks & Recreation has included the following new/ enhanced requests:

a) a $1,400,000 addition to the base Parks & Recreation operating budget in 2005 and an additional $1,513,970 in 2006 for the purpose of implementing enhanced grass cutting service as recommended in the Clean & Beautiful City budget proposal;

b) $953,710 be provided in 2005 to create enhanced horticultural displays as part of the Clean and Beautiful City report, $2,148,900 was recommended in 2007 to increase weeding of shrub beds.

c) an increase to the 2006 base operating budget of $444,000 for an Improved Integrated Plant Health Care Program (program development, training and implementation technical support) as recommended in the Parks & Recreation Service Improvement Priorities report.

The Chief Financial Officer and Treasurer has reviewed this report and concurs with the financial impact statement.

Recommendations:

It is recommended that this report be forwarded to Council for information.

Background:

Council Requests for Information

City Council at its May 18, 19 and 20, 2004 meeting considered a report from the Chief Administrative Officer: Joint Report No. 1 of the Economic Development and Parks Committee and the Works Committee: "Implementation of the City's Pesticide By-law" Council requested:

> 'The Commissioner of Economic Development, Culture and Tourism be requested to report to the Economic Development and Parks Committee on the cost and implementing a full Integrated Pest Management (IPM) program for city parklands within six months, and any recommendations be included in the 2005 budget submission; and
>
> The Commissioner of Economic Development, Culture and Tourism be requested to report to the Economic Development and Parks Committee on strategies to achieve beautiful pesticide-free parks using examples of best practices from such cities as Montreal, Halifax and Waterloo.'

City Council at its October 26, 27 and 28, 2004 meeting considered Clause 7 of the Economic Development and Parks Committee report No. 7: "Parks and Recreation Service Improvement Priorities for 2005-2006" directed:

> 'That the Commissioner of Economic Development, Culture and Tourism be requested to report to the Economic Development and Parks Committee on the use of corn gluten meal for weed control in parks.'

These three requests, being closely related, have been combined in this single report.

Related Items – 2005 Budget Process

The 2005 capital and operating budget processes have included requests related to the implementation of a full Integrated Plant Health Care program:

The Parks and Recreation Service Improvement Priorities for 2005-2006 report contained budget recommendations related to implementing an IPHC Program. The Economic Development and Parks Committee recommended that the budget requests be referred for consideration during the 2005 budget process, Council endorsed this at its October 26, 27 and 28, 2004 meeting. This report included:

"Improved Integrated Plant Health Care Program: - $444,000 (addition to base operating budget - 2006) Implementation of consistent best practices, plant health care and IPM, including program development, and implementation. Evaluation support and training is required to provide expected service levels within the context of the Pesticide By-law (i.e.: improve sportsfields and weed control on parkland). 5 FTE"

At its meeting of November 30, December 1 and December 2, 2004 City Council endorsed the recommendation of the Policy and Finance Committee to approve the report from the Chief Financial Officer and Treasurer (as forwarded from the Budget Advisory Committee), providing pre-approval (among many other items) to Parks & Recreation for a capital expenditure of $2,061,000 for the purchase of grass cutting equipment in 2005.

At its meeting of November 30, 2004 December 1 and December 2, 2004 City Council approved the recommendation of the Policy and Finance Committee to endorse the report from the Commissioner of Urban Development Services, the Commissioner of Economic Development, Culture and Tourism and the Acting Commissioner of Works and Emergency Services: 'Clean and Beautiful City - Five Point Action Plan.' This report included a budget recommendation that $1,400,000 be added to the base Parks & Recreation operating budget in 2005 and an additional $1,513,970 in 2006 for the purpose of implementing enhanced grass cutting service. Council specifically amended the clause "to provide that all parks receive extra grass cutting in 2005, subject to the normal budget approval process."

The Clean and Beautiful City Five Point Action Plan also recommended that an increase to the operating budget of $953,710 be provided in 2005 to create enhanced horticultural displays and that $2,148,900 be added to the operating budget in 2007 to increase weeding of shrub beds.

The above noted funding can provide a significant jump-start for the implementation of a full Plant Health Care and Integrated Pest Management Program.

Comments:

This report will:

i) introduce Integrated Plant Health Care (IPHC) as a management strategy that involves Plant Health Care (PHC) and Integrated Pest Management (IPM) as functional components

ii) recommend best Plant Health Care (PHC) practices and strategies that can be implemented on a consistent basis across the City of Toronto to create beautiful pesticide-free parks inclusive of turf management, horticultural display management and hard surface maintenance
iii) provide cost estimates of implementing a full Integrated Pest Management (IPM) in City parkland using Plant Health Care as the basis to provide quality service levels within the context of the City of Toronto Pesticide Bylaw.
iv) comment on best practices from other municipalities, and
v) provide an analysis of the usefulness of corn gluten meal as an organic, weed control measure for parks

1. Integrated Plant Health Care Components

See Attachment No. 1: Integrated Plant Health Care Diagram

a) Plant Health Care (PHC)

In the urban setting, it is the greenscape that makes a city not only liveable but also a desirable place to locate business and to visit as a tourist. In Toronto's urban greenscape, plants provide recreational, aesthetic, environmental and economic function and benefits contributing to the quality of life. Plant Health Care is a system that is used to establish and maintain optimum plant health. The operational components of a PHC system involve:

i) Proper landscape design, site selection and plant selection for new projects including consideration of service level needs and related stresses from use, as well as urban environmental stresses on plant health.
ii) Soil health, with emphasis upon managing the physical, chemical and biological properties of the soil to optimize soil health. Management practices include soil amendment using good quality compost, aeration, applications of organic fertilizers and liquid compost and proper watering.
iii) Proper mowing height and frequency, overseeding and compost topdressing for turf management
iv) Proper planting methods utilizing plant material appropriate for the site with correct sunlight level and air circulation and the use of mulch for horticultural management
v) Proper timing for all management practices

A healthy plant is less susceptible to pest related stress and is in a position to recover when these stress conditions occur. Plant Health Care is the first line of defence against pests. Using Plant Health Care to plan and manage green spaces to prevent weeds, insects and disease from becoming pests results in significant measures of pesticide reduction initially, and pesticide elimination when required. Instead of accepting pest attacks as inevitable, the concept of Plant Health Care recognises that a pest problem is an indication of an underlying plant health problem and identifies the means to correct plant health problems and prevent pest problems.

Plant Health Care promotes sustainability in the soil by increasing the ability of the soil to become biologically dynamic and possess a high degree of natural fertility. The soil becomes a

self-generating system of nutrient cycling with optimum nutrient levels becoming available to the plants. A biologically inactive soil is the key limiting factor to soil health and achieving sustainable plant management systems. The use of chemical pesticides can reduce populations of soil micro-organisms, thereby inhibiting soil health. Thus a reduction in the use of pesticides that results from a Plant Health Care program will contribute to improved soil and plant health.

A sustainable system of Plant Health Care recognizes the importance of best practices associated with soil biological health and involving applications of organic fertilisers and both dry and liquid compost. Once sustainability is achieved, resource inputs involving materials, labour and equipment become gradually reduced overtime.

For turf management, Plant Health Care recognises the intrinsic natural growth cycle of the cool season turfgrasses that are used for our regional groundcover. A PHC program works in concert with this natural growth cycle so that input efficiencies related to materials and labour become maximised. Inputs are timed for specific periods and avoided when they would run counter-productive to the natural growth habits of the turfgrass plant.

Attachment No. 2: City of Toronto Parks and Recreation Integrated Plant Health Care Protocol

b) Integrated Pest Management (IPM)

For matters of actual pest control, Integrated Pest Management (IPM) is the industry standard decision making process that is used to reduce pest populations to acceptable levels in order to protect the valuable infrastructure comprising Toronto's green space resources. IPM is a process that uses all necessary techniques to control pests effectively, economically and in an environmentally sound manner to sustain healthy landscapes. The functional components of the IPM process involve:

i) Planning and managing landscapes to prevent organisms from becoming pests
ii) Identifying potential pest problems
iii) Monitoring and recording populations of pests and beneficial organisms, pest damage and environmental conditions
iv) Using action thresholds to make treatment decisions
v) Reducing pest populations to acceptable levels that may include a combination of biological, physical, cultural, mechanical, pest behavioural (e.g.: pheromone traps) and chemical controls. A hierarchical approach is taken towards pest control whereby biological, physical, cultural, mechanical and behavioural controls are given priority and chemical pesticides are used on a last resort basis and only under the following conditions:
    -Least toxic to human health
    -Lowest impact to non-target organisms such as pets, plants, beneficial insects, wildlife, birds and fish,
    -Used in the smallest quantities possible consistent with maintaining acceptable quality of service and program – 'spot' as opposed to 'blanket' treatments,
    -Properly timed applications for maximum effectiveness to avoid repeat treatments

-Applied by licensed applicators with area posted conforming to Ontario Pesticide Act, Regulation 914

vi) Evaluating the effectiveness of treatments to inform future planning and program decisions

The principles, rationale and methodologies of IPM are compatible with the "Ten Steps to a Healthy Lawn", contained in the Chief Administrative Officer's report: No. 1 of the Economic Development and Parks Committee and Works Committee "Implementation of the City's Pesticide By-law" adopted by Council of the City of Toronto at its meeting on May 18, 19 and 20, 2004.

The City of Toronto Pesticide By-law defines infestation as "the presence of pests in numbers or under conditions, which involve an immediate or potential risk of substantial loss or damage." The Bylaw provides for the application of both exempt and non-exempt conventional pesticides "to control or destroy pests which have caused infestation to property".

Weed control on parkland grassed areas continues to be a significant, and ever increasing challenge for Parks & Recreation, especially in the context of the elimination of pesticides used or turf weeds as required by the Toronto Pesticide By-law. Thus there is an urgency to apply Plant Health Care on a broader scope on parkland to address this issue. The sooner that practices such as use of compost, organic fertilizer, liquid compost and over seeding are implemented, the sooner parkland will be healthier and more weed free.

A similar challenge exists for the control of weeds on hard surfaces and in shrub bed displays. The implementation of alternative weed control methods, replacing the labour efficiencies provided by pesticides should be considered as soon as possible. These alternatives include mechanical and manual removal; exempt pesticides like acetic acid; infrared weed burners and aquacide super heated water equipment.

