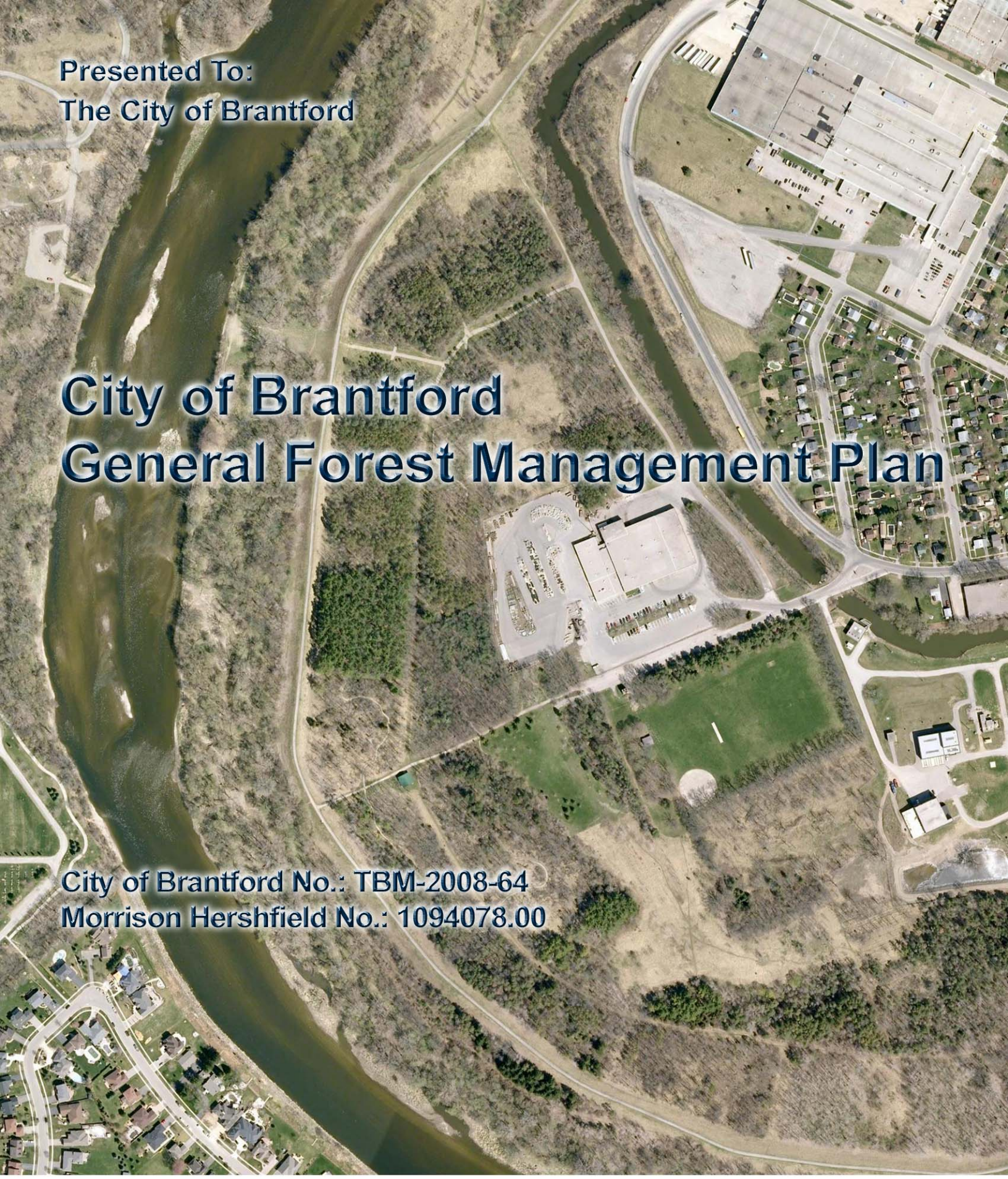
Presented To:
The City of Brantford

City of Brantford
General Forest Management Plan

City of Brantford No.: TBM-2008-64
Morrison Hershfield No.: 1094078.00



THE CORPORATION OF THE CITY OF BRANTFORD

November, 2010

MORRISON HERSHFIELD

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

Urban forests have enormous importance for urbanized areas. They provide diverse and numerous environmental, psychological, aesthetic, and economic benefits for citizens.

City woodlands introduce natural elements and wildlife habitats into the urban environment, mitigate air and noise pollution, improve soil and water quality, provide climate control, reduce storm water runoff, and prevent erosion.

The existing forests in cities are the result of historical human activity and natural events and they play a key role in improving public health, recreational activity, education, community sustainability, and significantly increase property values and enhance the community's beauty. City forests are very important components of a pleasant, spiritual and healthy urban environment.

The City of Brantford Parks and Recreation Department has developed the General Forest Management Plan (GFMP) including a specific module for Waterworks Park. The purpose of the General Forest Management Plan is to provide a document that will help to improve the City's and public's vision of future urban forest management. This will include sustainable use of urban woodlots, the planning of necessary activities and stakeholder partnerships, increase urban forest benefits for the community, and develop tools for adaptive, effective and sustainable management of City woodlots.

GFMP is significantly based on the research and analysis conducted for Waterworks Park (see Waterworks Park Module), as Waterworks Park is an excellent representative of a large urban woodlot. Recommendations developed for Waterworks Park can be used for other City woodlots and parks with consideration for their specific characteristics.

1.1 BENEFITS OF URBAN FORESTS

Urban forest and city trees provide a large number of important interrelated benefits for communities including: environmental; social and phychological; recreational and educational; and economical.

1.1.1 Environmental

Woodlots help to significantly ***reduce soil erosion***, especially for slopes and riparian areas, and promote proximate ***healthy aquatic communities***.

Forests help to increase ***water quality***, serving as storm water regulators and water stores, and pollutant and sediment absorbers. It is a highly important function for urban territories, where spacious paved areas dramatically increase rain run-off.

Urban forests are a ***unique habitat*** in modern cities for all groups of animals and play a major role in ***biodiversity conservation*** in local and regional contexts.

Trees reduce ***air pollution***, ***produce oxygen***, and have an important function in ***carbon dioxide balance***.

Trees often are used as a part of **sound control** mitigation measures as noise barriers. Forests offer visitors beautiful natural sounds: bird singing, leaves rustling, and a quietness that is so rare for cities.

1.1.2 Social and Psychological

Trees, parks and forest ***make our cities more vibrant, more alive, more appreciated and more valuable for residents and visitors***, increase ***community pride*** and "a sense of place".

Trees and forests create ***aesthetic values*** for an urban environment making it more attractive, spectacular and diverse during different seasons. It is impossible to create a ***good-looking and healthy urban environment*** without trees.

Park and woodlot maintenance, and recreational activities can provide employment opportunities.

Citizens of highly urbanized areas experience high level "city-life" stress and need ***positive sensations and experiences*** to help counteract it. Parks and forests are one of the most important and affordable sources for ***life enjoyment*** and provide adults and children with great experiences and connections with nature. Natural beauty helps increase our quality of life.

1.1.3 Recreational and Educational

City woodlots provide great opportunities for ***recreation*** often located within a short walking distance from residential areas. These include activities such as skiing, walking, jogging, bird and wildlife watching, cycling, picnicing, fishing, dog walking, and various sporting activities.

City forests are a fantastic natural science laboratory providing opportunities for **outdoor educational activities** for students of all ages. They also can provide a sense of place and distinctness when the species are indigenous to the area, reminding people of the ecoregion in which they live.

1.1.4 Economical

Woodlots play an important role in ***temperature control*** and consequently in ***efficient energy use*** providing cooling in summer and reducing wind speed and heat loss in winter.

Parks and forests play a very important role in ***increasing residential property values*** and therefore increasing ***budget revenue***. Properties located near parks or woodlots generally have much higher selling or renting price. Woodlots help to make adjacent

areas more attractive for some ***businesses*** (e.g. tourism, recreational) and serve as a stage for numerous community events.

The recreational, sports, and restorative potential of an urban forest is an important part of measures to ***protect the health*** of local residents and to reduce the burden on ***the public health service***.

As noted above, forested lands are effective natural, self-repairing (and in such a manner, inexpensive) ***storm water management*** systems.

1.2 SPECIFIC CHARACTER OF URBAN FORESTS MANAGEMENT

Traditional forestry management is primarily a tool for effective timber production. City forest ecosystems should be managed to maximize sustainable long-term use of specific benefits that parks provide for communities.

A challenge for urban forest management is the intensive adverse human impact on ecosystems: pollution, recreational activities, woodlot fragmentation, soil degradation, vandalism, etc.

In fact, city parks and woodlots are small and often isolated, highly urbanized, and specific natural protected areas (PA). Therefore management planning must take into account a number of additional factors such as recreational and educational uses, ecological benefits, public safety, green linkages, and wildlife. The use of a modernized holistic proactive and adaptive PA management approach can provide an integrated approach to managing these complex factors.

2.0 POLICY AND PLANNING CONTEXT

City of Brantford municipal planning is administrated under Provincial legislation such as the Provincial Planning Act, the Provincial Policy Statement, and the Municipal Act. These documents contain policies and legislative tools supporting protection and sustainable use of natural heritage and resources.

The Provincial Policy Statement (Section 2.1 Natural Heritage) states that "natural features and areas shall be protected for the long term. The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and ground water features." The Municipal Act contains a number of sections regulating municipal authority regarding trees and woodlands.

2.1 THE CITY OF BRANTFORD OFFICIAL PLAN

The City of Brantford Official Plan (Official Plan) is a planning document containing a statement of goals, objectives and policies for city land use, development and growth, and the basis for the zoning bylaw.

The Official Plan contains a number of statements and planning tools regarding natural heritage and environmental protection and use. For example, Section 6.2.4 states that one of the goals of the Official Plan is to sustain and enhance significant natural environment in the community. Section 8: *Natural Heritage*, Section 10: *Community Health and Safety*, and Section 15: *Parks and Open Space* establish detailed policies intended to protect and ensure sustainable use of natural heritage recourses and adequate land use of these areas.

The Official Plan also describes the various land use designations within the City of Brantford. In some circumstances, land use and related policies are overalapping and complementary, such as Floodway Policy Area, Major Open Space, and Environmental Control Policy Areas.

According to Schedule 1: *Land Use Plan* of the Official Plan (Figure 1), Waterworks Park and a number of other woodlots[1] are designated as a **Major Open Space** land use area in which "the predominant use of the land shall be for active and passive recreation, leisure and conservation uses."

The main permitted uses for Major Open Space land use designation include Community Parks and Open Spaces, Specialized Parks and Open Spaces, private parks, golf courses, conservation areas, etc. with some permitted secondary uses such as accessory buildings and structures, and limited commercial uses.

[1] *See Section 5.0 City Woodlots/Natural Heritage Framework.*

Specialized Parks and Open Spaces designation can preserve (among other things) environmentally unique or sensitive natural areas and large open spaces within an urban area.

