



Region of Waterloo

Regional Forest Management Plan: Overview and Approach 2007-2026



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1.0	Executive Summary	5
1.1	Policy Context of the Regional Forest Management Plan	6
1.2	Structure of the Regional Forest Management Plan.....	8
2.0	Background.....	9
3.0	Forest Management and the Need for a Forest Management Plan.....	9
3.1	Purpose and Scope of the Regional Forest Management Plan.....	11
3.2	Structure of the Regional Forest Management Plan.....	12
3.3	Policy Context of the Regional Forest Management Plan	12
3.4	Forest Sustainability Certification and Sustainable Forest Management.....	15
3.5	Goals	16
4.0	General Description of Regional Forest Properties	18
4.1	Property Location, Area and Status.....	18
4.2	Physical Environment	18
4.3	Past Operations	20
4.4	Forest Protection	21
4.5	Financial and Economic Considerations.....	24
5.0	Forest Resource Inventory.....	26
5.1	Inventory Procedures and Results.....	26
5.2	Regional Forest Data Sheets.....	26
5.3	Forest Stands and Working Groups	27
5.4	Forest Site Productivity	29
5.5	Forest Age Classes	30
5.6	Wetlands and Water bodies.....	30
5.7	Significant Plant Species and Habitats	30
5.8	Fish Habitat.....	30
5.9	Significant Wildlife Species and Habitats.....	31
6.0	Public and Stakeholder Consultation	32
7.0	Forest Management Issues	33
7.1	Ecological Management	33
7.2	Stand Management	34
7.3	Recreational Impacts	35
7.4	Education and Research	36
7.5	Agriculture.....	36
7.6	Financial Considerations	37
8.0	Property Management Issues	38
8.1	Property Boundaries	38
8.2	Gates	38
8.3	Parking Lots.....	38
9.0	Forest Management Plan.....	40
9.1	General Provisions	40
9.2	Guiding Principles & Operational Guidelines.....	45
9.3	Forest Management Implementation	50
9.4	Forest Monitoring.....	53
10.0	Management Plans for Individual Tracts.....	54
11.0	References.....	55

12.0 Tables 56

13.0 List of Acronyms 74

14.0 Flora Species List 75

15.0 Fauna Species List 76

16.0 Glossary of Technical Terms 77

1.0 Executive Summary

From 1961 to 2001 management of nine Regionally owned forest properties was undertaken by the Ministry of Natural Resources under their Agreement Forest program. Management goals and objectives were based on standards set by provincial foresters in consultation with the Region with the subsequent management planning and activities being carried out by MNR field staff. Under the Agreement Forest program, management costs were initially covered by the MNR and reimbursed by the revenue generated through timber harvesting. With a change in Provincial policy, Ministry restructuring and downsizing, the Agreement Forest program was phased out, and in 2001, responsibility for Regional Forests was turned over to the Regional Municipality of Waterloo. This management plan is the first major step in the realization of active ownership by the Region.

In September 2001 the Region of Waterloo's Ecological and Environmental Advisory Committee (EEAC) developed a Terms of Reference for the purposes of preparing a Management Plan for the Region's 16 Regional Forest and Woodland properties. GWS Ecological & Forestry Services Inc. (GWS) was retained in January 2002 to undertake a forest resource inventory of the properties and to begin preparation of a comprehensive Regional Forest Management Plan (RFMP) for these properties. The forest resource inventory was completed in the summer of 2002 and detailed property maps, including area calculations, were finalized by Regional staff during the fall of 2002. Field data were recorded on wildlife utilization, botanical resources, recreational usage and property maintenance issues. Additional information on the natural features and recreational and educational activities occurring on Regional Forests was extracted from various background documents supplied by the Region. Further details on these matters were obtained from concerned individuals and special interest groups.