Parks and Recreation is working closely with Toronto Public Health Pesticide By-law inspectors in fine tuning an Integrated Pest Management Protocol that outlines the process used to determine if and when non-exempt pesticides might be used in City parks, in compliance with the by-law. Such applications are, of course, a rare exception as is illustrated in the reduction in pesticide use by Parks & Recreation in the past five years.

Attachment No. 3: City of Toronto Parks & Recreation Pesticide Use 1998 - 2003

c) Integrated Plant Health Care (IPHC)

Plant Health Care (PHC) is the key operational system used to plan and manage landscapes to prevent substantial loss or damage that can result from weeds, insects and disease. Integrated Plant Health Care (IPHC) is an active management strategy that factors in human use as well as service level needs and expectations. IPHC recognises the unique set of demands and stresses that these place upon plant health and provides a holistic understanding of how plants grow and function in urban settings. In nature, plants are left to manage themselves, however in the urban

greenscape, IPHC is a requirement. An IPHC program provides the best opportunity to achieve a balance between human needs and plant health in relation to urban environmental stresses.

IPHC provides the best approach to develop plant management programs that are environmentally sound, responsive to community needs, healthy and sustainable. IPHC is also the driving force that will ensure the successful implementation of accepted IPM decision-making strategies to create:

i) beautiful, pesticide-free general parkland areas using organic fertilisers and liquid compost applications,
ii) ornamental and aesthetic horticultural displays where pest management is achieved in a stepped approach through the application of sound PHC practices, exempt pesticides or as a last resort, chemical pesticides within the provisions of the City of Toronto Pesticide Bylaw.
iii) functional and safe hard surface areas using IPM and pesticide-free weed control.

Documentation and data analysis involved in implementing an IPHC program provides the ability to forecast future management schedules so that the most optimum Plant Health Care management strategies can be planned and implemented with equipment, labour and materials being allocated efficiently and effectively.

It must be noted that an IPHC program results in a much healthier, useful and beautiful parkland. Incidentally, it is also the best way to reduce and eliminate weeds. In the context of the Toronto Pesticide By-law, and a virtual elimination of the use of herbicides to control weeds, two choices exist. The presence of weeds can be tolerated, or a full IPHC program can be implemented to ensure that healthy park landscapes crowd out weeds. Once again, the environmental benefit of the significantly enhanced, sustainable and healthy parkland established under IPHC is the most noteworthy result. Weed control is only a small part of the total benefit package.

Attachment No. 2: 'Toronto Parks & Recreation Integrated Plant Health Care Protocol' contains the full program listed by functional area (turf, sports fields, hort displays, etc.)

2. Corn Gluten Meal Use in City Parks

Corn gluten meal is a by-product obtained from corn milling. Interest in corn gluten meal was triggered by research conducted at Iowa State University in 1995 that indicated this material had potential to function as a pre-emergent herbicide for certain broadleaf and grassy weeds. Corn gluten meal is considered to be "organic" and as such would be a significant alternative to traditional chemical herbicides. With a nutrient analysis of 10% (Nitrogen), 0% (Phosphorous), 0% (Potassium), corn gluten is also a source of nitrogen which stimulates leaf growth and colour.

Parks and Recreation considered research available from Ohio State University, the Guelph Turfgrass Institute and its own field pilot project in studying the usefulness of corn gluten meal as a means of weed control in parks.

Our study suggested that the primary mode of weed control by corn gluten meal was its affect as an organic fertilizer in encouraging healthy grass that crowded out weeds. Its effectiveness in directly controlling weeds (i.e.: as a pre-emergent herbicide) was limited when used in quantities consistent with acceptable organic fertiliser application rates.

Corn gluten meal also poses a few disadvantages. It cannot be used in conjunction with overseeding (a very effective turf Plant Health Care Practice), as it is extremely effective in controlling grass seed germination. It is not effective when used on turf that is regularly irrigated or for example during a wet spring. Lastly, it is significantly more costly than other organic fertilisers that provide all the plant health benefits of corn gluten meal, without the drawbacks noted above.

Parks & Recreation's IPHC pilot project demonstrates that a Plant Health Care strategy can maintain weed populations to acceptable levels while reducing the need for exempt and / or non-exempt pesticide applications within the context of the City of Toronto Pesticide Bylaw. Emphasis should therefore continue to be given to the implementation of a full scale Integrated Plant Health Care (IPHC) program in City of Toronto's parks through the delivery of best Plant Health Care practices that will provide a competitive advantage for turf over weeds. Best practices include aeration and applications of organic fertilizers and compost (dry and liquid) to improve soil health as well as overseeding to increase turf density.

Parks & Recreation will continue monitoring corn gluten meal research, as well as conducting its own ongoing pilot to determine the longer term results of utilizing corn gluten meal in a parks setting. Until such time as corn gluten meal has demonstrated significant benefits in controlling weeds over less costly organic fertilisers, Parks & Recreation will limit its application to the current pilot project.

Attachment No. 4: Use of Corn Gluten Meal for Weed Control in City Parks.

3. Best Maintenance Practices in Other Municipalities

Many municipalities, like the City of Toronto, have recognized the need to meet service levels expectations of the community within the context of pesticide reduction and have responded to this challenge through the implementation of specialized programs involving best practices: Plant Health Care and Integrated Pest Management.

The parks management practices of Waterloo, Halifax and Burlington were reviewed with special attention to their documented operational procedures in achieving beautiful and healthy developed urban greenscapes within the operating context of pesticide reduction. No documented information was available from the City of Montreal.

Toronto Parks and Recreation endorses the best practices that are currently being implemented by the Cities of Waterloo, Halifax and Burlington. It is not by coincidence that Plant Health Care is the common management element between the municipalities. Like Toronto, the other municipalities have recognized that an active Plant Health Care management program is required to deliver the quality of greenspace expected in the urban environment.

The Toronto Parks & Recreation Integrated Plant Health Care (IPHC) Protocol is progressive relative to the other municipalities. IPHC takes into consideration human needs and the stresses of the urban environment on the developed and natural green landscape. For example, the relationship between plant health and human wellness is recognized and factored in. IPHC incorporates the best practices of Plant Health Care (PHC) as well as the practical application of Integrated Pest Management (IPM) for monitoring and responding to the effects of pests.

Though not appearing in their literature, it is assumed that the other three municipalities do employ IPM decision making in conjunction with best practices involving Plant Health Care. The City of Waterloo has emphasized the working dynamics between staff and their operational Plant Health Care program, emphasizing ongoing education and training. It is recommended that the City of Toronto pay particular attention to the human resource part of the model, which has been developed in the City of Waterloo.

Like Halifax, Toronto Parks and Recreation has a compost topdressing program for select sports fields, and as resources permit are expanding the program across all Districts in the City. Parks & Recreation actively monitors the compost program. Data collected confirms consistent performance benefits accrue when compost is used as a best Plant Health Care practice - especially when done in conjunction with aeration and overseeding.

Little documented data exists on horticultural area Plant Health Care best practices. The Toronto Parks and Recreation Plant Health Care Protocol includes best practices for horticultural areas, and pilot programs are scheduled for 2005.

Toronto Parks & Recreation emphasizes staff training and empowerment, like Waterloo, to ensure that Plant Health Care is utilized from the bottom up. Toronto Parks & Recreation should continue to develop and implement Plant Health Care best practices, in particular the use of high quality compost and other organics that improve soil health and bio-activity.

Special emphasis should be given to implementing Plant Health Care in horticultural areas. Most of the attention has been given to turf and sports fields in Toronto and other municipalities. Toronto should continue to employ Integrated Plant Health Care, incorporating the needs of the community and taking into account unique urban stresses (including human use) along with Plant Health Care principles in designing its greenspaces and maintenance programs.

Attachment No. 5: Best Parks Maintenance Practices in Other Municipalities

4. Implementation Resource Requirements for a Full IPHC Program

a) Introduction

Resource allocation is a limiting factor in the implementation of a full Integrated Plant Health Care and Integrated Pest Management Program. To meet community service level expectations within the context of the Pesticide By-law which limits the use of pesticides, a best practices

Plant Health Care and Integrated Pest Management program should be implemented for park land. Such an Integrated Plant Health Care Program should include:

- Program development
- Staff training
- Implementation support
- Program evaluation support
- Toronto Pesticide by-law compliance
- Operational Program elements as outlined in the attached 'Toronto Parks & Recreation IPHC
- Protocol' and 'IPM and Action Thresholds' (Attachments 2 and 3)

b) Program Development, Training and Evaluation

IPHC standards have been developed to provide a consistent protocol and service level across the City of Toronto for each functional area of parks management. Implementation of standards can be limited by resource availability for operationalizing such standards and for providing on-going technical field support. Integrated Plant Health Care is a strategy that can be applied to site-specific conditions so that programs can be customised for each park. Program Development elements include:

- Creating Plant Health Care and Integrated Pest Management checklists that will assist staff in implementing and documenting PHC practices at each site as well as the IPM process used in matters of pest control
- Assembling background site information
- Conducting site assessment – physical characteristics (soil conditions using soil tests, micro-climates), plant inventory and use patterns
- Site assessment and analysis
- Drafting site specific programs
- Revising programs based upon results and experience, determining the best management practices for each applicable site

Integrated Pest Management and Plant Health Care are dynamic and complex, requiring the exercise of judgement based upon a sound knowledge of principles applied to site specific conditions. A cookie cutter approach markedly diminishes the available benefits. Therefore, full-scale implementation in the field requires specialized, on-going training including time specifically dedicated to training. It is recommended that training be conducted in the following fashion:

- Classroom orientation where staff are brought to a general and consistent understanding of the principles, rational and methodology of IPM and IPHC. This would be facilitated with resource materials currently available in the form of books and publications.
- Practical on the job training so that existing principles and techniques are applied and reinforced under field conditions. This would be facilitated with formal IPHC and IPM checklists that can be used for each site and function

- Ongoing training and support so that staff can refine their understanding and skills so as to develop judgement in site specific applications of IPM and IPHC and also to stay abreast of new principles and techniques. Such training should be supported by a functionally –based networking system that provides Parks staff the ability to exchange information.
- External education opportunities such as conferences, workshops and industry standards compliance (IPM Accreditation Program) would also form part of the training component of the program.
- Each Park Supervisor should undertake the Ontario Parks Association recommended Municipal IPM Accreditation Program and each golf course supervisor undertakes the Golf Course IPM Accreditation Program.