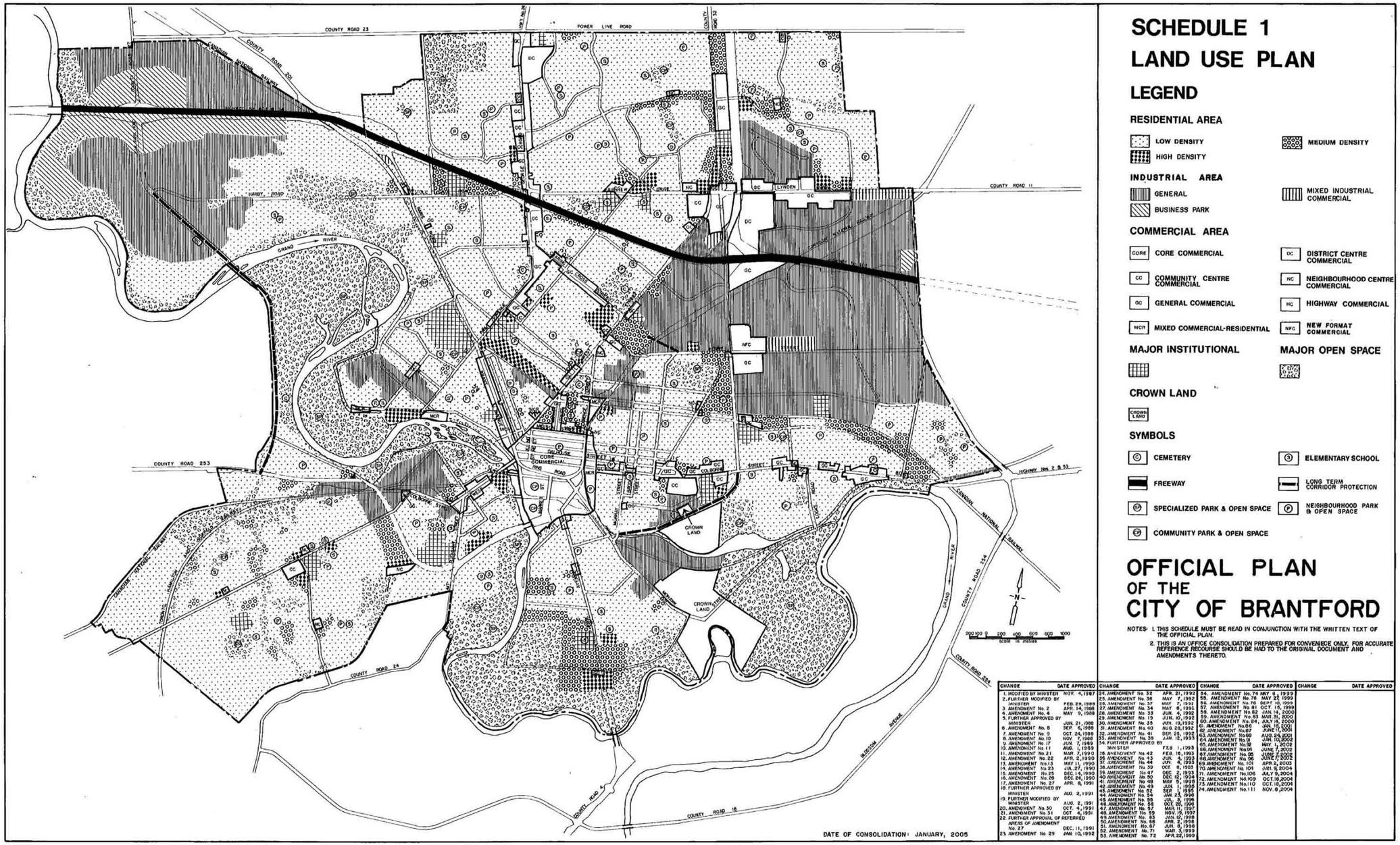
The OP's Section 8: *Natural Heritage* establishes policies intended to help protect and enhance natural heritage resources. According to the Schedule 3-1: *Natural Heritage: Environmental Areas* (Figure 2), Waterworks Park and most private woodlots are located in **Environmental Control Policy Areas** containing sensitive environmental features, and the Official Plan policies are intended to conserve their natural conditions and functions. It is stated that development in these areas will be carefully controlled to protect significant natural features, and an Impact Assessment shall demonstrate that there will be no negative environmental impact.

In addition, the planning process shall guarantee that fully-informed decisions are taken and "it will be necessary for the Municipality to form partnerships in the community to assist in ensuring the resources are used and managed in the interests of all concerns". According to Section 7.6.5 of the Official Plan, the City "will cooperate with all agencies and groups concerned with or involved in the acquisition, planning, development and activity programming of lands designated Major Open Space".

Some woodlots are located in the **Environmental Protection Policy Area** (Figure 2). According to the Official Plan (Section 8.2) "Environmental Protection Policy Areas have the highest level of intended protection and shall include the significant portions of the habitat of endangered and threatened species, provincially significant prairies, provincially significant savannahs, provincially significant wetlands, ravines with watercourses, significant forested areas, the Regulatory Flood Plain of the Grand River, a vegetative buffer zone along its course and areas of significant groundwater discharge. Environmental Protection Policy Areas are intended to protect and maintain natural conditions and functions and to prohibit development which may cause environmental degradation. The predominant use of Environmental Protection Policy Areas shall be for passive recreation, hiking trails, nature study and conservation uses".

The Official Plan (Section 8.2.5) establishes standards for the vegetative buffer zone for the Grand River, delineated as an Environmental Protection Policy Area, and for steep slopes.

According to the OP's Schedule 4-1: Community Health and Safety: Floodplain (Figure 3), woodlots located nearby the Grand River lie in **Special Policy Area 1** which consists of lands protected by dikes that have a reasonable level of protection from flooding, although some risk of flooding is assumed. Woodlots adjacent to the Grand River can be located in the **Floodway Policy Area** which "consists of all lands within the floodplain of the Grand River, as it passes through the City, that are not protected by dykes. These lands are expected to flood at various times". Development in this area has specific limitations and is subject to the Site Plan Control. Some minimal scale open space structures are permitted to support public recreation.



CHANGE	DATE APPROVED
1. MODIFIED BY MINISTER	NOV. 4,1987
2. FURTHER MODIFIED BY MINISTER	FEB. 29,1988
3. AMENDMENT No. 2	APR. 14,1988
4. AMENDMENT No. 4	MAY 9,1988
5. FURTHER APPROVED BY MINISTER	JUN. 21,1988
6. AMENDMENT No. 8	SEP. 6,1988
7. AMENDMENT No. 9	OCT. 24,1988
8. AMENDMENT No. 10	NOV. 7,1988
9. AMENDMENT No. 17	JUN. 7,1989
10. AMENDMENT No. 11	AUG. 1,1989
11. AMENDMENT No. 21	MAR. 7,1990
12. AMENDMENT No. 22	APR. 2,1990
13. AMENDMENT No. 13	MAY 11,1990
14. AMENDMENT No. 23	JUL. 27,1990
15. AMENDMENT No. 25	DEC. 14,1990
16. AMENDMENT No. 28	DEC. 24,1990
17. AMENDMENT No. 27	APR. 8,1991
18. FURTHER APPROVED BY MINISTER	AUG. 2,1991
19. FURTHER MODIFIED BY MINISTER	AUG. 2,1991
20. AMENDMENT No. 30	OCT. 4,1991
21. AMENDMENT No. 31	OCT. 4,1991
22. FURTHER APPROVAL OF REFERRED AREAS OF AMENDMENT No. 27	DEC. 11,1991
23. AMENDMENT No. 29	JAN. 10,1992
24. AMENDMENT No. 32	APR. 21,1992
25. AMENDMENT No. 36	MAY 7,1992
26. AMENDMENT No. 37	MAY 7,1992
27. AMENDMENT No. 34	MAY 8,1992
28. AMENDMENT No. 33	JUN. 4,1992
29. AMENDMENT No. 15	JUN. 10,1992
30. AMENDMENT No. 25	JAN. 19,1992
31. AMENDMENT No. 40	AUG. 28,1992
32. AMENDMENT No. 41	SEP. 25,1992
33. AMENDMENT No. 39	JAN. 12,1993
34. FURTHER APPROVED BY MINISTER	FEB. 1,1993
35. AMENDMENT No. 42	FEB. 15,1993
36. AMENDMENT No. 43	JUN. 7,1993
37. AMENDMENT No. 44	JUN. 4,1993
38. AMENDMENT No. 39	OCT. 8,1993
39. AMENDMENT No. 47	DEC. 2,1993
40. AMENDMENT No. 48	DEC. 17,1993
41. AMENDMENT No. 49	MAY 9,1994
42. AMENDMENT No. 52	JUN. 1,1995
43. AMENDMENT No. 54	JAN. 23,1996
44. AMENDMENT No. 55	JUL. 3,1996
45. AMENDMENT No. 56	OCT. 28,1996
46. AMENDMENT No. 57	MAR. 11,1997
47. AMENDMENT No. 59	NOV. 19,1997
48. AMENDMENT No. 53	JAN. 12,1998
49. AMENDMENT No. 66	APR. 2,1998
50. AMENDMENT No. 68	APR. 2,1998
51. AMENDMENT No. 67	JUN. 9,1998
52. AMENDMENT No. 71	MAR. 3,1999
53. AMENDMENT No. 72	APR. 22,1999
54. AMENDMENT No. 74	MAY 6,1999
55. AMENDMENT No. 78	MAY 27,1999
56. AMENDMENT No. 76	SEPT 10,1999
57. AMENDMENT No. 81	OCT 15,1999
58. AMENDMENT No. 82	JAN. 14,2000
59. AMENDMENT No. 83	MAR. 31,2000
60. AMENDMENT No. 84	JULY 18,2000
61. AMENDMENT No. 86	JAN. 16,2001
62. AMENDMENT No. 87	JUNE 19,2001
63. AMENDMENT No. 89	AUG. 28,2001
64. AMENDMENT No. 91	JAN. 10,2002
65. AMENDMENT No. 92	MAY 1,2002
66. AMENDMENT No. 96	JUNE 7,2002
67. AMENDMENT No. 95	JUNE 7,2002
68. AMENDMENT No. 98	JUNE 7,2002
69. AMENDMENT No. 101	APR. 2,2003
70. AMENDMENT No. 104	JAN. 5,2004
71. AMENDMENT No. 106	JULY 9,2004
72. AMENDMENT No. 109	OCT. 18,2004
73. AMENDMENT No. 110	OCT. 18,2004
74. AMENDMENT No. 111	NOV. 8,2004

Figure 1: The City of Brantford Official Plan, Schedule 1 - Land Use Plan

Figure 2: The City of Brantford Official Plan, Schedule 3-1 - Natural Heritage: Environmental Areas

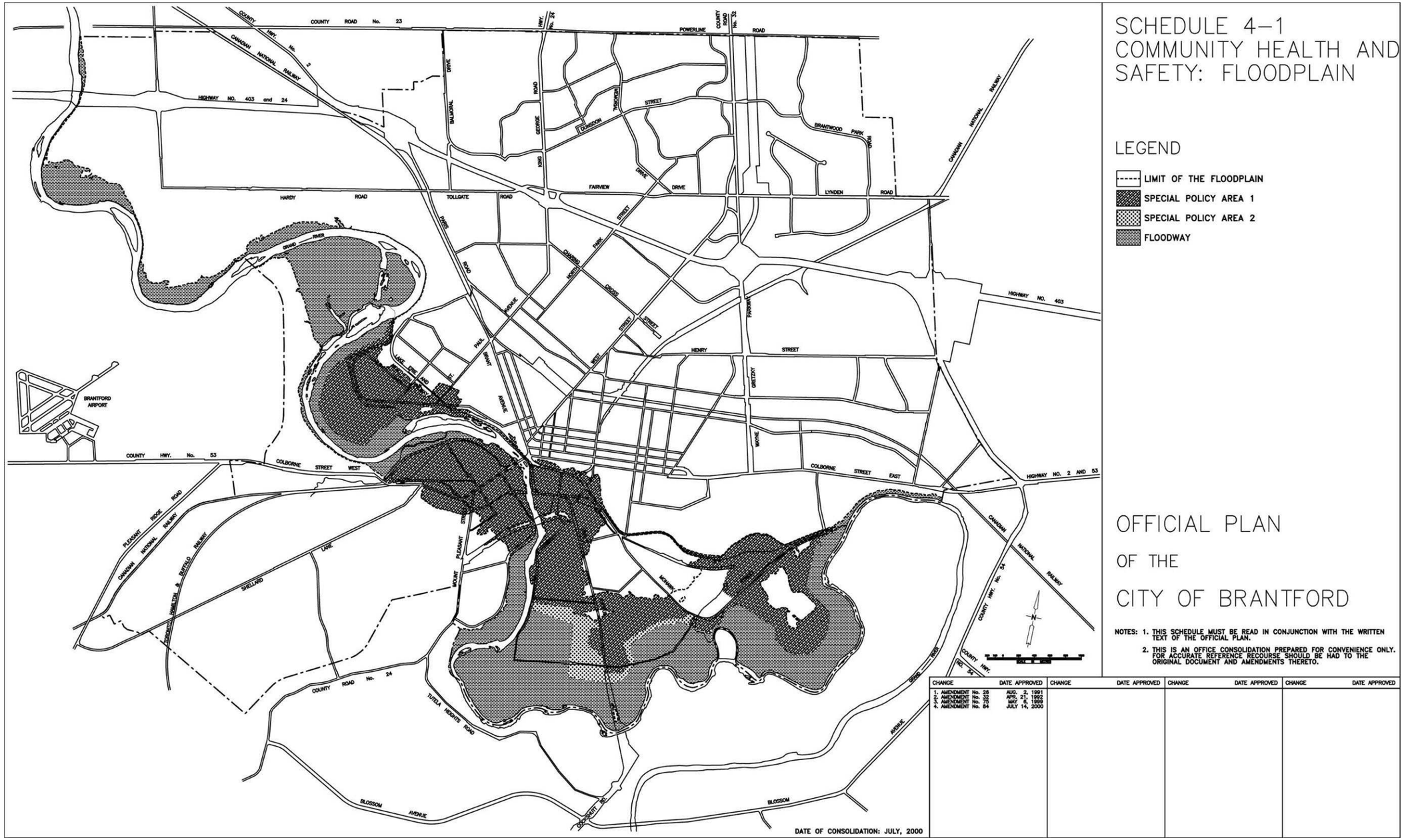


Figure 3: The City of Brantford Official Plan, Schedule 4-1 - Community Health and Safety: Floodplain

2.2 THE CITY OF BRANTFORD BY-LAWS

The City of Brantford has established a number of by-laws intended to protect natural areas, parks, trees and regulate their use. All trees on City property are protected (By-law 62-91), private woodlots are protected (By-law 171-2002), and a number of rare tree species are protected (By-law 171-2002, Schedule A).