GWS, in consultation with Regional staff and EEAC, prepared a draft forest management plan which was then revised by Regional staff in conjunction with EEAC. Since public concerns play an important role in the decision making process, the Regional Municipality of Waterloo also presented the draft management plan at several open houses held during the spring of 2006. Public concerns and comments were taken into consideration in the preparation of the final draft of this plan. Additional input will be sought through public consultation in the preparation of site specific operational plans on a property by property basis.

Traditionally, forests have been seen as producing economically valued materials such as timber, maple syrup, and game. Such products lend themselves readily to measurement and quantification. Today, however, within urban and urbanizing areas such as the Region of Waterloo, forests are valued more in terms of the non-consumptive services and values they provide to society. These include:

- opportunities for passive recreation (i.e. walking, bird-watching, bicycling);
- enhancement of property values;
- aesthetically pleasing landscapes;
- moderation of urban "heat island effects" through shading and cooling; and
- improvement of urban air quality by trapping pollutants and the release of oxygen

Even less tangible products and services of forests are the ecological processes and conditions such as groundwater recharge and natural areas of plant and animal habitat which provide indirect benefits such as clean drinking water and homes for native plants and animals that are unable to exist in close proximity to human development. Many of the forest tracts in Waterloo Region have been designated Environmentally Sensitive Policy Areas (ESPAs) which places a priority on ensuring the continuing health and ecosystem function of the forest. Management activities

designed to maintain or enhance forest ecosystem health and function do not always maximize timber production.

Although the Regional Official Policies Plan (ROPP) lists one of the goals for the Regional Forests as "timber production according to sustainable forest management practices," timber management for its own sake is **not** seen as an acceptable goal in publicly owned woodlands. In the approach taken by this management plan the following factors means that that timber will be a by-product rather than the primary product of forest management:

- The limited total area of individual forest tracts and indeed of the entire network,
- the designation of most of the Regional Forest tracts as ESPAs, and
- the other stated goals for the Regional Forests.

1.1 Policy Context of the Regional Forest Management Plan

The Regional Forest Management Plan integrates the management of the forest for "forestry purposes," as defined in The Forestry Act, with other relevant federal and provincial legislation, provincial and Regional policies and documents. The Regional Official Policies Plan (ROPP) lists the objectives for managing the Regional Forest system in order of priority:

- a) The conservation or enhancement of significant natural features and functions, particularly where Regional Agreement Forests lie within the Natural Habitat Network or exhibit "Carolinian forest", old growth, or interior habitat attributes;
- b) Passive recreation including trails for nature appreciation, hiking and cross-country skiing;
- c) Outdoor education and research;
- d) Timber production according to sustainable forest management practices; and
- e) Hunting, fishing, horse-back riding and mountain biking where expressly permitted.

The policy concludes with the statement "*Notwithstanding the above, it is recognized that trees and other vegetation may be removed, or destroyed by authorized cutting or burning to achieve the above objectives.*"

Based on the interpretation of the ROPP policy, the goals and objectives for the Regional Forest Management Plan have been established as follows:

Management Goal

To conserve, enhance, and where feasible, restore woodland ecosystems to reflect the native biodiversity of the respective parts of the Region of Waterloo in which the Regional Forest tracts are located while at the same time accommodating appropriate recreational, educational, social activities which do not jeopardise the health or sustainability of the forests.

Ecological Objectives

- To place the highest level of protection, conservation and management on Regional Forests that contain: ESPAs, Significant Woodlands, or other parts of the Natural Habitat Network.
- To conserve native species and habitats representative of the Region's native biodiversity with particular attention to habitats and species within Regional Forests that exhibit any of the following characteristics: Carolinian habitat, Old Growth trees and Woodlands, Rare Species, Significant Wildlife Habitat, Interior Forest Habitat, Wetlands, Groundwater Recharge/Discharge Zones,

High Quality Forest Habitat, Slopes and Valleys, Creeks and Streams, Locally Significant Species, Wildlife Corridors, Unusual Habitat.