Ongoing evaluation using accurate records is essential to the success of an IPHC program. It is important to determine both successes and failures, to build on what worked and identify ways to change site designs and management practices so as to improve the program and prevent future problems. IPHC is a dynamic concept that with proper evaluation can readily be changed to accommodate new sets of legislative demands and conditions involving pesticide application restrictions. Evaluation also helps to assess the cost benefit ratio of the program.

Full program development would require five (5) full time IPHC Technicians (one per District and one specific to Golf Course and Other Speciality areas) to develop, implement and support a full IPHC program including an in-house training component. The technicians would provide direct technical support to parks operational staff including ongoing program evaluation and conducting research and pilot projects that would generate recommendations to improve the program.

IPHC Technicians would also be responsible for assisting in meeting IPM Program requirements and Pesticide by-law compliance such as pest monitoring and related IPM documentation.

In order to implement full IPHC program development, training and evaluation, an increase to the base operating budget of $444,000 would be required. Although requested for the 2006 operating budget year, an earlier implementation would be highly desirable in order to provide a solid foundation for on-going proactive implementation.

c. Operational Implementation

Implementation of a full and comprehensive Integrated Plant Health Care Program including Plant Health Care components, Integrated Plant Health Care and use of alternative weed control practices as detailed in this report and attachments has been estimated to require an increase to the base operational budget of approximately $18.5 Million, reducing and stabilizing at $11.7 Million by the seventh year of implementation. In addition, related one-time equipment costs have been estimated at $2.4 Million. It is understood that in the current fiscal environment, such funding is not realistically achievable and that a phased, balanced approach is required. Parks & Recreation has begun to address the issue of funding for this program in the 2005 budget process as outlined in the following section.

d). Parks & Recreation Funding Requests: 2005 Budget Process

The Economic Development and Parks Committee Report 7: Parks and Recreation Service Improvement Priorities for 2005-2006 (All Wards) contained budget recommendations related to implementing an IPHC Program. The Economic Development Committee recommended that the budget requests be referred for consideration during the 2005 budget process, and Council endorsed this in its meeting of October 26, 27 and 28, 2004. This report included:

"Improved Integrated Plant Health Care Program: - $444,000 (addition to base operating budget - 2006) Implementation of consistent best practices, plant health care and IPM, including program development, and implementation. Evaluation support and training is required to provide expected service levels within the context of the Pesticide By-law (i.e.: improve sportsfields and weed control on parkland - 5 FTE")

At its meeting of November 30, December 1 and December 2, 2004 City Council endorsed the recommendation of the Policy and Finance Committee to approve the report from the Chief Financial Officer and Treasurer (as forwarded from the Budget Advisory Committee), providing pre-approval (among many other items) to Parks & Recreation for a capital expenditure of $2,061,000 for the purchase of grass cutting equipment in 2005.

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The Clean and Beautiful City Five Point Action Plan also recommended that an increase to the operating budget of $953,710 be provided in 2005 to create enhanced horticultural displays and that $2,148,900 be added to the operating budget in 2007 for increased weeding of shrub beds.

The above noted funding can provide a significant jump-start for the implementation of a full Plant Health Care and Integrated Pest Management Program.

Conclusions:

Integrated Plant Health Care, and its components of Plant Health Care and Integrated Pest Management represent a progressive, best practices approach to providing healthy, environmentally friendly public greenspace. It represents a viable means of complying with the Pesticide By-law, while addressing public expectations of service levels in City parkland.

More noteworthy, however are the myriad of environmental and plant health benefits that are derived from implementing a comprehensive Integrated Plant Health Care Program which addresses the fundamental principle that healthy, bio-active soil is the foundation for healthy plants. Improved soil bio-health results not only in healthier and more beautiful plants that resist pest infestation, but also in creating parkland that actively works to clean Toronto's air and water creating an overall healthier environment for all.

It is understood that in the current fiscal environment, full funding for a comprehensive Plant Health Care program is not realistically achievable at this time and that a phased, balanced approach is required. Never-the-less, given the rate of deterioration of City parkland over the past six years including the proliferation of weeds, it is highly desirable to implement Plant Health Care as soon as possible. As mentioned earlier, the benefits are not only fewer weeds, but also much healthier, attractive and user- friendly parks that contribute to Toronto as a Clean and Beautiful City. In particular, initiating full program development and on-going staff training is essential to the long term success of Plant Health Care.

Parks & Recreation budget submissions included in the ED&P Committee Report: Parks and Recreation Service Improvement Priorities for 2005-2006; The Clean and Beautiful City Five Point Action Plan as submitted to the Policy and Finance Committee; and in the pre-approval process for the 2005 capital budget process includes funding that will be appropriately allocated so as to significantly jump-start the implementation of a full Plant Health Care and Integrated Pest Management Program. Parks & Recreation will continue to expand upon this program as resources become available through the normal budget process.

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Joe Halstead
Commissioner Economic Development, Culture and Tourism

List of Attachments:

Attachment No. 1: Integrated Plant Health Care Diagram
Attachment No. 2: Parks & Recreation Integrated Plant Health Care Protocol
Attachment No. 3: Parks & Recreation Pesticide Use 1998 – 2003
Attachment No. 4: Use of Corn Gluten Meal for Weed Control in Parks
Attachment No. 5: Best Maintenance Practices in Other Municipalities

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TORONTO PARKS & RECREATION
INTEGRATED PLANT HEALTH CARE PROTOCOL

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1.0 PURPOSE

The purpose of this protocol is:

- to introduce Integrated Plant Health Care (IPHC) as a management strategy that involves Plant Health Care (PHC) and Integrated Pest Management (IPM) as functional components
- to recommend best Plant Health Care (PHC) practices and strategies that can be implemented on a consistent basis across the City of Toronto to create beautiful pesticide-free parks inclusive of turf management, horticultural display management and hard surface maintenance, and
- to provide cost estimates of implementing a full Integrated Pest Management (IPM) in City parkland using Plant Health Care as the basis to provide quality service levels within the context of the City of Toronto Pesticide Bylaw.

2.0 GENERAL STRATEGIES FOR ACHIEVING PESTICIDE-FREE PARKS

2.1 Plant Health Care (PHC)

In the urban setting, it is the greenscape that makes a city not only livable but also a desirable place to locate business and to visit as a tourist. In Toronto's urban greenscape, plants provide recreational, aesthetic, environmental and economic function and benefits contributing to the quality of life.

Plant Health Care is a system that is used to establish and maintain optimum plant health. The operational components of a PHC system involve:

- Proper landscape design, site selection and plant selection for new projects including consideration of service level needs and related stresses from use, as well as urban environmental stresses on plant health
- Soil health, with emphasis upon managing the physical, chemical and biological properties of the soil to optimize soil health. Management practices include soil amendment using good quality compost, aeration, applications of organic fertilizers and liquid compost and proper watering
- Proper mowing height and frequency, overseeding and compost topdressing for turf management
- Proper planting methods utilizing plant material appropriate for the site with correct sunlight level and air circulation and the use of mulch for horticultural management
- Proper timing for all management practices

A healthy plant is less susceptible to pest related stress and is in a position to recover when these stress conditions occur. Plant Health Care is the first line of defence against pests. Using Plant Health Care to plan and manage greenscapes to prevent weeds, insects and disease from becoming pests results in significant measures of pesticide reduction initially, and pesticide

elimination when required. Instead of accepting pest attacks as inevitable, the concept of Plant Health Care recognizes that a pest problem is an indication of an underlying plant health problem and identifies the means to correct plant health problems and prevent pest problems.

For turf and horticultural applications, Plant Health Care promotes sustainability in the soil. Plant Health Care is predicated upon the principle of sustainability, that is the ability of the soil to become biologically dynamic, possess a high degree of natural fertility and thus become a self-perpetuating system of nutrient cycling in the soil and nutrient availability to the plant. Having a biologically inactive soil is the key limiting factor to soil health and achieving sustainable plant management systems. A sustainable system of Plant Health Care recognizes the importance of best practices associated with soil biological health and involving applications of organic fertilizers and both dry and liquid compost. Once sustainability is achieved, resource inputs involving materials, labour and equipment become gradually reduced overtime.

For turf management, Plant Health Care recognizes the intrinsic natural growth cycle of the cool season turfgrasses that are used for our regional groundcover. A PHC program works in concert with this natural growth cycle so that input efficiencies related to materials and labour become maximized. Inputs are timed for specific periods and avoided when they would run counter-productive to the natural growth habits of the turfgrass plant.

2.2 Integrated Pest Management (IPM)

For matters of actual pest control, Integrated Pest Management (IPM) is the industry standard decision making process that is used to reduce pest populations to acceptable levels in order to protect the valuable infrastructure comprising Toronto's greenspace resources. IPM is a process that uses all necessary techniques to control pests effectively, economically and in an environmentally sound manner to sustain healthy landscapes. The functional components of the IPM process involve:

- Planning and managing landscapes to prevent organisms from becoming pests
- Identifying potential pest problems
- Monitoring and recording populations of pests and beneficial organisms, pest damage and environmental conditions
- Using action thresholds to make treatment decisions
- Reducing pest populations to acceptable levels that may include a combination of biological, physical, cultural, mechanical, pest behavioural (e.g.: phermone traps) and chemical controls. A hierarchical approach is taken towards pest control whereby biological, physical, cultural, mechanical and behavioural controls are given priority and chemical pesticides are used on a last resort basis and only under the following conditions:
  - Least toxic to human health
  - lowest impact to non-target organisms such as pets, plants, beneficial insects, wildlife, birds and fish,
  - Used in the smallest quantities possible consistent with maintaining acceptable quality of service and program – 'spot' as opposed to 'blanket' treatments,
  - Properly timed applications for maximum effectiveness to avoid repeat treatments

  - Applied by licensed applicators with area posted conforming to Ontario Pesticide Act, Regulation 914
- Evaluating the effectiveness of treatments to inform future planning and program decisions

The principles, rational and methodologies of IPM are compatible with the "Ten Steps to a Healthy Lawn", contained in the report from the Chief Administrator Officer: Joint Report Report No. 1 of the Economic Development and Parks Committee and Works Committee :"Implementation of the City's Pesticide By-law" adopted by Council of the City of Toronto at its meeting on May 18, 19 and 20, 2004.