Chapter 420 - Parks-Avenues-Boulevards Drives-Regulation-Control regulates the authorized uses and activities for parkland, properties, and water areas, and a detailed list of prohibited personal uses. This by-law establishes penalties for contravention and plays an important role in their enforcement.

There are several statements regarding tree and woodlot protection and use established by City By-law Number 171-2002. Examples include a prohibition to injure or destroy any living tree within woodlots, within an Environmental Protection Policy Area, or within an Environmental Control Policy Area. Schedule A of this by-law contains a list of tree species that are protected in naturally occurring populations.

Only private woodlots are under jurisdiction of By-Law Number 171-2002, and the City of Brantford does not manage these woodlots directly. Nevertheless, private woodlots can play a significant role in the formation of the City forest framework (see Section 5).

2.3 OTHER PLANS

The City of Brantford's Community Strategic Plan (2006) is a guide for setting priorities, making budgetary decisions, and providing the services and programs needed to achieve community vision. It plays an important role in developing a collective vision and future planning. All other plans, policies and strategies should support the Plan and should be based on its directions.

The City of Brantford has established the goal to be a "proud city with a positive image". It proposes to accomplish this by creating a healthy community, expanding tourism, enhancing capabilities for higher education, and providing citizens and visitors with opportunities to enjoy a full range of well-supported and maintained heritage, culture, recreational facilities.

The City recognizes the importance of environmental stewardship and protection of natural features.

The City of Brantford Parks and Recreation Master Plan (2003) is a comprehensive report intended to guide the delivery of recreation services, parks and open spaces, programs and facilities, and provides the City of Brantford with a strategy for the future provision of parks, recreational facilities and services. The report contains detailed parks and recreation facilities, programs and services inventories and analysis, and provides a strategy for the future provision of parks and recreation facilities and services.

A Watershed Forest Plan for the Grand River (Grand River Conservation Authority, 2004) has no authority over landowners or land managers, but **"**offers suggestions, recognizing that these are not the only possible scenarios to an improved future for the Grand River Watershed Forests, the Grand River, and the community". It provides vision for a sustainable forest for a healthy, sustainable watershed and community. The Plan contains detailed facts about the watershed forest history, analysis of current conditions, issues and opportunities.

2.4 KEY PARTICIPANTS AND AREAS OF RESPONSIBILITIES

The management of natural heritage and features, and their recreational, educational and economic potential, lies in the overlapping responsibilities of many players: federal and provincial governmental agencies, conservation authorities, municipalities, NGOs, and the public.

The City of Brantford bears day-to-day responsibilities to manage, maintain and control the uses of City parks and urban forests that divide and partially overlap several departments.

The City of Brantford Parks and Recreation Department (through The Engineering & Operational Services Commission and the Park, Recreation and Waterfront Advisory Board) is responsible for parks and recreation services in the City. For general consideration, the Parks and Recreation mission statement is: "*Parks and Recreation shall ensure quality opportunities and experiences, and the conservation of natural spaces, which promote and enhance active lifestyles in a healthy community".*

The Tourism, Planning, and Economic and Business Development, Environmental Services Departments also participate in parks and recreational services.

3.0 MANAGEMENT PLANNING APPROACH AND METHODOLOGY

3.1 THE CITY OF BRANTFORD VISION OF SUSTAINABLE URBAN FOREST MANAGEMENT

The City of Brantford does not have a written concise forest management vision statement. One of the objectives of this report is to support the City's vision based on analyses of woodlots history, current context, community expectation, existing problems and opportunities.

Nevertheless, the City of Brantford Parks and Recreation Department has provided the following guidelines:

- Manage trees in parks and natural environment areas, for health, public safety and to increase ecological functions
- Manage trees and urban forests on municipal lands according to a common vision and outcomes
- Preserve the existing wooded areas
- Protect the health of urban forests
- Promote diversity in tree species and tree ages
- Increase the tree canopy where possible
- Optimize environmental, social, economic, and aesthetic benefits through forest management
- Increase community awareness, knowledge, and involvement of the benefits and management of urban forests
- Promote educational partnerships
- Build regional cooperation
- Adhere to forestry professional and quality standards
- Use the products of urban forests
- Invest in green infrastructure
- Promote native vegetation communities

With respect to public awareness and vision, according to a household telephone survey (Parks and Recreation Master Plan, 2003) the majority of residents (52%) strongly agreed with a statement: the City should do more to ensure natural areas are protected. Seventy two percent (72%) assigned this as a top three rating. The consultation process for the Parks and Recreation Master Plan demonstrates that Brantford's open space and trail system is very important to residents.

The following top 5 public priorities of the City woodlots management have been identified during the Forest Management Community Meeting (June 27, 2009).

- To preserve the existing forest
- To protect the health of the forest

- Manage trees in groomed parks and natural environment areas, for health, public safety and to increase the ecological function
- Diversity in tree species and ages throughout the forest
- Promote and plant trees to optimize aesthetic, social, environmental and economic benefits of trees

3.2 MANAGEMENT PLANNING APPROACH

Management planning includes the following steps:

- **Identification of problems and opportunities**;
- **Key issues** based on the analyses of collected data and research;
- **Identification of goals and measurable objectives** based on understanding of the problems/opportunities/assumptions and current woodlot conditions;
- **Identification of the most effective alternatives** for reaching the management goals;
- **Identification of plan implementation tools**;
- **Monitoring and evaluation of management success** (including identification of the proper indicators and monitoring procedures).

Use of the planning adaptive management approach based on SWOT analysis (**S**trengths, **W**eaknesses, **O**pportunities, **T**hreats) allows us to create a SMART (**S**pecific, **M**easurable, **A**chievable, **R**ealistic, **T**ime-bound) Management Plan. SMART management is a goal driven adaptive approach to management. It will provide the City of Brantford with an instrument to improve sustainable, adaptive, site specific and economically effective management of the City woodlots thereby helping the City to realize benefits for the community.

The key steps for SMART management are monitoring and evaluating management success, and adjusting management goals and tools, depending on achievements and the current situation.

Figure 4 illustrates the general components of management planning.

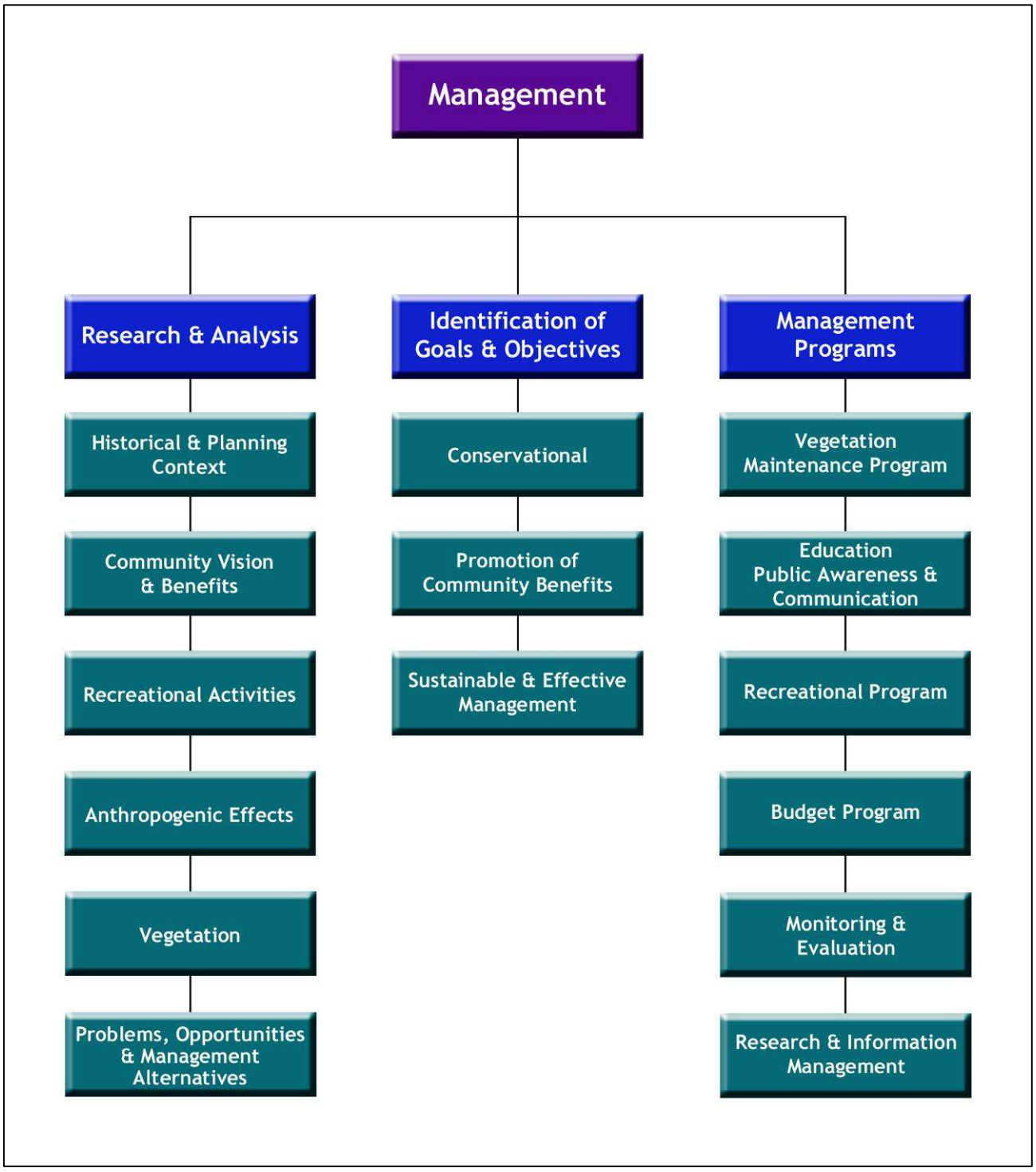


Figure 4: General Scheme of the Approach to Management Planning

3.3 ASSUMPTIONS OF THE MANAGEMENT PLAN

This Management Plan is based on the following main assumptions:

- The City of Brantford and the local community support the vision of Waterworks Park and other woodlots as valuable natural heritage areas with significant recreational, educational, and conservation potential. The City of Brantford Parks and Recreation Department can establish cooperation with external agencies, public groups, educational organizations, non-governmental organizations and businesses to support this vision.
- The existing woodlot maintenance funding level will be relatively stable and may be increased for approved action plans and programs recommended within the Management Plan.
- Native species are preferable and invasive species control is a part of woodlot management.
- Safety of visitors is one of the main priorities of park management.
- Ecological integrity is one of the most important goals of the City's woodlot management.
- The City of Brantford protects forested lands and intends to increase their size and number if it is feasible.

3.4 SWOT ANALYSIS

The SWOT (**S**trengths, **W**eaknesses, **O**pportunities, **T**hreats) analysis is a simple and very useful tool for understanding and decision-making.

3.4.1 Strengths

- The City of Brantford owns relatively large woodlot areas. Public ownership allows the City to protect these areas and to manage woodlots, which will be beneficial to all community groups.
- The City of Brantford's planning process has the necessary planning and legislative tools to help protect the natural heritage and recreational resources, promote sustainable management, interdepartmental and public communication, and participation in decision making.
- The majority of residents support the City's administration in the protection of natural areas and share the City's understanding of the importance for proper management of recreational resources.
- There are a number of productive partnership opportunities for the City to promote urban forest management with governmental agencies, NGOs, and educational institutions.
- Waterworks Park and other urban woodlots are large enough to be sustainably managed with reasonable management costs.

3.4.2 Weaknesses

- Existing information about urban forests (historical, previous phytopathological, vegetation/wildlife surveys, records of previous forestry management, recreational activities study, etc.) is often insufficient for understanding ecosystem trends, and for making decisions which would result in successful management.
- Due to the City and the public's current lack of vision regarding detailed objectives for urban forest management, identification of the most effective alternatives and evaluation of successful management is difficult.
- Most urban forest ecosystems have been dramatically altered from their original state and are no longer "natural". They cannot be left "as is" and should be managed to ensure their sustainable long-term existence, use and protection.
- Many of the City's woodlots are too small to be kept healthy by natural processes and should be intensively managed.
- The urban forests are highly affected by invasive species.
- All the City's woodlots have been affected by intensive adverse human impacts: pollution, recreational activities, woodlot fragmentation, soil degradation, water regime changes, vandalism, etc. (See Table 1).
- The City forests are highly fragmented and insufficiently connected.

3.4.3 Opportunities

- Proper and adaptive management can be very successful due to public support, and conformity with the City's priorities.
- Although most of the identified problems need immediate action, they can be solved during regular planning phases.
- There are opportunities to improve ecological integrity and connectivity of the City's urban forests, support natural biodiversity and sustainability of the woodlots, contribute to national and provincial conservation goals, and decrease competiveness of invasive species, all while maintaining healthy and aesthetically attractive ecosystems.
- Appropriate communication and educational activities can successfully increase public awareness and correspondently increase opportunities for partnership, volunteering and financial support.

3.4.4 Threats

- Fragmentation and isolation of woodlots threaten their sustainability and ecological integrity.
- Invasive species and pests threaten all the City's urban forest ecosystems.
- Parks and woodlots are experiencing continuous intensive adverse human impacts which are expected to increase as the City's population grows. The following Table 1 summarizes these effects.

- The demand for housing and industrial development can cause a reduction in the size of the City's forests and destroy opportunities for restoration of their connectivity.
- Future climate changes can modify natural conditions and make ecosystems less stable; as a result, decreasing native species' ability to compete with exotic species, changing the water regime, and transforming wildlife habitat conditions.
- Industrial areas located adjacent to woodlots create a potential threat of accidental contamination.

Table 1: Main Anthropogenic Effects on the City's Woodlot/Park Ecosystems

Types of Anthropogenic Effects	Effect Factors and Objects	Source of Effect	Positive or Negative	Trend	Level of Effects
Urban development	• Vegetation and wildlife habitat loss and fragmentation • Change of ecosystem types and function • Increase in nuisance wildlife species • Increased predation and harassment of wildlife by domestic pets • Increased human-wildlife conflicts	Construction activities, maintenance, housing, human activity, traffic	Mostly negative	Increasing	High
Water level regulation and water consumption	• Change of natural water regime • Change of ecosystem types and function • Biodiversity changes (including invasive species)	Flood control works (Installed dikes and constructed channels), industry and public	Probably mostly negative	Probably stable	High
Historical agricultural land use	• Vegetation and wildlife habitat loss and fragmentation • Change of ecosystem types and function • Invasive species distribution	Historical agriculture land use	Mostly negative	Decreasing	High
Vegetation management	• Vegetation and wildlife damage • Biodiversity changes (including invasive species)	Maintenance	Positive (if properly done)	Increasing	Medium-High

Types of Anthropogenic Effects	Effect Factors and Objects	Source of Effect	Positive or Negative	Trend	Level of Effects
Damage from maintenance equipment	• Serious damage and injury of mature trees resulting in premature death and costly removal and replacement	Mowing, snow removal, and maintenance operations	Negative	Probably stable	Medium
Air Pollution	• Regional and local background pollution	Transport, Industry	Negative	Probably decreasing	Probably medium
Recreation	• Soil erosion • Fire • Vandalism • Wildlife disturbance and harm • Skiing (winter soil frost penetration and erosion) • Picking herbs and flowers	Visitors	Negative	Increasing	Low-Medium
Trail/road construction, maintenance and operation	• Ecosystem fragmentation • Wildlife road-killing • Disrupt wildlife migration • Air and soil pollution • Invasive species migration corridors	Maintenance, visitors	Mostly negative	Increasing	Low-Medium
Utilities construction and operation	• Vegetation and wildlife damage • Change of ecosystem types • Invasive species migration corridors	Utilities construction and operation	Depends on the management	Increasing	Low-Medium
Soil and groundwater pollution	• Regional and local background pollution, mostly from the past	Industry, potential accidental contamination (e.g. water treatment plant)	Negative	Probably decreasing	Probably low

Types of Anthropogenic Effects	Effect Factors and Objects	Source of Effect	Positive or Negative	Trend	Level of Effects
Climate change	• Changes of natural conditions • Exotics invasion	Human activities	Mostly negative	Increasing	Low in the near future, Medium-High over the long term
Fire	• Vegetation and wildlife damage	Visitors, natural causes	Negative	Unknown	Minimal

3.5 IDENTIFY MANAGEMENT GOALS, OBJECTIVES, ALTERNATIVES AND PRIORITIES

3.5.1 Management Philosophy

Management goals have been established based on the following management philosophy:

- The City cannot (and should not) “do it all”. Management can be successful through cooperation with a variety of community partners.
- The management plan should be flexible and able to adapt to change.
- Because of the unknown elements involved in such planning, managers should be very careful and conservative with regards to areas of management and/or vision.
- Management should be proactive: “Better to prevent it than to cure it”.
- Management decisions should be based on realistic budget estimates.
- Management activities should be properly located within a scale of “Do Nothing – Do Everything”.
- Urban forest/park management should be part of the City’s general planning and management process.
- Management should work with nature, not against it.

3.5.2 Principal Goals of Urban Forest Management

Based on the analysis of the existing community vision, planning context, SWOT analyses, findings of the field inventories and consultations, the study team recommends the following management goals and objectives:

- Improve/restore the urban forest/park ecological integrity: preserve existing woodlots, parks and natural areas, promote their connectivity, improve environmental conditions of the urban forests.
- Promote public stewardship, provide opportunities for public partnership and awareness of the common vision of the future of urban forests.
- Improve recreational opportunities with respect to protection of the natural heritage.
- Increase quality and effectiveness of the management process, standards and routines, and decision making information support systems.

3.5.3 Management Alternatives and Priorities

An important part of management planning is the identification and evaluation of alternatives. Insufficient information regarding woodlots’ and park’s level of recreational use, the City’s and public’s vision of urban forest management, and the absence of an annual action plans make this step complicated at this time.

The study team evaluated the following three main alternative management scenarios:

- **Do Nothing**: Lack of management and regular maintenance will lead to decreasing or even total loss of urban forest benefits for the community. The woodlot's ecosystems are threatened by numerous anthropogenic factors; they can not exist and be sustainably used without effective management. Degradation of the ecosystems can be slow, but will occur eventually. Public safety is an issue that requires ongoing attention.
- **Do Everything:** The City immediately implements all of the Management Plan programs and recommendations. This scenario does not appear feasible as the City currently has insufficient staff and budget to proceed immediately with full plan implementation. Furthermore the management plan can be effectively implemented by yearly action plans. The implementation of the plan will require time and is best done step by step with regular performance evaluations and adjustments of the woodlots' vision and management.
- **Priority Steps:** The City needs time to develop adequate action plans to fully realize the Management Plan recommendations. The limited available resources and staff constraints require careful prioritizing and planning of management activities. The City should make a selection of the most urgent, realistic, and preferable actions, based on available resources and existing opportunities. Managers should take into consideration that, unfortunately, in "real life" the sequence of the implemented undertakings may be far from ideal and some of the necessary programs will be reduced or not be realized. However even limited successful implementation of the recommendations in this Management Plan will help to increase the woodlots' benefits and public awareness and will lead to increasing public support for the necessary budget and opportunities.

The study team, based on their expert opinion, has assigned an estimated priority value (Low – Medium – High) to all recommendations with the following main parameters: **significance, urgency, and required resources**.

Timing and **ease of implementation** are other important parameters which should also be taken into account. Some undertakings may not be very significant, but they are uncomplicated and do not require substantial resources to be implemented within the short term.

A simple Priority Matrix (Figure 5) may help to identify the highest priority undertakings. The urban forest management should focus on actions located in the right top corner of the diagram as they are highest priority.

At the same time, a number of factors, e.g. public interest and concerns, availability of scientific data, or the City policy changes, can extensively affect the decision making as well as the priority setting (Figure 6).

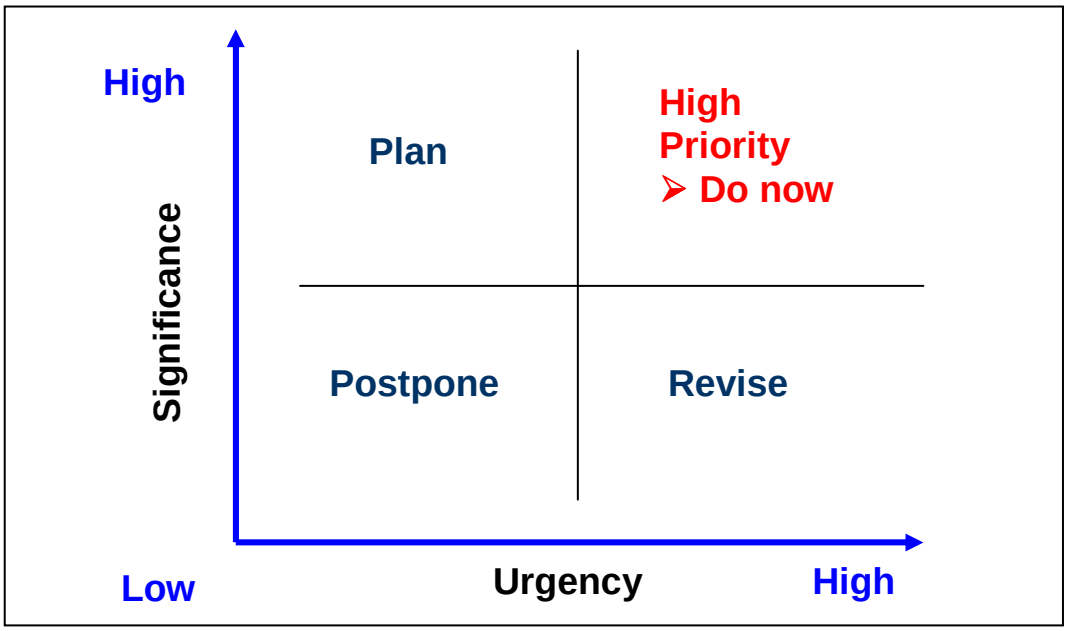


Figure 5: Management Priority Matrix

Figure 6: Influences on Decision Making
(Adopted from "National Park Planning: Future for the Parks…Parks for the Future", the U.S. National Park Service)

The priority matrix template shown below in Table 2 provides a guide for developing management priorities (numbers have been inserted to provide examples only, and are not indicative of actual prioritization or any actual values or weights, which would require further study, consultation, and review). The table can be modified as goals and visions change.

Relative weights (multipliers) (e.g. a variety of values ranging from lowest (1) to highest (5) depending on criterion importance) are to be assigned to each criterion. Then the undertakings are rated under each criterion and multiplied by the weights (multipliers). The resulting values (Total Priority) support decision making and assist in action plan development. Action plans should be developed by comparing the individual undertaking's total value and prioritizing them.

Due to the matrix's simplicity, the highest score may not always indicate the best option, but this tool assists in discussions to reach consensus.

Table 2: Management Priority Matrix Template [2]

UNDERTAKING	CRITERION							TOTAL PRIORITY
	SIGNIFICANCE	URGENCY	BUDGET REQUIRED	STAFF REQUIRED	EASE OF IMPLEMENTA-TION	PUBLIC INTEREST	INFLUENCE (POSITIVE IMPACT ON OTHER PROCESSES)[3]	
	MULTIPLIERS[4]							
	3	***2***	***-3***	***-2***	***1***	***2***	***1***	
E.g. Recreational study	5	5	2	2	5	5	5	***35***
E.g. Interpretive signage	3	2	4	3	3	5	3	***11***
E.g. Wildlife studies	3	2	1	1	5	3	2	***21***
Etc.								

[2] *Numbers are given as examples only.*

[3] *E.g. conducting a recreational or wildlife survey may increase public awareness if it is advertised or done by local volunteers, and signage may increase public safety to bring awareness of potential hazards.*

[4] *Some criterion should be negative, for example - when high budget/staff requirements negatively impact the undertaking of a priority.*

3.5.4 Plan Implementation

Realization of management goals is recommended through several prioritized management programs focused on the following directions:

- Vegetation/Habitat Management
- Recreational Management
- Public Education, Awareness and Communication
- Research and Information Management
- Budget Maintenance
- Management Monitoring and Evaluation

The implementation of the Management Plan's programs should be realized by short-term annual operations plans. An annual operations plan allows managers to make decisions promptly within a dynamic environment and achieve the management objectives in a step by step-progressive manner (see Figure 7).