The City of Toronto Pesticide By-law defines infestation as "the presence of pests in numbers or under conditions which involve an immediate or potential risk of substantial loss or damage." The Bylaw provides for the application of both exempt and non-exempt conventional pesticides "to control or destroy pests which have caused infestation to property". Attachment 1: Parks and Recreation Integrated Pest Management Program and Action Thresholds contains the full data on the process used to determine if and when pesticides may be used in City parks, in compliance with the by-law. NOTE: See attached: "Integrated Pest Mamanagement and Action Thresholds".

2.3 Integrated Plant Health Care (IPHC)

Plant Health Care (PHC) is the key operational system that is used to plan and manage landscapes to prevent substantial loss or damage that can result from weeds, insects and disease. Integrated Plant Health Care (IPHC) is an active management strategy that factors in human use as well as service level needs and expectations. IPHC recognizes the unique set of demands and stresses that these place upon plant health and provides a holistic understanding of how plants grow and function in urban settings. In nature, plants are left to manage themselves, however in the urban greenscape, IPHC is a requirement. An IPHC program provides the best opportunity to achieve a balance between human needs and plant health in relation to urban environmental stresses.

IPHC provides the best approach to develop plant management programs that are environmentally sound, responsive to community needs, healthy and sustainable. IPHC is also the driving force that will ensure the successful implementation of accepted IPM decision-making strategies to create:

- beautiful, pesticide-free general parkland areas using organic fertilizers and liquid compost applications,
- ornamental and aesthetic horticultural displays where pest management is achieved in a stepped approach through the application of sound PHC practices, exempt pesticides or as a last resort, chemical pesticides within the provisions of the City of Toronto Pesticide Bylaw.
- functional and safe hard surface areas using IPM and pesticide-free weed control.

Documentation and data analysis involved in implementing an IPHC program provides the ability to forecast future management schedules so that the most optimum Plant Health Care

management strategies can be planned and implemented with equipment, labour and materials being allocated efficiently and effectively.

2.4 Landscape Design Features

A full IPM program is predicated upon sound Parks Design. Design features would encompass:

- Poured concrete (can be patterned, textured and coloured for aesthetic purposes) for hard surface areas so as to avoid cracks where weeds are prone to develop
- Appropriate plant / cultivar selection, compatible with site conditions and expected use for turf and horticulture
- Weed suppressant landscape fabric (where practical) and mulch for horticultural displays
- Rootzone soil preparation and amendment for new sports fields and horticultural displays
- Irrigation and drainage systems installation and maintenance
- other design features and strategies that provide efficiencies and ease appropriate maintenance. For example, turf between garden beds and pathways should not be grown in narrow strips that can not properly accommodate mowing equipment.

2.5 Pest Control Alternatives

Parks and Recreation is committed to the continued development of Integrated Plant Health Care (IPHC) programs, including the investigation of least toxic controls and alternatives that will achieve pesticide reduction. In addition to pesticides exempted under the by-law, these include:

- For weed control on hard surfaces, Aquacide super heated water treatment and infrared burners
- for disease suppression on golf course and lawn bowling greens, the application of liquid and dry compost
- For weed control on turf, the application of corn gluten meal (as a fertilizer or as a registered ‘herbicide’) and liquid beet extract (as a fertilizer that inhibits broad leafed weeds)
- For weed control on small scale turf areas and in horticultural beds, the use of tools that facilitate the mechanical removal of weeds (e.g.: ergonomic weed pullers and water injection devices)

Note: Pesticides such as horticultural soaps and oils, exempt under the Pesticide By-law are not considered ‘alternatives’. They are the pesticides of first resort in applying Integrated Pest Management (IPM).

3.0 PROGRAM DEVELOPMENT FOR IPHC and IPM

Toronto’s urban greenscape is made up of developed landscapes as well as natural areas. In order to create beautiful parks with healthy plants while at the same time reducing and/or eliminating non-exempt pesticide applications, full scale programs involving IPHC and IPM will need to be

developed and implemented in the functional areas of turf, horticulture, hard surface areas and natural areas.

3.1 Action Thresholds

The principles and rational for both IPHC and IPM outlined previously are consistent across all these functional areas. They are however distinct in terms of methodology. For example, while the goal of IPHC is to achieve healthy soil conditions, this is accomplished by using different methods for particular turf and horticultural applications. In terms of IPM, these functional areas have some distinctions regarding action thresholds. The use of thresholds within the IPM framework has been developed according to the "Ten Steps to a Healthy Lawn", contained in the report from the Chief Administrator Officer: Report No. 1 of the Economic Development and Parks Committee and Works Committee "Implementation of the City's Pesticide By-law" adopted by Council of the City of Toronto at its meeting on May 18, 19 and 20, 2004.

Parks and Recreation has developed action thresholds that would be functional within the provisions of the Pesticide By-law. Each group of pests (weeds, insects and diseases) were so considered. See Appendix I: Integrated Pest Management and Action Thresholds for full data on IPM and Action Thresholds.

4.0 PARKS FUNCTIONAL AREAS

4.1 Turf

Mowing is an important plant health component of turf management and should not be considered separately from Plant Health Care. Mowing practices involving proper height of cut and frequency of cut impact very positively on turf health. The converse is true, with root function becoming naturally limited when turf is cut too short or too infrequently. Grass becomes excessively long with infrequent mowings resulting in too much of the leaf blade being removed and this places the plant under stress. Heavy amounts of clippings produced from infrequent mowing cannot decompose readily into the soil and quickly brown-off compromising the aesthetics of a just maintained landscape.

Program dynamics involving turf therefore must recognize mowing as an intrinsic element of turf Plant Health Care. They are directly associated with each other and intended to work together in order to ensure the successful implementation of an IPHC program for turf management.

The operational areas involving turf are broken out into categories and sub-categories that include: General Parkland, Sports Fields, Destination Parks, Golf Courses and Bowling Greens.

4.1.1 General Parkland Turf

General parkland refers to turf in a park that is not part of a sports playing field. General parkland includes all of the neighbourhood parks of approximately 1 to 3 hectares as well as areas within the larger Destination parks that are not designated as intensively maintained.

Toronto's community places a high value and commensurate high use and demand on general parkland areas. They can be seen as an extension of the home lawn and as such have much the same function as an informal recreational surface for passive activities and social interaction. In terms of total surface area, the general parkland area makes up the largest maintained proportion of the City's parks and as such is a significant part of the developed living, green and aesthetic landscape. Because general parkland is such a dominant part of the landscape, it tends to act as a significant indicator of municipal service levels that are being provided to the community by Parks & Recreation.

Lawn Care and Mowing Frequency

As well as being a best Plant Health Care practice for turf, increasing the frequency of cut in these areas is fundamental to immediately improving park aesthetics, form and function. Increasing the frequency of mowing also results in considerable pesticide free weed control in general parkland areas.

Prolific weed growth, especially that involved with dandelions compromise the aesthetic integrity of general parkland. Frequent mowing during key weed growth periods reduces weed prominence providing parks with a more neat and cared for appearance. In addition, mowing off weed flower heads prior to their going to seed helps to reduce seed dispersal and reducing the spread of weeds. Lastly, weeds are subjected to stress when cut on a frequent basis and this allows the turf to become more competitive and denser, further crowding out weeds.

Cutting programs are designed around the natural growth cycles of the cool season turfgrasses found in the parks. Increases in the frequency of cut are required during the peak growth periods of spring (mid- April, May and June) and fall (September and October). Mowing frequency is lowered (minimum 10 working day mowing rotation) or curtailed during the dormant growth period of summer (July and August) depending upon amounts of natural precipitation.

A 'general maintenance' standard has been applied towards general parkland. General maintenance is consistent with low service levels – basically mowing the turf on a 10 working day rotation. General parkland is not fertilized and is dependent upon natural precipitation for water requirements. Given sufficient resource allocation for labour and equipment, implementation of an augmented mowing program could go a long way to reducing weeds in general parkland.

An IPHC program for general parkland provides the best opportunity to raise standards and associated service levels that are compatible with the high demands that the community places upon this important resource.

Plant Health Care

A Plant Health Care program for general parkland turf would involve the following components:

- A five (5)working day mowing rotation during the active growth period of spring and a seven (7) working day mowing rotation during the fall. During the summer, mowing would be done on an as required basis, that is when no more than 1/3 of the leaf blade is removed to achieve the desired height of cut of 7.5 cms. (3 inches)
- aeration during the fall to relieve soil compaction as well as to facilitate oxygen and water movement into the rootzone
- overseeding during the fall with drought tolerant seed cultivars (fescues) that can establish under low maintenance regimes (low fertility and no irrigation)
- Applying organic fertilizer during the fall that will provide valuable organic matter to the soil and facilitate overall soil health
- Applying liquid compost / seaweed twice during the season. This particular organic treatment is used as part of the soil health care strategy that is intended to enhance the biological properties of the soil. Its primary benefit is stress management for grasses to help them withstand stresses associated with the heat of summer. Seaweed supplements plant growth hormones that are naturally occurring in the turfgrass plant

Integrated Pest Management (IPM)

IPM for general parkland would manage instances such as insect infestation where the use of insecticides is allowed under the Toronto Pesticide By-law.

In accordance with the CAO's report: "Implementation of the City's Pesticide By-law" adopted by Council of the City of Toronto at its meeting on May 18, 19 and 20, 2004, no action thresholds have been set for the application of herbicides and fungicides on general parkland. The proliferation of weeds in general parkland has been expressed as an area of concern by the community In compliance with the Pesticide by-law, IPHC is the only strategy that can effectively address this issue and maintain weed populations at acceptable levels. It must be noted that, IPHC is a gradual process that takes about three years to produce well-defined positive results.