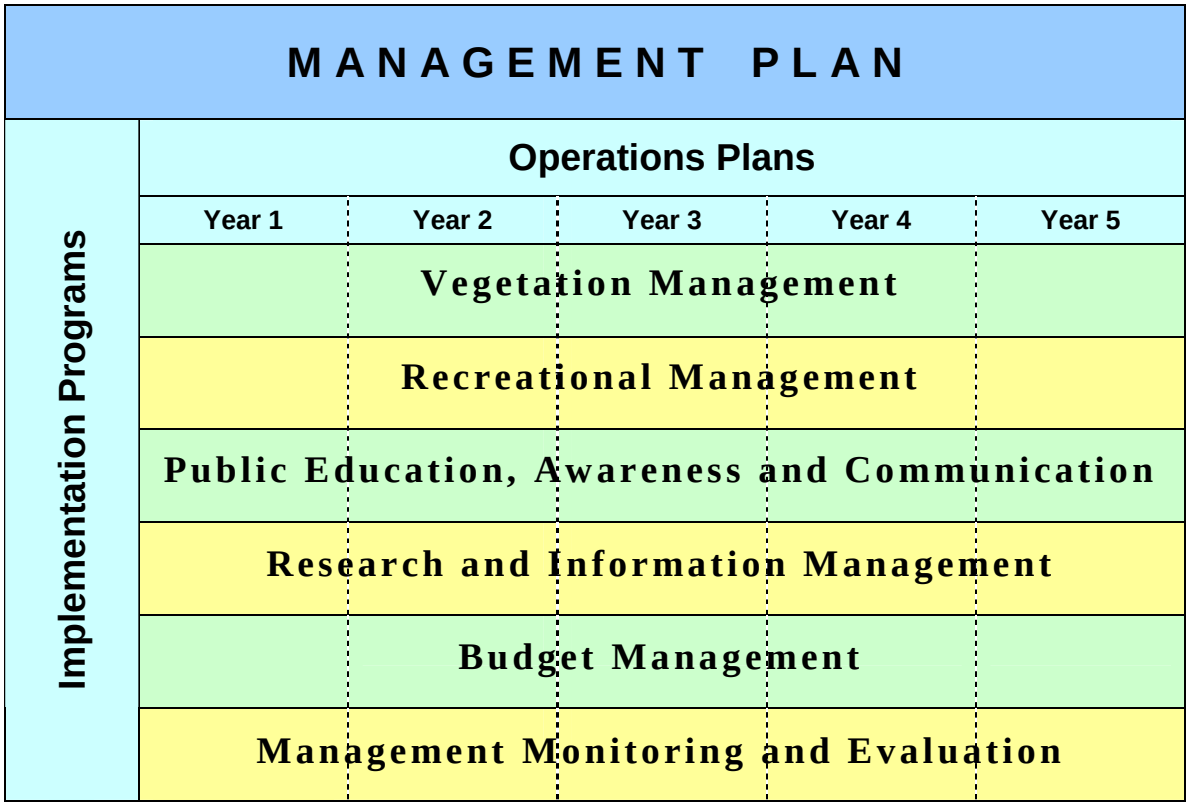


Figure 7: Management Plan Temporal Structure

4.0 MANAGEMENT PROGRAMS

4.1 RECREATIONAL MANAGEMENT

4.1.1 Recreational Activity

Parks, woodlots and natural areas provide a great variety of outdoor recreational opportunities for residents and visitors.

According to information received from the City of Brantford Parks and Recreation Department, the primary recreational activities for parks are as follows:

Year-round activities:

- Trail use - jogging, cycling, walking (no motorized vehicles permitted)
- Observing nature
- Leashed pet use
- Picnics
- Hiking

Summer uses:

- Fishing
- Soccer, cricket
- Picnics
- Group games (mowed field or pavilion)

Winter uses:

- Skiing
- Snowshoeing

The City of Brantford's Parks and Recreation Master Plan designates two park categories: Active and Passive. "Active" parks are designated to serve the municipality's needs for organized recreational activities and programmed sports. "Passive" parks are designated for aesthetic appeal, informal sports, games and play or limited active uses in natural areas primarily for daytime use.

These recreational activities play a vital role in maintaining a healthy community, providing a large number of personal, social, economic, and environmental benefits. Recreation is essential to a community's quality of life, pride, and is necessary for sustaining a healthy city. Unfortunately, recreational activities often negatively impact the environment, generating significant threats to an ecosystem's sustainability. Table 3 details the adverse effects caused by recreation.

A challenging goal for park/woodlot management is to find a balance between increasing recreational uses and maintaining conservation needs.

Territorial overlapping and the impact of multi-use recreational activities make recreational management and analysis difficult. Some activities are typically located only in specific areas (e.g. sports games, fishing), some are associated with trails and designated areas (such as walking, picnicking), while others are undertaken throughout park (observing nature). Some of these activities may be in conflict with one another, such as walking and cycling on the same trails, or sports being played where visitors are walking their dogs. Recreational management should endeavor to separate competitive activities by time and/or space.

Certain recreational activities may be prohibited in all park/woodlot areas or outside designated locations[5]. Activities such as cycling, sport games, and picnics can have significant environmental impact if they occur outside designated trails or playing fields.

Table 3: Typical Recreational Activities

Type of Recreational Activity	Negative Environmental Effects[6]	Areas	Season
Walking, jogging	• Wildlife distribution	Trails	Throughout the year
Dog walking	• Pollution • Ground nesting bird and wildlife disturbance • Visitors safety • Transfer of disease to wildlife	Trails, open spaces	Throughout the year
Skiing, snowshoeing	• Winter soil frost penetration and erosion under ski-track	Trails, open spaces	Winter
Fishing	• Fish loss • Accidental introduction of non-native bait species	Waterfront	Summer

[5] *E.g. The City of Brantford Municipal Code Chapter 420 Parks-Avenues-Boulevards-Drives-Regulation-Control contains a detailed list of prohibited uses of parkland and regulates authorized uses and activities.*

[6] *Negative effects may only be a potential for a negative effect.*

Type of Recreational Activity	Negative Environmental Effects[6]	Areas	Season
Wildlife watching/nature observation	• Wildlife distribution	All park/woodlot territory	Throughout the year, mostly spring, summer, and autumn
Educational	• Wildlife distribution	All park/woodlot territory	Throughout the year
Cycling	• Soil erosion • Visitor safety	Trails	Mostly summer
Picnicking	• Fire threat • Littering, contamination • Wildlife distribution • Noise	Designated areas	Summer
Sport	• Soil erosion/ compaction • Wildlife distribution • Increasing demand of open/ deforested spaces • Noise	Designated areas	Summer
Vandalism[7]	• Damage of vegetation, recreational infrastructure, decreasing aesthetic values, visitors safety and satisfaction	All park/woodlot territory	Throughout the year

4.1.2 Recreational Management Recommendations

No field investigations were undertaken for recreational activities and the following recommendations are based on information provided by the City, and the study team's expertise with similar studies for other parks/woodlots.

[7] *Strictly speaking vandalism is not a generally understood recreational activity, but for the study purposes it is located in this section due to its environmental effect.*

Table 4: Recreational Management Recommendations

Recommendations	Goals	Outcome	Priority
A recreational study is recommended to gain a better understanding of the specific recreational uses within woodlots. The frequency of use, use patterns (e.g. seasonal, weekly and daily), user types, environmental impacts of uses, user recreational demands and expectation should be the focus of the study. The study[8] could be simple, and could possibly be carried out mostly by volunteers and/or students using methods such as field observations and user surveys. Until the above suggested study has been undertaken, recommendations shown below are based primarily on expert opinion. Analysis of outcomes will enable more specific recommendations to be made.	To provide the City of Brantford with critical information for analyses and an understanding of public recreational needs and expectations, types and structure of recreational uses, and their environmental impacts.	Appropriate and realistic management decisions regarding control, limitation and support of different types of recreational activities in designated locations based on analysis of the correct and complete information.	High
Development of a "passive" educational infrastructure which could include road-side boards, information kiosks/centres, and brochure/leaflet boxes along the most popular trails and points of interest are recommended. This would offer visitors with information regarding the park/woodlot history, significant natural features, conservation and management issues, woodlot benefits, hazards (e.g. poison ivy), the rules of conduct in the park, etc.	To increase public knowledge and awareness of conservation and urban forest benefits.	Increased public awareness, urban forests public value, and public support. Increased number of volunteers. Visitors' satisfaction.	High
Regular guided educational tours could be developed and provided by volunteers and/or City staff. These tours would include topics such as the history of the natural heritage areas, surrounding wildlife, vegetation, anthropogenic effects and conservation, invasive species and biodiversity, urban forest benefits, etc.	To increase public knowledge and awareness of conservation and urban forest benefits.	Increased public awareness, urban forests public value, and public support. Increased number of volunteers. Visitors' satisfaction.	Medium

[8] *Volunteers and/or students would require training; field observation format and user surveys to be developed by recreational professionals or adapted from similar recreation survey data.*

Recommendations	Goals	Outcome	Priority
Recreational management should take into account cumulative effects and the competitive characteristics of the different types of activities and use specific infrastructure and zoning planning measures to separate them.	To minimize negative overlap of the concurrent activities and adverse cumulative effects.	Proper location/time restrictions for different types of recreational activities	Medium
Some woodlot areas located adjacent to the Grand River have the potential for more intensive use for picnics and observing nature. These spots may be appropriate for daytime picnic areas and can be equipped with adequate features such picnic tables, barbecues, benches, garbage cans, and portable washrooms. Technical considerations regarding possible ice damage, vandalism, remoteness of the areas from roads, and operational costs require future evaluation. Other considerations include wildlife habitat and habitat potential. Recommendations for these types of recreational areas will depend on the results of the above study findings.	To provide visitors with increasing opportunities for new types of activities.	New recreational opportunities. Visitors' satisfaction.	Low
Create greater opportunities for nature appreciation (e.g. the installation of bird feeders) in select areas along the trails.	To increase the opportunity for observing wildlife.	Visitors' satisfaction.	Low

4.2 PUBLIC EDUCATION, AWARENESS AND COMMUNICATION

The City of Brantford's urban forests, natural areas and parks are excellent natural laboratories and classrooms for visitors of all ages.

Education serves as an effective tool for supporting natural heritage and urban forest management. People protect, appreciate, and value things they know well and understand. Education plays a vital role in teaching both children and adults about forest benefits including its conservation, aesthetic, economic, and recreational values. Users should learn about the sustainable uses of urban forests and be given opportunities to participate in forest management. Increasing community knowledge promotes awareness, involvement in park/woodlot management and partnership opportunities. Resident involvement in a dialog about urban forests and recreation management will promote positive communication between the City and the public and a sense of community.

4.2.1 Challenges

Management challenges include insufficient availability of educational and communication materials and opportunities. No specific public education, awareness and communication plans are in place.

4.2.2 Goals

Goals are to educate residents and visitors and provide them with a sufficient level of knowledge for sharing in the City's vision and priorities. There needs to be an increase in the public's understanding of management issues, the value of natural heritage as well as increased opportunities for communication and community support.

4.2.3 Stakeholders and Partners

A challenge in the planning and management of urban natural areas/parks and the development of communication programs is the large number of stakeholders who often have different and/or opposite interests, responsibilities, and visions. As a result, governmental agencies are ultimately responsible for the strategic policies and goals. Municipalities are mainly responsible for natural heritage management. Residents who take advantage of the benefits provided by urban forests participate in discussions and reviews. NGOs contribute their experience, expertise and skills.

It is helpful to analyze and categorize stakeholders at the beginning of the planning stage. Idle and Bines (2004) offer detailed classifications of the planning parties (Figure 8). To economize time and resources, appropriate stakeholders should be chosen who can play a key role in obtaining information and support and in helping to successfully realize the plans.

There are many varied ways of interacting with stakeholders. These include using both formal and informal methods, such as conferences, meetings, briefings, discussions, use of the media, public consultations, etc. It is important to open up problems and conflicts in order to understand which ones are based in reality and which ones are the result of false perceptions. It is necessary to find a consensus for all management steps: identification of priorities, staging, roles and responsibilities. The key to interacting with stakeholders is to foster respect, trust, and understanding.

One of the most effective ways to increase public support is to initiate and promote the establishment of a "Friends Association/Group". Even a small group of "Friends" can be a helpful and powerful partner for the City and can help stakeholders contact each other in an informal way and initiate "ice breaking" and the development of trusting relationships.

Unfortunately these groups cannot be created solely by a bureaucratic decision. Such groups should consist of volunteers with a high level of enthusiasm and leadership skills in the community; the City can initiate and support the public group.

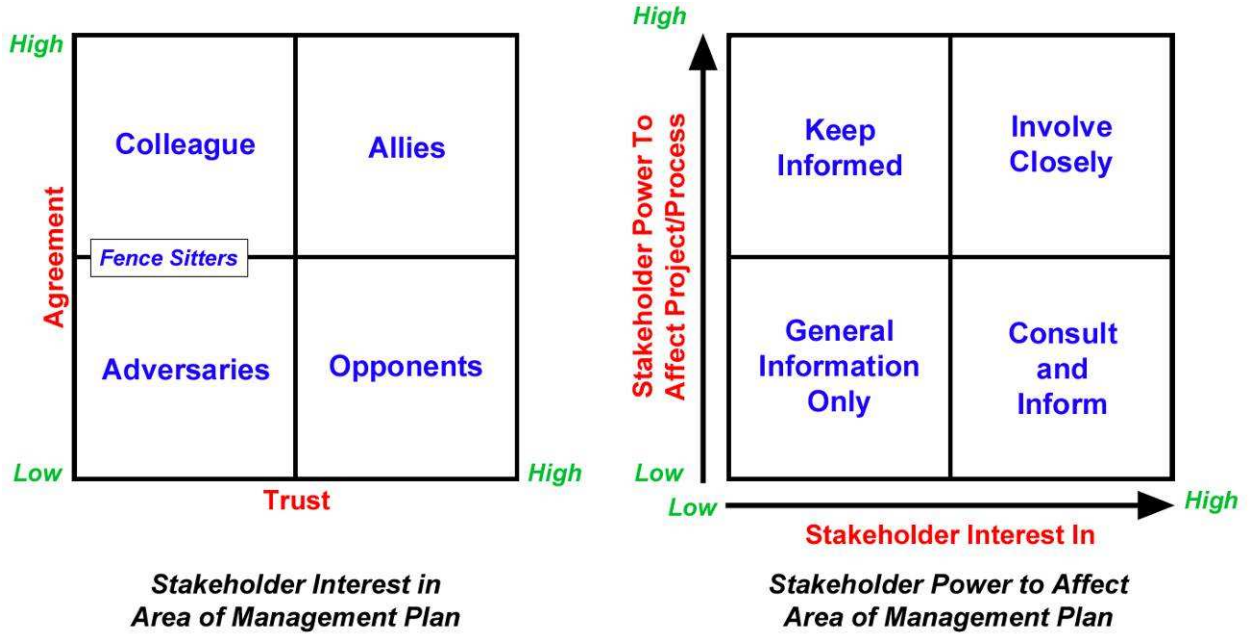


Figure 8: Categories of Stakeholders (Adapted from Idle and Bines, 2004)

Successful implementation of the Management Plan will be difficult without the support of a number of partners categorized in Table 5. Lists of potential partners also can be found in Section 4.2 of the City of Brantford "Parks and Recreation Master Plan" and in Section 4.5 of "A Watershed Forest Plan for the Grand River".

Table 5: Groups of Potential Partners for Public Education, Awareness and Communication

Group of Partners	Area of Cooperation
Governmental Agencies: e.g. the Ministry of Natural Resources, the Ministry of Environment, the Grand River Conservation Authority, etc.	Education, research, public awareness, vegetation maintenance, conservation activities, planning, funding
Educational and Research Institutions	Education, research, public awareness
Interest Groups	Recreation, education, research, public awareness, volunteering
Conservation NGOs	Conservation actions, research, education, public awareness, volunteering, funding
Volunteers	Education, research, public awareness, maintenance
General Public	Planning, education, public awareness, funding

4.2.4 Recommendations

Table 6: Public Education, Awareness and Communication Recommendations

Recommendations	Goals	Outcome	Priority
Conduct surveys regarding public vision, demands and expectations of urban forest management	To understand the public vision and expectations	Understanding of public vision and expectations	High
Municipal employees should be well informed of urban forest management issues (e.g. staff information sessions, regular updates, etc.)	To increase inter-departmental communication and coordination	Increased coordination between City staff	High
Prepare a list of existing and potential partners for education and cooperation, and a selection of focus groups	To understand cooperative opportunities	List of partners	High
Communicate with partners, support and coordination of partnerships	To increase opportunities for partnership	Partnership	High
Develop a "passive" educational infrastructure which could include information kiosks/centres, and brochure/leaflet boxes, along popular trails and points of interest. This would provide visitors with information regarding park/woodlot history, significant natural features, conservation and management issues, woodlot benefits, hazards (e.g. poison ivy), rules of conduct in the park/woodlot, etc.	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public awareness, urban forests public value, and public support. Increased number of volunteers. Visitors' satisfaction and safety	High
Increase volunteer opportunities (e.g. for employment of students' "community hours")	To increase number of volunteer	Increased volume of work done by volunteers	Medium - High
Publish educational materials (e.g. leaflets, self-guides, brochures)	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public awareness, urban forests value, and public support	Medium - High

Recommendations	Goals	Outcome	Priority
Create opportunities for internship and co-op programs	To bring in new resource: interns' skills and knowledge	Interns involved in urban forest management	Medium
Initiate and support the establishment of "Friends of the City Parks/Woodlots Association/Group"	To increase effective public support	Public support, better stakeholder communication and partnership	Medium
Organize special urban forest related community events including: • Presentation of the General Forest Management Plan • Information sessions, Public Information Centres • Waterworks Parks anniversaries • "Green" festivals	To increase public awareness	Increased public interest and awareness Visitors' satisfaction	Medium
Organize departmental photographic library, publication of archives	To prevent loss of information and educational material	Photographs and publication used for educational activities	Medium
Create/develop a specialized web-site as an inexpensive, fast and effective way to communicate with the public	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public awareness, urban forests value, and public support	Medium
Provide regular guided educational tours, which could be developed and provided by volunteers and/or City staff. Tours may include topics such as the history of the natural heritage areas, surrounding wildlife, vegetation, anthropogenic effects and conservation, invasive species and biodiversity, urban forest benefits, etc.	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public awareness, urban forests value, and public support. Increased number of volunteers. Visitors' satisfaction	Medium

Recommendations	Goals	Outcome	Priority
Adapt and publish educational material for children	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public knowledge and awareness of conservation and urban forest benefits	Medium
Promote special school activities including: • Eco day camps • Outdoor lessons • School festivals and events • Research programs • Volunteer programs	To increase public knowledge and awareness of conservation and urban forest benefits	Increased public knowledge and awareness of conservation and urban forest benefits Increased number of volunteers Visitors' satisfaction	Medium

4.3 RESEARCH AND INFORMATION MANAGEMENT

Scientific research should be the basis for the management process. Insufficient information about natural areas, woodlots, parks, their recreational use, historical changes, anthropogenic effects, etc. undermine the ability to make educated decisions. Ecological monitoring provides critical information regarding results of the management.

4.3.1 Challenges

There is insufficient data relating to the historical maintenance of the City's woodlots, wildlife, vegetation, biodiversity, phytopathology, recreational activities, community vision and demands, and plans for collecting and this data and have not been developed. Planning/management tools should be developed to ensure the use of study results and monitoring data in decision making.

4.3.2 Goals of Research and Information Management Program

The goals for the Research and Information Management (RIM) program include the development of a system for collecting, storing, and presenting information necessary for making management decisions.

4.3.3 Research and Information Management Recommendations

The main recommendation is to establish an effective partnership with potential research associates which would be beneficial for the City. A number of educational and scientific institutions, agencies, NGOs, public groups, and volunteers would make excellent partners. As the City is unable to work alone to develop a RIM program,

inviting these various groups to become part of a partnership will create an environment of cooperation. As the City is unable to undertake the research, it is important to make this partnership appealing, so that students and volunteers will be interested in participating in the required studies; for example, by assisting students in field work and research. Publication of the studies' results (e.g. annual issues) will be an additional stimulus for students and researchers.

Table 7: Research and Information Management Recommendations

Recommendations	Goals	Outcome	Priority
Inventory and review of the studies undertaken for the City's natural heritage	To inventory existing data	Systematized database of the study results[9]	High
Analyse the existing data and studies undertaken	To understand the data sufficiency and existing gaps	Understanding the data sufficiency and gaps	High
Prepare a list of future priority studies and inventories	To eliminate of the research gaps	List of priority studies	High
Prepare a list of existing and potential partners for research (educational and science institutions, agencies, NGOs)	To understand cooperation opportunities	List of partners	High
Communicate with partners and support and coordinate the research partnership	To increase opportunities for partnership	Research partnership	High
Develop a system/planning tools providing study findings to be incorporated in management/planning steps and routines (e.g. through Environmental Assessment, Site Plan Control, etc.)	To use the information for increasing the quality of decision making process	High quality of decision making process	High
Develop a relevant GIS database and tools for regular update based on regular inventories	To increase effectiveness of store and use of information	Updated GIS database used for the City management	Medium
Publish/present the study results	To increase public knowledge and awareness	Public awareness	Low

[9] *Woodlots have a long history and trees can exist for many decades. This means it is necessary to retain the data for decades as well.*

4.4 VEGETATION/WILDLIFE HABITAT MANAGEMENT

Vegetation management should be very specific for each woodlot and depends on site characteristics such as woodlot size and location, biodiversity, existing vegetation, recreational use, ecosystem history and anthropogenic effects, desired functions, etc. The Waterworks Park Module contains detailed site specific recommendations for vegetation/habitat management for Waterworks Park. No field investigations were undertaken for other woodlots and the following recommendations are based on information provided by the City, and the study team's expertise with similar studies for other parks/woodlots.

The overall strategy of the forest management plan aims to increase the ecological integrity of the City's urban forest by actively supporting native biodiversity and decreasing the competitiveness of exotic species, while maintaining healthy and aesthetically pleasing ecosystems.

4.4.1 Challenges

The scattered, small, and fragmented nature of the wooded areas in Brantford reduces the self-sustaining capacity of their function. Further, based on a quick assessment of aerial imagery, the mature tree cover in urban areas of Brantford is low, and provides poor cover for migratory birds. An inventory of the City's woodlots, wildlife, vegetation, biodiversity, phytopathology, and recreational activities is required. To build consensus and public investment, the community must be informed of the results of the inventory, and their vision and demands must be determined.

There is a lack of knowledge of the current tree species, their age, and the percent cover. This knowledge can guide managers to deciding where to anticipate issues and allocate resources, such as in the event of a catastrophic event, or the introduction of a new invasive species (such as the emerald ash borer).

4.4.2 Goals of Vegetation/Wildlife Habitat Management Program

The goals for the vegetation and wildlife habitat management program are to use the information gained through an inventory for making management decisions, reduce human/wildlife conflicts, improve ecological connections and habitat to allow it to be more self-sustaining, increase public stewardship opportunities and interest, and anticipate and prevent serious losses of trees from natural catastrophes and pests.

4.4.3 Vegetation/Wildlife Habitat Management Recommendations

By collaborating with the public, they will gain a better understanding of challenges. This contact will provide the City with a direct link to dissemination of educational information in order to reduce wildlife/human conflicts. They will also understand and potentially support and carry out stewardship activities such as the maintenance and improvement of existing wooded areas by increasing their size, connection, and diversity. The importance of having programs for planting trees on private properties cannot be

emphasized enough, and by continuing this practice year to year, the younger trees will succeed as the mature trees die or become unhealthy and pose a hazard.

Although the expansion of existing woodlots and wildlife corridors may not be feasible in some areas due to urban development, areas where this may be possible must be identified for the Natural Heritage Network before the opportunity is permanently lost through urban expansion. Once these areas are identified, the focus of management for them must be determined to allow for future budget planning and discussions with the City Council. Where wildlife corridors are fragmented such as by development in riparian areas, increasing the riparian buffer is key to allowing these areas to function. As many people perceive lawns to be the most desirable vegetative cover, the City of Brantford must work together with the Conservation Authority to appeal for the planting of vegetation which provides a more ecologically sound riparian area. This will enhance safe wildlife movement with the added benefit of increased protection from bank erosion. In other areas where residential development is adjacent woodlands, fencing, wildlife-proof garbage containers, or other methods of reducing impacts should be investigated.