4.1.2 Sports Field Turf

Sportsfields are valued for the recreational opportunities that they provide for individuals and for teams. They are very much tied into the multi-cultural dimension of the City of Toronto providing a multitude of desired community sport opportunities. They attract both major sporting events at Stadiums and Premier Fields as well as local tournaments at the local, neighbourhood fields. Sportsfields generate permit revenue which is required to fund Parks & Recreation programs. Service levels are directed towards providing a safe, playable surface.

Stadiums and Premier Sports Fields

These sports' fields are kept in the best possible condition with on site-dedicated staff and equipment. They are high profile fields where user groups place a high demand on turf quality and playability. They are sites for special events and tournaments and attract people from across and outside of Toronto. The fields are lit and have automatic irrigation systems. Field closure is at the discretion of on site staff during or as a result of inclement weather. There is a set protocol should user groups request more intensive maintenance than existing turf standards. Turf renovations are done on a yearly basis. Examples would include Esther Shiner Stadium, Birchmount Stadium, Sunnybrook Park, Christie Pits, Centennial Park.

Class A Sports Fields

These are lit, regulation-sized sports' fields that are irrigated and permitted to user groups. Whereas Stadiums and Premier fields have on site staff and equipment, maintenance for Class A fields is done by "flying crews" (staff that are mobile in the field and will move from park to park). Conditions for field closure due to inclement weather are detailed on the permit. Turf renovations are done as needed based upon condition of the field. Examples would include Neilson Park, Stan Wadlow Park and Bond Park.

Parks and Recreation are currently involved in an operational plan to bring Class A sports' fields to the same service standards level as Stadiums and Premier Fields and of establishing a consistent approach to IPM.

Plant Health Care for Stadiums, Premier Sports Fields and Class A Fields

The following components are involved:

- Mowing on a 5-day cycle. Mowing will be curtailed during conditions of slow turf growth so that no more than 1/3 of the leaf blade is removed to achieve the desired height of cut. Height of cut for this classification of sports fields is sports specific:

  Soccer: 7.5 cms. (3 inches)
  Baseball: 4 cms. (1.5 inches)
  Cricket: 4 cms. (1.5 inches)

- Aeration at least twice a season, once during the spring and again during the fall
- Overseeding with sports field blends twice a season, once during spring and again during fall
- Topdressing with good quality compost twice a season, once during spring and again during fall
- Applying organic fertilizer twice a season, one application in late summer and one application mid-fall
- Applying slow release synthetic fertilizer once during spring to stimulate turf growth, turf density and colour
- Applying liquid compost / seaweed, three applications at three week intervals over the course of summer and into early fall

- Timely irrigation that would provide the proper amounts of water consistent with soil conditions while accounting for natural rainfall. Irrigation is applied in a manner that allows the water to soak deeply into the soil encouraging deep rooting
- Utilizing protective turf covers in localized areas such as goalmouths to hasten germination of grass seeds and establishment of grass plants and to protect against winter damage

Topdressing with compost is the most expensive sportfield Plant Health Care component accounting for approximately 66% of the total costs involved. To ensure benefits, it is essential that good quality, commercially sourced compost is being used that conforms to specifications for this particular application (less costly composts are not effective).

Class B Sports Fields

These fields include all other unlit, regulation sized or lit undersized sports' fields that are irrigated and permitted to user groups. They are subject to continuous and prolonged usage throughout the play season. Service levels address provision of safe, playable fields. Turf renovations are done on an as required basis and as resources permit. Examples would include Dentonia Park, Talbot Park and Earlscourt Park.

Class C Sports Fields

These fields include all undersized, unlit sports surfaces that are not irrigated and are used by groups for permitted or pick-up use. Class C fields are found in the smaller parks (1 to 2 hectares) and provide for recreational opportunities at the local or community level. Service levels are addressed to providing safe, playable fields. Turf renovations are done on an as required basis and as resources permit. Examples would include Anson Park, Viewmount Park, Lambton / Kingsway Park and Dufferin Grove Park.

Note that current turf management practices involving Plant Health Care (with the exception of irrigation practices) and decision-making involving IPM are consistent for both B and C classes of sports' field.

Plant Health Care for Class B and C Sportsfields

The following components are involved:

- 5 working day mowing rotation during the active growth periods of spring and a 7 working day mowing rotation during fall. During the summer, mowing would be done on an as required basis, that is when no more than 1/3 of the leaf blade is removed to achieve the desired height of cut of 7.5 cms. (3 inches)
- aeration during the fall to relieve soil compaction as well as to facilitate oxygen and water movement into the rootzone
- overseeding during the fall with drought tolerant seed cultivars (fescues) that can establish under low maintenance regimes (low fertility and no irrigation). For fields with irrigation, overseeding with appropriate sports field blend.

- Applying organic fertilizer during the fall that will provide valuable organic matter to the soil and facilitate overall soil health
- Applying liquid compost / seaweed twice during the season. This particular tool is used as part of the soil health care strategy that is intended to enhance the biological properties of the soil and for stress management purposes
- Topdressing with good quality compost once during the fall
- Timely irrigation practices for fields with irrigation systems
- Utilizing protective turf covers in localized areas such as goalmouths to hasten germination and establishment and to protect against winter damage

Sports fields and soccer fields in particular are prone to localized and intensive play such as around goalmouth areas. The problem is compounded when these fields are accessible to continuous play and demands are such so that they cannot be closed to allow the turf a period of recovery. Localized turf loss results from the abrasive effects of play on the turf plants and it is important to emphasize that this loss is not a function of Plant Health Care. The soil can be healthy in these localized areas, however the amount of stress that these areas are put under will simply not sustain viable turf for any length of time. Solutions for this particular problem may be found more in the area of field management such as closing off goals and establishing temporary goals and play across the width of the field for practice between games as well as field closure and the use of protective turf covers to allow the Plant Health Care practices outlined above to take hold and for turf to become established.

4.1.3 Destination Parks Turf

These parks attract citizens from across Toronto and are also tourist destination locations. They are valued for their unique qualities, aesthetics and functionality (examples include wedding photography and picnics). They are high profile locations (including Garden Parks) and as such the turf areas within the park are designated for higher maintenance. These areas and regional parks are comprised of irrigated turf and horticultural displays as well as hard surfaces. Examples of these types of parks would include G. Ross Lord, Sunnybrook, Centennial, Edwards Gardens and Toronto Music Garden.

Plant Health Care

Components for Destination Parks include:

- Mowing on a 5-day cycle. Mowing will be curtailed during conditions of slow turf growth so that no more than 1/3 of the leaf blade is removed to achieve the desired height of cut. Height of cut is set at 4 cms (1.5 inches)
- Aeration once during the fall
- Overseeding with premium quality seed blends once during fall
- Topdressing with good quality compost once during fall
- Applying organic fertilizer once during fall
- Applying slow release synthetic fertilizer once during spring to stimulate turf growth, turf density and colour

- Applying liquid compost / seaweed, three applications at three week intervals over the course of summer and into early fall
- Timely irrigation that would provide the proper amounts of water consistent with soil conditions while accounting for natural rainfall. Irrigation is applied in a manner that allows the water to soak deeply into the soil encouraging deep rooting

Topdressing with compost is the most expensive Destination Park turf Plant Health Care component accounting for approximately 60% of the total costs involved. To ensure benefits, it is essential that good quality, commercially sourced compost is being used that conforms to specifications for this particular application (less costly composts are not effective).

4.1.4 Golf Courses

Golf courses demand a high level of service. At the corporate level, the City's golf courses are valued because they generate revenue. Revenue is very much a function of the course conditions, playability and to a lesser extent, aesthetics. These are the values that a paying golfer places on the facility and that must be considered in golf course maintenance.

Plant Health Care

Parks and Recreation has well structured Plant Health Care programs in place at each of the golf courses. Turf quality is maintained through proper mowing and irrigation regimes, overseeding with the best-suited seed blends, aeration, topdressing (using compost in some areas), and fertilizing with foliar, synthetic and organic products. Parks and Recreation has initiated a very progressive liquid compost program at each of the five City of Toronto's golf courses. Liquid compost is manufactured on site by staff, supplemented with liquid organic seaweed (that contains naturally occurring plant growth hormones) and applied to greens and tees for Plant Health Care benefits.

4.1.5 Bowling Greens

Bowling greens are valued for the recreational opportunity that they provide. There is also an important social and community building element that is found at lawn bowling clubs. Maintenance practices are designed primarily to provide playable conditions.

Parks and Recreation treats bowling greens in the same manner as golf greens using the same Plant Health Care and IPM practices.

4.2 HORTICULTURAL AREAS

Horticultural displays include roses, carpet beds, ornamentals (e.g. rhododendron, azalea, magnolias) annuals, perennials, grasses, hedges and shrubs.

Significant ornamental and aesthetic value is placed upon horticultural displays in parks. In the case of displays such as roses and carpet beds, there is often a heritage value as well. Horticultural displays require specialized maintenance in order to provide their contribution to Toronto as a beautiful, livable City.

To meet this demand, there is a need to implement consistent and best practices involving Plant Health Care and Integrated Pest Management. In order to achieve and maintain beautiful horticultural displays as an integral part of the parks' infrastructure, service levels increases in the following areas must be considered:

- Horticultural displays have deteriorated over the years and require renovation and rejuvenation. Improvement is required not only at Civic Centre and Destination Park displays but also at Neighbourhood Park beds. In order to avoid future, wide scale deterioration of horticultural displays, operational funding is required towards a program of annual plant replacement.
- Ongoing horticultural management implementing Plant Health Care with particular emphasis upon the weeding of shrub beds in parks in ways that maintain a pesticide-free approach is required.

Garden Bed Renovation / Rejuvenation

A comprehensive approach that involves some aspects of Plant Health Care is recommended for the renovation and rejuvenation of shrub and perennial horticultural beds in the City's parks.

A garden bed rejuvenation plan begins with establishing optimal soil health using good quality compost as a soil amendment. Ideally, all plant material is removed and put aside or re-located. The area is then excavated to a depth of 45 cms. (18 inches). The rootzone for planting purposes should involve the existing soil (if suitable) modified with appropriate amounts of a mixture of 50% medium sand loam and 50% good quality compost by volume. An assessment is required to determine if the existing soil is suitable for modification and the precise modification formula. Another option would be to create a raised bed by simply adding compost at 50% volume and roto-till it on site into the existing soil to the depth of 45 cms. (18 inches).