Table 8: Vegetation/Wildlife Habitat Management Recommendations

Recommendations	Goals	Outcome	Priority
A vegetation inventory for all City's woodlots is recommended to gain necessary information for management decisions, and identification of restoration priorities	To provide the City of Brantford with information for analysis, prioritizing, and decision making	Appropriate and realistic management decisions regarding woodlot management	High
Specific woodlot and urban forest Management Plans should be developed and modified as required.	To plan effective and appropriate management activities To allow effective budgeting and determine staffing requirements	Timely conduct of maintenance and reduction of crisis-style management; increased longevity of trees; reduction of safety and liabililty issues	High

Recommendations	Goals	Outcome	Priority
Identify all significant and sensitive wildlife habitats and develop site specific Wildlife Management Programs	To increase woodlot/park ecological integrity and opportunities for recreation (e.g. bird watching)	Creating the opportunity for wildlife populations to be self-sustaining and not require costly intervention to prevent extinction	High
Increase of woodlot size and connectivity[10]. Lands in the most important areas of existing green corridors or their prospective locations (and appropriate proximate land use designations) should be reserved for the City's natural heritage network. Sustainable management of the City's woodlots should be generally based on the same principals as recommended for Waterworks Park taking into account specific environmental conditions, history, size, existing vegetation, invasive species effect on the biodiversity, recreational functions, etc.	To increase woodlot integrity, sustainability and benefits, which are invaluable	Reduced infrastructure costs as natural system delivery of services such as stormwater and flood control are realized Increased urban forest benefits	High
Increase biodiversity, increase tree species diversity, introduce and maintain new native tree species Understanding of current species cover and distribution	To assist wooded areas in natural resiliency and increase cross-pollination and gene flow; planning for pest issues such as Emerald Ash Borer	Reduced severity of pest outbreaks; increase in genetic diversity of existing native trees	High
Develop and implement specific Vegetation Maintenance Standards for the City's woodlots[11]	Regular and appropriate management operations	Better allocation of staff resources	Medium High

[10] *See Section 5. City Woodlots/Natural Heritage Framework*

[11] *See Vegetation Maintenance Recommendations for Waterworks Park (Waterworks Park Module).*

Recommendations	Goals	Outcome	Priority
Decrease the competitiveness of exotic species; invasive species control	To increase native flora which in turn supports indigenous wildlife	Support of less common and rare species through enhancement of native habitat for all species	Medium
Increase in core forests (forests with a centre that is 100 m away from the outer perimeter in any direction) by replanting in between fragmented areas and around the perimeter	To provide a biological sink and source for wildlife and native plants for proximate wooded areas; provide specialized habitat for core dependant (area sensitive) wildlife	Higher resiliency for natural disasters and invasive pests; increased diversity and protection of area-sensitive species; increased buffer from windblown and shade-intolerant invasive species	Medium
Provide incentives, training, and tools for retention of trees and woodlots on private lands, including through established organizations such as the Brant Woodlot Owner's Association	To reduce pressures for land-clearing on lands to be developed; to increase stakeholder participation in the maintenance of existing trees and encouraging further tree planting; to increase tree health through proper arboricultural maintenance methods	Good relationships with stakeholders; prevention of woodlot/tree owners from the idea that they are bearing the entire cost for environmental services which benefit all citizens; prevention of further tree cover loss; prevention of untimely tree death due to poor maintenance practices	Medium

Recommendations	Goals	Outcome	Priority
Continue to increase tree cover in the City of Brantford on both private and public lands where suitable	To increase from current estimated cover of 20% and contribute to County of Brant's goal of 30% natural cover for a "good" rating[12] and provide better cover for migratory and resident birds and other wildlife	Healthy and sustainable landscape; ensure a diversity of tree ages for forest succession; increase offset to carbon emissions	Medium to Low
Develop wildlife strategy; present wildlife inventory results and wildlife strategies to the public	To decrease potential human/wildlife conflicts	Increased public awareness of methods of dealing with conflicts such as avoidance and tolerance, thus less conflicts	Medium

4.5 MANAGEMENT MONITORING AND EVALUATION

Recognizing that the Management Plan is a dynamic planning document, it should undergo regular reviews based on implementation experience, additional research and feedback from stakeholders. To ensure the plan remains current, it should be updated as soon as possible following these reviews.

Five yearly periodical strategic reviews of the Management Plan are recommended as well as a review if any significant events occur (e.g. the City policy changes, significant study findings, budget amendment, etc.). Operations plan reports and reviews should be a part of annual planning cycle. Figure 9 illustrates the recommended planning cycle.

Evaluation of the results for recognizing achievements and failures is a critical component of a management process. This can often be a very challenging task because it is impossible to track everything and selecting the correct indicators of success and reasonable and inexpensive performance measurement techniques/routines is complicated.

A selection of the proper indicators for monitoring and evaluation is a challenging part of the management process: they should be measurable, representative, and relevant. Table 9 below contains recommended monitoring and evaluation indicators and management success measurement techniques.

[12] *According to Environment Canada, 2004. How Much Habitat is Enough?*

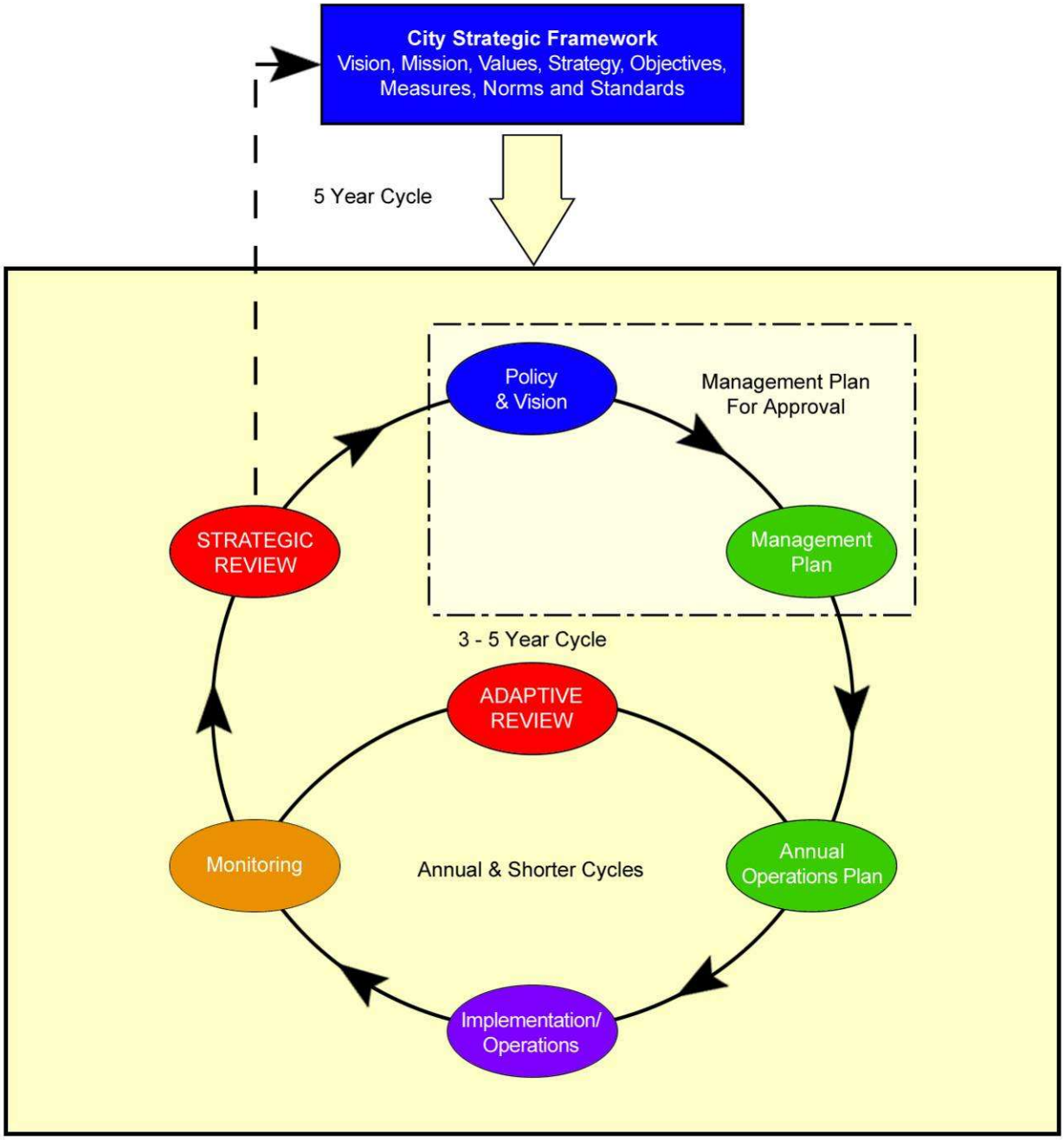


Figure 9: Management Policy and Planning Cycles
(Adapted from "*A Framework for Developing and Implementing Management Plans for South African National Parks*", 2008)

Table 9: Recommended Monitoring and Evaluation Indicators and Measurement Techniques

Evaluated Management Activities/Programs	Objectives	Indicators of Success	Success Measurement Techniques	Frequency
Ecosystem Management				
Vegetation management	To increase woodlots/parks ecological integrity, functions, community benefits	Tree/forest status, species distribution, vegetation health Size of areas of vegetation disturbed by fire, pests, invasives	Regular vegetation surveys	During regular planning cycle
Invasive species control	To increase adaptability and sustainability of woodlot/park ecosystems	Number of invasive species Size of areas of invasive species distribution and domination	Regular vegetation surveys	Seasonally (except winter)
Pest control	To prevent vegetation damage/loss	Decreasing the number of pest registration/outbreaks and influenced areas	Regular vegetation surveys	Seasonally, as needed
Woodlots connectivity/linkage	To increase woodlot integrity, sustainability and benefits	Total magnitude/size and conditions of the linkages and forested areas	Reviews, surveys, inventories	During regular planning cycle
Wildlife management	To increase woodlot/park ecological integrity and opportunities for recreation (e.g. bird watching)	Number of species (including species at risk) and their status Visitor satisfaction	Research, inventories	During regular planning cycle or every 3-5 years

Evaluated Management Activities/Programs	Objectives	Indicators of Success	Success Measurement Techniques	Frequency
Education, Communication and Cooperation				
Involvement of public groups and business in urban forest management	To create a shared vision and increase community support, public awareness, and understand city woodlots value	Number of support groups, programs, events, neighborhood actions and initiatives, increased funding, number of formal cooperation agreements Availability of information for public	Reviews	During regular planning cycle
Education	To increase public knowledge of conservation and urban forests benefits, reduce vandalism and negative effects of unmanaged recreation To increase number of volunteers and public support	Increased knowledge and awareness Decreased number of vandalism incidents Decreased negative effects in certain areas Increased number of volunteers Increased number of public initiatives and funding	Surveys, reviews	During regular planning cycle

Evaluated Management Activities/Programs	Objectives	Indicators of Success	Success Measurement Techniques	Frequency
Economical Benefits				
Economical benefits	To increase economical benefits for the community To use knowledge of benefits value for increasing public support	Number of employees in urban forest sector and connected business (e.g. tourism, sport) Volume of benefits (e.g. property tax increases) Public satisfaction	Research, surveys	5 years
Recreational Management				
Recreation	To increase recreational opportunities	Visitors' satisfaction Number of visitors Number of types of recreational activities and their spatial pattern Development of recreational facilities and infrastructure	Surveys Reviews	During regular planning cycle
Public safety				
Public safety	To maximize visitor and personnel safety	Number of accidents	Reports	During regular planning cycle

Evaluated Management Activities/Programs	Objectives	Indicators of Success	Success Measurement Techniques	Frequency
Scientific Research and Information Management				
Scientific research	To increase level of available information and knowledge for decision-making	Quantity of research, publications and reports undertaken	Reviews, reports	During regular planning cycle
Information management	To increase level of information storage and use	Databases' completeness; number of GIS layers	Reviews, reports	During regular planning cycle
Management Process				
Agencies/department cooperation	The City departments share a common vision and coordinate their efforts	Decreasing of inter-departmental conflicts, formal plan coordination Natural heritage is a priority in the City planning process	Plans overviews and reports Adequate City regulations	During regular planning cycle
Planning process	Adaptive and open to public input Community participation	Scheduled plan development and evaluation Public participation in planning	Plans	During regular planning cycle
Maintenance standards	Regular and appropriate management operations	Number and quality of operational standards for all types of maintenance activities	Reviews and reports	During regular planning cycle

Evaluated Management Activities/Programs	Objectives	Indicators of Success	Success Measurement Techniques	Frequency
Budget	To maintain adequate funding for implementing plans	Increased budget, focusing on key areas. Additional budget (grants, donations, etc.)	Reports	During regular planning cycle
Personnel	Adequate and trained personnel	Planned activities performed properly and according to schedule	Reviews and reports	During regular planning cycle
Management monitoring and evaluation	Ongoing adaptation of management activities based on regular evaluations	Long-term changes in vision, adaptation of management routines	Monitoring and evaluation routines	During regular planning cycle

4.6 COST–BENEFIT ANALYSIS AND BUDGET MANAGEMENT

A cost-benefit analysis for an urban forest management plan is often very challenging. Although maintenance costs can usually be determined, it is difficult to precisely measure the indirect benefits accrued from woodlots (e.g., human health), and direct benefits must be determined by further study (e.g. determination of numbers of recreational users). The following analysis is largely based on expert assessment and comparison to similar cases (e.g. other cities). It provides a starting place for management; however, detailed cost-benefit analysis is not possible with the current information, and benefits are based on value-judgments, which are affected by local interests which change over time and must also be determined and re-evaluated.

4.6.1 Costs

The total sum of all the urban forest management costs consists of direct maintenance costs, management costs, property loss costs (e.g. damage caused by fallen trees), and some indirect costs such as the negative effect of pollen on people's health.

For urban forests and parks, the direct costs can be divided into the following three main groups:

- Cost of tree/vegetation maintenance (planting, removal, pest control, mowing, etc.)
- Administration costs (inspections, administrative management, GIS, public communication, etc.)
- Maintenance/repair of recreational infrastructure and facilities, and related costs (trail maintenance, garbage removal, information materials, fire control, vandalism repair, etc.)