While on-site modification is preferred, in some cases, the specified soil may need to be custom blended off site. For all soil modification, it is essential that any introduced soil mix be weed seed free. The new mixture must be gradiently incorporated into the existing soil at the lowest depth in order to avoid an interface between two dissimilar soil types that can limit water and nutrient flow and root development. Creating a gradient change from one type of soil to the other eliminates this problem.

Organic fertilizer is then applied and integrated to a depth of 8 cms. (3 inches) to provide a continuous supply of slow release nutrients.

Beds are appropriately edged to allow for a uniform depth of mulch cover. This is the appropriate time to consider the installation of landscape fabric for weed suppression. Landscape fabric is a material that is positioned over the amended soil and prevents the passage of light so

that weed seeds cannot germinate and any that do cannot pass through the fabric, so do not grow. Once the planting bed is established, landscape fabric also acts as a barrier to weed seed contamination. Properly installed landscape fabric allows for air, water and liquid nutrient infiltration to the soil while reducing soil erosion. Landscape fabric however can become problematic in large-scale installations having continuous public and wildlife access. The material can eventually become exposed and pulled away from the bed to a degree that would require very labour intensive reinstallation. It is for this reason that the application of landscape fabric is more properly suited to smaller scale beds.

Mulches are soil coverings of organic materials such as shredded bark, wood chips, pine needles or compost and they provide many Plant Health Care benefits. Mulches hold moisture in the soil and moderate soil temperatures. Organic materials add nutrients to the soil as they decompose and keep the soil surface from becoming compacted.

A 10 cm (4 inch) layer of mulch can effectively suppress weeds by blocking the light that the weeds require to grow and any weeds that do manage to grow through the mulch can be pulled easily because the soil is not compacted. Some mulches like shredded bark and compost block the light more effectively than other mulches such as wood chips. It is important to ensure that mulches are free of seeds from weeds and from invasive species such as Norway and Manitoba Maple.

Mulches are well suited to shrub and perennial flower beds because they can stay undisturbed for years around permanent plantings. Mulches also reduce soil erosion. For small-scale areas, all mulches work best in combination with landscape fabric mentioned earlier. The landscape fabric is spread over the planting bed and then the mulch is applied overtop.

Plant Health Care for Horticultural Areas

Once garden beds have been renovated and rejuvenated, best practices involving Plant Health Care can then be implemented. Plant Health Care provides the best means to ensure that these beds are kept in a continual state of rejuvenation and beauty.

Horticultural Plant Health Care begins with proper design principles that involve good bed location, proper planting methods that provide appropriate sunlight and air circulation and the correct choice of plants for the location. Each plant species has its own particular requirements for soil type, water and sun light. The right plant in the right spot is given the best opportunity to establish and will remain viable using best practices associated with Plant Health Care.

A plant that is struggling to survive, despite use of best practices is in the wrong location. It would be relocated to a more appropriate spot and replaced with a more suitable plant material that will be more pest resistant in that location. Using a variety of plant species is encouraged for aesthetic value and to promote biodiversity that ultimately contributes to the health and vibrancy of the bed and avoids pest problems associated with mono-cultures.

Maintenance regimes involving Plant Health Care are specific to each class of plant material. A regime for roses would be different from the regime for shrub beds in terms of best practices and timing. There are however, common elements of Plant Health Care between each class of plant material. These elements involve irrigation, soil amendment, fertilization with both dry and liquid organic fertilizers, biological stimulation of the soil using liquid compost and biostimulants (seaweed) and ongoing maintenance including pruning, deadheading, clipping, mulching and proper bed sanitation where diseased leaves and stems are removed.

Plant Health Care programs are directed towards highly maintained and generally maintained horticultural areas.

Highly Maintained Horticultural Areas

Highly maintained areas include those characterized by:

- High profile due to location and quality
- community partnerships and high public expectations
- planted with seasonal spring, summer and fall displays requiring intensive maintenance
- have dedicated horticultural crews and a dedicated gardener on site

Highly maintained horticultural areas include Destination Parks (Garden Parks, Civic Centres, Waterfront and Island Parks), streetscapes involving planters and hanging baskets and carpet beds. Examples would include Edwards Gardens, Rosetta McLain, James Gardens and Toronto Music Garden.

Plant Health Care practices for highly maintained areas include:

- An average twice weekly maintenance for designated display beds. Maintenance involves cultural practices such as deadheading, clipping, weeding, etc. that can be required at specific times of the season.
- Planning and maintaining a proper watering schedule with irrigation provided 2 times per week as required. Water is best applied during the early morning in order to reduce leaf wetness and inhibit disease. Hand watering is done on disease susceptible plants and is directed to the base of the plant and allowed to soak deeply into the rootzone.
- Organic matter added on an annual basis during the spring or fall. Good quality compost is used as a soil amendment and integrated carefully so as to not injure plant roots or simply used as a top dressing.
- Where possible, organic fertilizer added on an annual basis during the fall. This practice can be done in conjunction with soil amendment as it is more beneficial to have the organic fertilizer integrated directly into the soil as opposed to remaining on the surface
- Soil drench every 3 weeks using a liquid compost / seaweed solution. This solution can be supplemented with a liquid organic fertilizer when required in order to provide additional nutrients
- Trimming on carpet beds to a minimum of every 3 weeks
- Cultivating annual beds weekly until plant material is established and then once every three weeks thereafter as long as the soil surface is visible and accessible. Cultivating is done carefully so as to not injure rootsystems and is restricted to the top 3 cms. (1 inch) so as to

limit weed seed germination. Cultivating both removes weeds and improves in the percolation of water and air in and out of the soil.
- Mulching on an annual basis, where appropriate.
- Pruning of shrubs on a rotational basis, as appropriate to the species to provide more optimal branch distribution and improve light and air circulation through the plant. This can result in a healthier and more vigorous plant that is less prone to disease. Pruning is also done for aesthetic purposes, enhances the shape and flower display of the shrub.

Generally Maintained Horticultural Areas

Generally maintained horticultural areas would include the shrub beds in most parks, neighbourhood park horticultural displays, parkette beds and hedges as well as sign beds.

Generally Maintained areas include those characterized by:
- Moderate profile
- Moderate public expectations
- Planted for spring and summer displays only
- Maintained by "flying crews" that move between sites

Plant Health Care practices for these areas include:
- For annuals, twice weekly maintenance until establishment and then once per week thereafter as required. Perennials can require a similar level of maintenance as annuals, dependant on the nature of the planting and the degree to which Plant Health Care principles have been implemented in display design and implementation. Maintenance for perennial display beds involves different activities and timing, but can be as time consuming as for annual beds.
- Planning and maintaining a proper watering schedule with irrigation provided up to 4 times per week as required. (for example, hanging baskets require frequent watering, but established annual beds, in a good organic soil, require at most, twice per week irrigation). Water is ideally applied during the morning in order to inhibit conditions that lead to disease. Water is directed to the base of the plant and allowed to soak deeply into the rootzone.
- Organic matter is added on a bi-annual basis during fall using good quality compost as a soil amendment
- Organic fertilizer is applied on a bi-annual basis during the fall
- Soil drench every 3 weeks using a liquid compost / seaweed solution. This solution can be supplemented with a liquid organic fertilizer when required in order to provide additional nutrients
- Hedges are trimmed a minimum once per year
- Cultivating annual beds weekly until plant material is established and then once every three weeks thereafter until the soil is no longer visible. Cultivating is done carefully so as to not injure root systems and is restricted to the top 3 cms. (1 inch) so as to limit weed seed germination.
- Mulch replenished on a bi-annual basis
- Pruning of shrubs is done on a less frequent cycle than for highly maintained areas.

Reduction of pesticide application in horticultural areas can be achieved in harmony with improved plant management programs involving Plant Health Care. This is especially important when the goal is implementing a pesticide-free approach to horticultural maintenance.

Weeds compete with desirable plant material for nutrients and moisture in the soil. Above the surface, weeds block sunlight and impede air circulation. These conditions are all limiting factors that compromise overall plant health. From a public perception point of view and as an indicator of service levels being provided, weeds significantly reduce the aesthetic value of garden beds. This situation is especially evident with shrub beds.

4.3 HARD SURFACES

Hard surfaces have important functional value to the user. They are a basic infrastructure component in parks and service is directed to maintain the utility and safety related to their use. Pest control is directed primarily towards eliminated trip hazards, and to a lesser extent, the aesthetic value of each particular hard surface. While pathways are the primary address for the control of trip hazard weeds, other hard surfaces include: under bleachers and fence lines, around tennis courts, benches, curb stones and buildings such as washrooms and along backstops and dugouts on baseball fields.

Plant Health Care

Plant Health Care does not pertain to hard surfaces. A significant part of hard surface maintenance however, involves weed control and therefore using proper IPM methodology.

4.4 NATURAL AREAS

Toronto's natural heritage areas are valued for the many benefits they provide to the urban setting:

- enhanced air and water quality
- provide unique opportunities to interact with the environment
- provide a habitat for wildlife
- provide an aesthetic and sound sanctuary from the rest of the City of Toronto –
- provide continuity for the river, creek and ravine systems that comprise the urban ecological infrastructure

Plant management strategies involving natural areas are implemented to maintain healthy ecosystems and native biodiversity. Invasive plants threaten the ecological integrity and biodiversity of natural areas. To date, the only effective means of controlling these plants has been the careful use of pesticides. Experience has demonstrated that when pesticides are used to control invasives, they do so successfully and with a corresponding reduction in the need to use pesticides in later years.

Plant Health Care for Natural Areas

Ecological principles (from which Plant Health Care was derived) are utilized in the management of natural areas.

5.0 IPHC COSTING ELEMENTS

Resource allocation is a limiting factor in the implementation of Integrated Plant Health Care and Integrated Pest Management. To meet community service level expectations within the context of the Pesticide By-law which limits the use of pesticides, a best practices Plant Health Care and Integrated Pest Management program should be implemented for park land.