4.6.2 Benefits

The sum of the urban forest economic benefits[13] consists of energy saving value[14], carbon sequestration, the value of improved air and water quality, storm water runoff regulation, added property and property tax value, and other indirect benefits such as the reduction of health service costs and opportunities for recreation and education, and business.

The net economic benefits assessment for urban trees and woodlots are similar in different publications. For example:

- Environment Canada's study of the neighborhood greenbelt in Windsor, Ontario (fact sheet "Community Greenspaces Are Worth Money"

[13] *Urban forest benefits are discussed Section 1.1. Benefits of Urban Forests.*

[14] *Trees reduce the urban heat island effect and decrease the demand for energy. This benefit probably is more applicable to street trees located adjacent to buildings than for woodlots, nevertheless it is applicable for the park as well.*

http://www.on.ec.gc.ca/community/greenspace/intro.html) states that greenspaces significantly increase residential property values (e.g. for the neighborhood examined, the potential increase in property tax was estimated to be eight percent).

- The City of Seattle (Washington, U.S.A.) Urban Forest Management Plan (2007) estimates annual net benefits (US$) as $1 – $8 for a small tree, $19 – $25 for a medium tree, $48 – $53 for a large tree.
- Portland's (Oregon, U.S.A.) Urban Forest Management Plan (2004) states that a large tree can provide $50-$100 (US$) benefits per year with the average annual costs for a residential tree at only $1.
- The City of Vancouver (in Washington, U.S.A., not British Columbia, and has a comparable population to Brantford of approximately 163,000) Urban Forestry Management Plan estimates[15] the value of air pollution removal services by Vancouver's trees each year to be more than $78 million (US$) (17,000 tons of intercepted pollutants) and identifies the urban tree canopy as a means to significantly reduce stormwater runoff. The estimated annualized benefits for the stormwater management provided by Vancouver's tree canopy (based on installation cost of comparable stormwater retention structures) are $12.9 million.
- The City of Regina (Saskatchewan, Canada) Urban Forest Management Strategy estimates economic benefits as providing a cost/benefit ratio of nearly 1:42.

4.6.3 Recommendations

It is best to plan funding requirements based on the cost of specific urban forest management recommendations. Limited guidance is provided by estimating the cost of management activities in a general way. Planned undertakings can often be implemented using very different approaches for which costs will vary dramatically. For example, information/signage can be constructed using various techniques and materials resulting in a range of costs; information materials, web-sites, public events, etc., can be inexpensive or high-priced; some work may be done by volunteers/partners, by "in house" staff with minimal cost and/or by contractors at an increased program cost.

Increasing the management budget will be necessary in order to implement any/all of the recommendations. A few potential ways to increase funding for urban forest management activities are:

- Increase the regular departmental budget (supported by approved management programs and increased public support due to an increased awareness and appreciation of park benefits);
- Increase the participation of volunteers, coop-students and interns;
- Apply for Grants from recreational, environmental and educational sources for special activities and events;

[15] *Based on US Department of Agriculture Forest Service model*

- Partner with governmental agencies, conservation authorities, educational and research institutions, and other publicly funded groups;
- Assess and charge appropriate service fees;
- Effectively use the existing budget based on management monitoring and evaluation (e.g. some activities may not achieve planned results and should be revised or deleted from the program).

5.0 CITY WOODLOTS/NATURAL HERITAGE FRAMEWORK

One of the most challenging problems for urban ecosystems is intensive fragmentation. Parks and woodlots are often isolated and insufficiently connected by "green" linkages. The small size of woodlots impedes their sustainability and does not support ecological functions such as wildlife migration and habitat.

According to Schedule B of the City of Brantford By-Law Number 171-2002 (Figure 10) there are 92 private woodlots (667 acres) located within Environmental Policies and 51 other woodlots (181 acres).

Providing linkages and integrating the mosaic of natural areas into a holistic natural heritage framework, is one of the core principals of landscape ecology for disturbed areas.

5.1 INCREASING WOODLOTS CONNECTIVITY: RECOMMENDATIONS

Recommendations	Goals	Outcome	Priority
Connectivity of natural areas (including those located on private lands) by linkages and corridors should be one of the priorities of the City's natural heritage management according to Section 5.6 of the City Official Plan[16].	Integration of connectivity planning in the decision making process	Increased opportunity for linkages design and protection	High
A heritage network inventory and a feasibility study including linkage corridors are recommended. Lands in most important areas of existing green corridors or their prospective locations should be reserved for the City's natural heritage network[17]. As well, adjacent land uses should be complimentary or have policies which reduce development pressure and negative impacts (for example, requiring natural vegetation retention on estate-sized lots where clearing is uneccessary for building and services)	Understanding feasibility of linkage system Preservation of potential parts of the natural heritage network	Linkage areas preliminary design plan	High

[16] *Section 5.6.1 of the Official Plan: "A connected system of public and private parks and open spaces is a integral element of the City's urban structure and will be encouraged wherever possible".*

[17] *See Section 5.6.2 of the Official Plan.*

Recommendations	Goals	Outcome	Priority
Sustainable management of the City's woodlots should be generally based on the same principals as recommended for Waterworks Park taking into account specific environmental conditions, history, size, existing vegetation, invasive species effect on the biodiversity, recreational functions, etc.	Consistent and effective management for all City woodlots	Consistent planning and management, unified system of management procedures	High
Identification and protection of existing linkages between natural heritage areas as well as identification of and design of new linkages should be a part of development design/control and Environmental Assessment/Impact Assessment[18] processes.	Integration of connectivity protection in planning process	Preservation of existing linkages. Increasing opportunity for linkage design and protection	High
Woodlot landowners should be encouraged to provide good stewardship using opportunities and funding from specific support programs of MNR, other governmental agencies, conservation authorities, and NGOs.	Use of opportunities to increase the connectivity on private lands	Increased connectivity and linkage opportunities	High
Increasing the size of the City's forested areas should be one of the priorities of natural heritage management.	Increasing the City's natural heritage sustainability and benefits	More sustainable natural areas/parks and increased ecological function	Medium-High
Natural heritage management should take into account potential negative effects of increasing connectivity (e.g. raising opportunities for invasive species/ diseases through monoculture, fire to spread through bigger areas by reduction of fuel through controlled burns, decrease wildlife/vehicle collisions through ecopassages, etc.).	Proper natural heritage planning	Minimal negative effects of connectivity linkages	Medium

[18] *The City Official Plan requires that an Impact Assessment be prepared when development is proposed within Environmental Control Policy Areas an in adjacent lands to Environmental Protection Policy Areas and Environmental Control Policy Areas (Appendix III to the Official Plan of the City of Brantford: Impact Assessment Guidelines).*

Recommendations	Goals	Outcome	Priority
Utility corridors and road right-of-ways can be used as potential linkages with consideration for specific functional requirements and regulations.	To use opportunities to make utility corridors more “green”	Increased size of the connectivity linkages	Medium
Treed corridors are preferred (as most ecologically functional) to linkages with shrubs and/or ground cover.	To increase ecological function of linkages	Increased ecological benefits	Medium

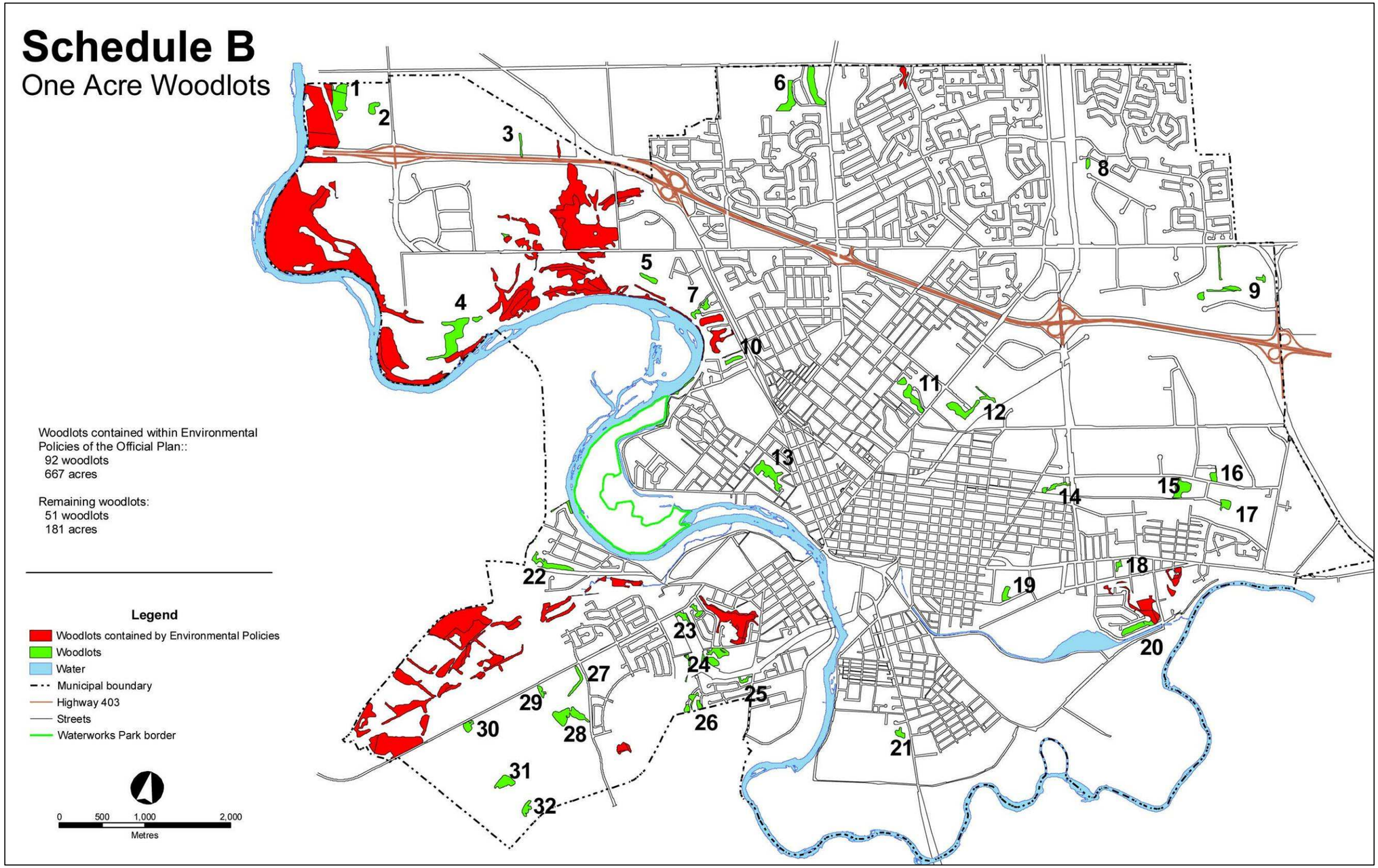


Figure 10: The City of Brantford Woodlots (By-Law No.: 171-2002, Schedule B)

6.0 LIMITATION OF REPORT

This report has been prepared pursuant to a contract with the City of Brantford and is for the sole use of the City of Brantford for the sole purpose of use for sustainable management of woodlots. Morrison Hershfield Limited, its servants, employees, officers, or agents accepts no responsibility to any person or entity other than the City of Brantford in connection with this report.

Morrison Hershfield Limited has conducted this study and developed the report using documentation of the date and version provided by the City of Brantford and/or its consultants. Morrison Hershfield Limited, its servants, employees, officers, or agents accepts no responsibility to any person or entity for information, documented or otherwise, developed by the City of Brantford and/or its consultants that differs in date or version from the documentation provided, or for documentation not provided to Morrison Hershfield Limited.

Morrison Hershfield Limited, its servants, employees, officers, or agents accepts no responsibility to any person or entity for the use of this report in conjunction with any other process including but not limited to any review, negotiation, agreement, endorsement or approval, that Morrison Hershfield Limited has not participated in fully and received full disclosure.

7.0 REFERENCES

Brantford's Community Strategic Plan. City of Brantford, 2006.

City of Brantford By-Law Number 171-2002

City of Brantford – Growth Management Strategy. 2006.

The Corporation of the City of Brantford Parks and recreation Master Plan. Monteith Planning Concultants in assossiation with The JF Group, 2003.

Environment Canada, 2004. *How Much Habitat is Enough?* Second Edition. Accessed at http://www.on.ec.gc.ca/wildlife/factsheets/fs_habitat-e.html.

A Framework for Developing and Implementing Management Plans for South African National Parks, 2008

Idle, E.T., Bines T.J.H. Eurosite management planning toolkit. A handbook for practitioners, 2004.

The Official Plan of the City of Brantford. 2005 consolidation.

A Watershed Forest Plan for the Grand River. Grand River Conservation Authority, 2004.