Such an Integrated Plant Health Care Program should include:

- Program development
- Staff training
- Implementation support
- Program evaluation support
- Toronto Pesticide by-law compliance
- Operational Program elements as outlined earlier in this protocol

5.1 Program Development

IPHC standards have been developed to provide a consistent protocol and service level across the City of Toronto for each functional area of parks management. Implementation of standards can be limited by resource availability and more specifically, labour, equipment and material inputs. Integrated Plant Health Care is a strategy that can be applied to site-specific conditions so that programs can be customized for each park. Program Development elements include:

- Creating Plant Health Care and Integrated Pest Management checklists that will assist staff in implementing and documenting PHC practices at each site as well as the IPM process used in matters of pest control
- Assembling background site information
- Conducting site assessment – physical characteristics (soil conditions using soil tests, micro-climates), plant inventory and use patterns
- Site assessment and analysis
- Drafting site specific programs
- Revising programs based upon results and experience, determining the best management practices for each applicable site

5.2 Training

From a technical point of view, IPM and IPHC are dynamic and complex, requiring the exercise of judgement based upon a sound knowledge of principles applied to site specific conditions, rather than a formulaic, cookie cutter approach. Therefore, their full-scale implementation in the field requires specialized, on-going training with time specifically allotted for training. It is recommended that training be conducted in the following fashion:

- Classroom orientation where staff are brought to a general and consistent understanding of the principles, rational and methodology of IPM and IPHC. This would be facilitated with resource materials currently available in the form of books and publications.
- Practical on the job training so that existing principles and techniques are applied and reinforced under field conditions. This would be facilitated with formal IPHC and IPM checklists that can be used for each site and function
- Ongoing training and support so that staff can refine their understanding and skills so as to develop judgement in site specific applications of IPM and IPHC and also to stay abreast of new principles and techniques. Such training should be supported by a functionally –based networking system that provides Parks staff the ability to exchange information.
- External education opportunities such as conferences, workshops and industry standards compliance (IPM Accreditation Program) would also form part of the training component of the program.
- Each Park Supervisor should undertake the Ontario Parks Association recommended Municipal IPM Accreditation Program and each golf course supervisor undertakes the Golf Course IPM Accreditation Program.

Full program development would require five (5) full time IPHC Technicians (one per District and one specific to Golf Course and Other Speciality areas) to develop, implement and support a full IPHC program including an in-house training component. The technicians would provide direct technical support to parks operational staff including ongoing program evaluation and conducting research and pilot projects that would generate recommendations to improve the program.

IPHC Technicians would also be responsible for assisting in meeting IPM Program requirements and Pesticide by-law compliance such as pest monitoring and related IPM documentation.

5.3 Implementation

Implementing the Plant Health Care component of the IPHC model would require costs be allocated for materials, equipment and labour. It must be noted that a PHC implementation program is front-end loaded. That is, the recommended material inputs are required on an annual basis for the first 3 years and in subsequent years material inputs and related labour and requirements progressively diminish to the point where only periodic supplementation is needed to maintain a sustainable PHC management system. It is anticipated that costs involved in program implementation can be reduced by 30% after 3 years and 50% after 5 years.

Implementing the Integrated Pest Management component would require costs be allocated for materials, equipment and labour to be used specifically for pest control as well as for the time required for record-keeping involving monitoring and the utilization of the IPM checklist.

New equipment is required to implement and deliver the IPHC program. This includes both basic and specialized equipment for turf management such as topdressers, overseeders and liquid compost makers as well as tools such as thermal infrared and manual units for weed control in horticultural and hard surface applications.

5.4 Evaluation

Ongoing evaluation using accurate records is essential to the success of an IPHC program. It is important to determine both successes and failures, to build on what worked and identify ways to change site designs and management practices so as to improve the program and prevent future problems. IPHC is a dynamic concept that with proper evaluation can readily be changed to accommodate new sets of legislative demands and conditions involving pesticide application restrictions. Evaluation also helps to assess the costs versus benefits of the program.

City of Toronto Parks & Recreation

USE OF CORN GLUTEN MEAL FOR WEED CONTROL IN PARKS

Background

Corn gluten meal is a by-product obtained from corn milling. Interest in corn gluten meal was triggered by research conducted at Iowa State University in 1995 that indicated this material had potential to function as a preemergent herbicide for certain broadleaf and grassy weeds. Corn gluten meal is considered to be “organic” and as such would be a significant alternative to traditional chemical herbicides. With a nutrient analysis of 10% (Nitrogen), 0% (Phosphorous), 0% (Potassium), corn gluten is also a source of nitrogen which stimulates leaf growth and colour. When considering applying corn meal gluten for weed control in parks, current research as well as recent Parks & Recreation experience should be taken into account.

Iowa State University Research

- Weed Reduction (86% for crabgrass, 90% for clover and dandelion) was noticed in turf trials at Iowa State University after four years using relatively heavy rates of application of 18 kg and more per 90 m^2 (40^+ lb/1000 ft^2). The research from Iowa indicates that “rather large application rates are needed to practically suppress resistant weeds.”
- Mode of action was found to be strictly on a preemergent basis so that applications of corn gluten meal must be properly timed at three to five weeks prior to weed seed germination to be effective. Weed control was found to be less effective if the material was applied too early in the season.

- Corn gluten meal controls weeds by inhibiting the initial root development when seeds germinate.
- Corn gluten meal is most effective in controlling grass plants and also inhibits the growth of desirable grass species, especially creeping bentgrass but also including park and sports field varieties.
- Weed control was found to be most effective under dry conditions. Under wet conditions, weeds that are initially prevented from forming a root can grow out of the problem and control is reduced. It is recommended that when weed seeds have germinated, a short drying period is required for plants without a root to die before irrigation is continued. Rainfall can also disrupt the efficacy of CGM.

Guelph Turfgrass Institute (GTI) Research

The Guelph Turfgrass Institute is an accredited and independent research facility that specializes in areas of turf management The GTI conducted field trials over two years (2000, and 2001) at their test location near Guelph, Ontario, to determine the efficacy of corn gluten meal on reduction of crabgrass and broadleaf weed infestation in turf. The results of the field trials were published in the Annual Research Reports for 2001 and 2002.

The key results of the field trials are:

- Two years of treatments using corn gluten meal blend (8-2-4) at a 9 kg per 90 m^2 (20 lb/1000 ft^2) and 18 kg per 90 m^2 (40 lb/1000 ft^2) did not provide significant control of dandelion, plantain, chickweed, birdsfoot trefoil or clover.
- Corn gluten meal particularly at the higher rate of application (18 kg/90 m^2) provided significant control of crabgrass during both years of the field trials.
- Improvement in turf density was noted using the high rate (18 kg/90 m^2) of corn meal gluten application. The Annual Report of 2002 notes, "The double rate CGM (Corn Gluten Meal) treatment was always best for all turf functional features, which is not surprising given that it involves a double rate of fertility."
- Any general reductions in weed presence, other than crabgrass were associated with the improved turf quality resulting from the fertility aspect of the corn gluten meal at this rate of application (18 kg/90 m^2).

Pilot Project, City of Toronto, Parks and Recreation Department

Parks and Recreation initiated a pilot project in the spring of 2003 to assess whether the application of corn gluten meal provided any significant degree of weed control beyond that provided by the application of best Plant Health Care practices for turf management. The pilot project was scheduled to run over 2 years and was completed in November, 2004.

Corn gluten meal was applied at the rate of 9 kg per 90 m^2 (20 lb/1000 ft^2). No significant difference in weed coverage was found between areas treated with the corn gluten meal and

untreated areas. An increase in turf density was observed in the area treated with corn gluten meal. Improvements in turf density were more apparent in both treated and untreated areas during the second year following the application of best Plant Health Care practices:

- aeration and fertility inputs in 2002; and
- aeration, fertility inputs and overseeding in 2003.

With increased turf density to both treated and untreated areas during 2003, there was no significant difference between the two in terms of either turf quality or weed control.

Conclusions

- Results from the Parks & Recreation IPHC pilot project to date correlate with the research conducted at the GTI and indicates that the efficacy of corn gluten meal for broadleaf weed control in parks is limited.
- The value of corn meal gluten as a preemergent weed suppressant in parks is limited as its main value is in controlling undesirable grass species. Control of crabgrass in parks is not an issue, but rather the control of dandelions and to a lesser extent, plantains is the primary concern.

- Weed reduction at both Iowa State and the GTI trials has been associated with the fertility aspect involved from the organic nitrogen provided by the corn gluten meal. Nitrogen derived from corn gluten meal and applied over a length of time at the rates used in the Iowa and GTI research would give the turf a competitive edge over weeds and this would be effective at reducing weed populations overtime.
- Rates of application and associated expense are high when corn meal gluten is utilized as an organic fertilizer, as compared to other organic fertilizers. For Plant Health Care purposes, Parks and Recreation is currently using a 6 kg per 90 m^2 (13 lbs/1000 ft^2) rate of organic fertilizer per application, as compared to the 18 kg per 90 m^2 (20 lbs/ 1000 ft^2) rate used in GTI trials for CGM.
- Moreover, corn gluten meal is limited as a fertilizer because it does not contain any phosphorous and potassium but is only a source of nitrogen. Manufacturers supplement corn gluten meal with other ingredients in order to provide the missing elements but this increases the cost of the product.
- Improvements in turf quality found at the GTI with high rates of corn gluten meal application can be achieved with other organic fertilizers having a balanced nutrient content and at considerably less cost.
- Data from Iowa State indicates that weed reduction with corn gluten meal is more effective during drought conditions. To act as a preemergent, corn gluten meal would need to be applied during April. In Toronto, this is a traditionally wet period and so this could limit the effectiveness of CGM. CGM would not be suitable for high profile areas in Destination Parks and at sportsfields that require active irrigation to maintain service levels.
- Overseeding, which is a best practice in Plant Health Care programs, would not be possible when using corn gluten, which is effective at suppressing grass seed germination.

Recommendations

Parks & Recreation's IPHC pilot project demonstrates that a Plant Health Care strategy can maintain weed populations at acceptable levels while reducing the need for exempt and/or non-exempt pesticide applications within the context of the City of Toronto Pesticide By-law.

Emphasis should continue to be given to the implementation of a full scale Integrated Plant Health Care (IPHC) program in City of Toronto's parks through the delivery of best Plant Health Care practices that will provide a competitive advantage for turf over weeds. Best practices include aeration and applications of organic fertilizers and compost (dry and liquid) to improve soil health as well as overseeding to increase turf density.

Parks & Recreation will continue monitoring corn gluten meal research, as well as conducting its own ongoing field test to determine the longer term results of utilizing corn gluten meal. Until such time as corn gluten meal has demonstrated significant benefits in controlling weeds over less expensive organic fertilizers, Parks & Recreation will limit its application to the current test project.

City of Toronto Parks & Recreation

BEST PARKS MAINTENANCE PRACTICES IN OTHER MUNICIPALITIES

Many municipalities, like the City of Toronto, have recognized the need to meet service level expectations of the community within the context of pesticide reduction and have responded to this challenge through the implementation of specialized programs involving best practices: Plant Health Care and Integrated Pest Management.

The parks management practices of Waterloo, Halifax and Burlington were reviewed with special attention to their documented operational procedures in achieving beautiful and healthy developed urban greenscapes within the operating context of pesticide reduction. No documented information was available from the City of Montreal.

City of Waterloo, Ontario

The City of Waterloo's Plant Health Care Program (PHCP) was made operational in 1991. The program is an active component of the City of Waterloo's "Environment First" policy that provides the direction for the development and implementation of environmentally responsible practices and the elimination of waste.

The Plant Health Care Program is designed to work with nature. By consistently employing a particular organic set of turf and horticultural practices, healthy growth is encouraged while

having the least possible environmental impact. The naturally beneficial qualities of plants are maximized with a healthy plant becoming its own best defence against pest attack.

The program has provided both tangible and intangible benefits. It has allowed the Waterloo Parks Services Group to effectively target resources, eliminate waste, and organize personnel to improve productivity, and achieve a high level of quality without depending on pesticides. In addition enhanced staff motivation and morale was achieved through employee empowerment.

The program has the following components:

- Monitoring/scheduling
- Mowing
- Fertilizing
- Aerating
- Topdressing
- Overseeding
- Irrigating
- Dethatching
- Alternatives to chemical pesticides
- Education / training

To make the program work, the Parks Services Group recognized the human resource dimensions of program implementation as key. The success of the program has been predicated upon the redefinition of the term "work" and the involvement and commitment of the entire Parks Services Group. While before parks maintenance was tedious, repetitive and routine, the Plant Health Care Program has provided the opportunity for bottom up input, impact and change. Through the education / training component, the staff have been made aware of the importance of their responsibility and their collective contribution to the overall success of the program and the achievement of environmental objectives using best practices. The structure of the Plant Health Care Program has actually put staff in a key position in the organization.

The City of Waterloo reports that in 1979, 73.5% of the City's total greenspace was sprayed with pesticides. In 1993, when blanket spraying had been eliminated for nearly a decade and after the implementation of PHCP in 1991, 0.5% of the City's total greenspace was sprayed and this was reduced further to 0.01% in 1997. Pesticide applications are limited to spot applications to control poison ivy near walking paths.

Currently, the Waterloo Plant Health Care Program continues to operate successfully with regular staff training and ongoing refinements that ensure continued and future success.

City of Halifax, Nova Scotia

The Halifax Regional Municipality (HRM) has a "Sustainable Community" mandate that promotes the most efficient use of resources, generates the least amount of waste, employs sustainable practices and provides quality service to its residents. This includes the maintenance of parks, athletic fields, open spaces and natural areas.

The Environmental Management services section of HRM has developed a "Sustainable Landscape Maintenance Handbook" and related protocols to serve as guidelines to ensure that programs and services are implemented in a sustainable and cost-effective manner that meets the expectations of the community. Residents expect a desirable landscape design and sustainable maintenance program.

For HRM, Plant Health Care is integral to the concept of sustainable landscape maintenance and a way to achieve the proper management of time, money and natural assets. The following four principles are applied to develop sustainable landscape programs:

· Knowing the particular site
· Improving soil health
· Valuing diversity
· Saving energy

Strategies used to develop and initiate best practices involving Plant Health Care are based upon the following four key elements:

- Design - safe, functional, maintainable, environmentally sound, cost-effective, visually appealing
- Plant material selection - use, type, location, height/size, hardiness, soil needs, maintenance, pest problem characteristics, seasonal interest
- Implementation - functional, maintainable, environmentally sound, cost-effective, planting, soils, amendments, hard goods, features
- Maintenance - functional, safe, clean facilities, environmentally sound, cost-effective, attractive

HRM has developed a "Sustainable Landscape Maintenance Protocol" specific to turf management for sportsfields. This protocol provides support and direction for compost to be used as a topdressing and soil amendment on playing fields. It recognizes compost topdressing as a fundamental and best Plant Health Care practice that is consistent with the strategy to achieve and provide sustainable landscapes. The protocol cites the following benefits associated with compost topdressing:

· Improves turf health, facilitates resistance to disease, produces a competitive advantage for turf over weeds
· Prolongs the life of the field and reduce the need for costly renovations
· Improves playing surface for field users
· Reduces need for other inputs (sound environmental and fiscal approach)

HRM has an active review process whereby as sustainable maintenance protocols are developed they will be added to the "Sustainable Landscape Maintenance Handbook". The protocols are updated as soon as new best practices, information or materials are available. The protocols are reviewed on an annual basis to ensure that they reflect best practices and are being successfully implemented within HRM.

City of Burlington, Ontario

The City of Burlington's "Healthy Green Spaces Strategy for Public Lands" program is an operating strategy involving best practices in order to manage greenspaces. The objective of the strategy is to develop ways to ensure that the ecological health of active parkland and natural areas is protected, restored and enhanced. As well, the City is proposing to develop a naturalization program, which would involve identifying appropriate areas for planting different varieties of native species.

The City of Burlington is committed to reducing the use of pesticides on the public green spaces that it maintains. In 2002, Burlington City Council approved a report that recommended the elimination of pesticide applications on municipally owned properties as of 2003 with the following exceptions:

- Limited use of fungicides at the lawn bowling green and the limited use of pesticides at Tyandaga Golf Course. At both locations, the focus is on best Plant Health Care practices to maintain necessary service levels and periodic applications of pesticides when problems arise.
- Limited use of pesticides at Greenwood Cemetery for specific pest control applications.
- General use of herbicide (glyphosate) on poison ivy not accessible to the Aquacide (super-heated water) unit. Aquacide is recognized as an alternative to chemical herbicide applications, however it is not without limitations in terms of the time required and repeat applications necessary for effective treatment.

To respond to the action of eliminating pesticides in all other public areas, Burlington has adopted a "Turf Management Program" informed by a "Turf Maintenance Manual" which has effectively integrated individual Plant Health Care practices into an overall program and ensured that they are done on a site specific and timely basis.

Burlington's goal is produce healthy turf in sports fields and passive turf areas that can resist both weed and insect infestation while eliminating the use of pesticides where possible. They makes the statement that Plant Health Care is a gradual process whereby noticeable improvements in turf quality would be anticipated over a two to three year period following program implementation.

The "Turf Maintenance Manual" includes a complete inventory of City-owned turf. Greenspaces are divided into separate categories (or "turf types") depending on use, profile in the community, proximity to the lake and other criteria. These "turf types" include:

- Active, irrigated
- Active, non-irrigated
- Lakefront Parks
- Passive Parks
- High profile Boulevards
- Other Boulevards
- Hedgerows
- Urban / Rural Roads

Detailed schedules of Best Plant Health Care practices have been developed which are both "turf type" and "site" specific. Best practices include:

- Aeration
- Fertilization
- Mowing
- Overseeding
- Sodding
- Irrigation

Regular monitoring and record keeping are seen as essential to the success of the program.

Commentary

Toronto Parks and Recreation endorses the best practices that are currently being implemented by the Cities of Waterloo, Halifax and Burlington. It is not by coincidence that Plant Health Care is the common management element between the municipalities. Like Toronto, the other municipalities have recognized that an active Plant Health Care management program is required to deliver the quality of greenspace expected in the urban environment.

Toronto Parks & Recreation Integrated Plant Health Care (IPHC) program is progressive relative to the other municipalities. IPHC takes into consideration human needs and the stresses of the urban environment on the developed and natural green landscape. For example, the relationship between plant health and human wellness is recognized and factored in. IPHC incorporates the best practices of Plant Health Care (PHC) as well as the practical application of Integrated Pest Management (IPM) for monitoring and responding to the effects of pests.

Though not appearing in their literature, it is assumed that the other three municipalities do employ IPM decision making in conjunction with best practices involving Plant Health Care. The City of Waterloo has emphasized the working dynamics between staff and their operational Plant Health Care program, emphasizing ongoing education and training. It is recommended that

the City of Toronto pay particular attention to the human resource part of the model which has been developed in the City of Waterloo.

Like Halifax, Toronto Parks and Recreation has a very active compost topdressing program for select sports fields, and as resources permit are expanding the program across all Districts in the City. The Parks & Recreation IPHC Section actively monitors the compost program. Data collected confirms consistent performance benefits accrue when compost is used as a best Plant Health Care practice - especially when done in conjunction with aeration and overseeding.

Little documented data exists on horticultural area Plant Health Care best practices. The Toronto Parks and Recreation Plant Health Care Protocol includes best practices for horticultural areas, and pilot programs are scheduled for 2005.

Conclusions and Recommendations

- Toronto Parks & Recreation should emphasize staff training and empowerment, like Waterloo, to ensure that Plant Health Care is utilized from the bottom up.
- Toronto Parks & Recreation should continue to develop and implement Plant Health Care best practices, in particular the use of high quality compost and other organics that improve soil health and bioactivity.
- Special emphasis should be given to implementing Plant Health care in horticultural areas. Most of the attention has been given to turf and sports fields in Toronto and other municipalities.
- Toronto should continue to employ Integrated Plant Health Care, incorporating the needs of the community and taking into account unique urban stresses (including human use) along with Plant Health care principles in designing its greenspaces and maintenance programs.

Attachment 1