- To maintain and enhance healthy, sustainable forest ecosystems with a range of successional stages and diversity of forest communities.
- To restore plantations with low vigour and low ecological function to healthy woodlands consisting of representative native species.
- To carry out active management activities using suitable techniques including ecological restoration and silvicultural prescriptions (i.e. tree cutting, prescribed burning), and where feasible implement measures to control or eradicate introduced species that threaten the health and integrity of Regional Forests.

Social and Educational Objectives

- To provide recreational opportunities and visitor facilities which do not damage native vegetation and wildlife habitat, impair the productivity of the forest, degrade soil or water, or cause conflict with other users or adjoining property owners.
- To demonstrate examples of good forestry practice in order to promote good woodland stewardship on private and public lands.
- To use the forests to promote greater understanding and appreciation of woodland ecosystems by the public at large.
- To provide opportunities for *bona fide* ecological and forestry research provided it does not jeopardise significant species or habitats or the sustainability of the forest.
- To provide for effective public consultation in the formulation and implementation of management objectives.

Legal Objectives

- To maintain forests in such a manner as to prevent potential threats to the health and safety of users.
- To ensure that management activities in Regional Forests conform to applicable federal, provincial, and municipal legislation and policy.

Economic Objectives

- To develop realistic capital and operating budgets for the forest system.
- To obtain a fair economic return from the sale of any forest products or other services that may result from management activities.

The goals and objectives for the Regional Forests lean more toward ecological and social values than economic. While economic returns will be considered, decisions will be based primarily on improving forest health and stand quality over the longer term. This may well result in trees of lower economic value being cut for firewood rather than higher quality trees being taken for sawlogs or veneer logs. It is, however, recognized that it is difficult to put an economic valuation on aesthetics, ecosystem function or educational opportunities. By taking this approach, the Region of Waterloo will be able to demonstrate good forestry practices and a sound stewardship ethic. In fact, it is proposed that parts of several of the Regional Forests (Doon, Sandy Hills) be used as forest management demonstration sites with the management activities being conducted in co-operation with the Waterloo-Wellington Woodlot Owner's Association and the Waterloo Stewardship Network.

1.2 Structure of the Regional Forest Management Plan

The entire Regional Forest Management Plan will consist of several modules. This document:

- provides a general overview of forest management as it applies to the Regional Forests;
- presents the philosophical and policy approach being taken;
- discusses forest and property management issues;
- provides general information about the overall Regional Forest system;
- articulates the goals and objectives to be pursued over the term of the plan; and
- provides guiding principles and operating guidelines for all management activities.

This document does not present operational details regarding specific stand management activities, nor does it detail the property management activities that are required. All management activities will be dealt with in a series of five-year operating plans that will outline priorities and general schedules. The five-year operating plans will be further fleshed out in one-year plans that will contain site and stand specific details including the silvicultural prescriptions (e.g. harvesting details, planting, vegetation controls etc.) and budget items. The five-year plans will be presented for Council approval prior to implementation.

2.0 Background

From 1961 to 2001 management of nine Regionally owned forest properties was undertaken by the Ministry of Natural Resources under their Agreement Forest program. Management goals and objectives were based on standards set by provincial foresters in consultation with the Region with the subsequent management planning and activities being carried out by MNR field staff. Under the Agreement Forest program, management costs were initially covered by the MNR and reimbursed by the revenue generated through timber harvesting. With a change in direction from service delivery to “servicing relationships” as well as through Ministry restructuring and downsizing, the Agreement Forest program was phased out, and in 2001, responsibility for Regional Forests was turned over to the Regional Municipality of Waterloo. This management plan is the first major step in the realization of active ownership by the Region.

In September 2001 the Region of Waterloo’s Ecological and Environmental Advisory Committee (EEAC) developed a Terms of Reference for the purposes of preparing a Management Plan for the Region’s 16 Regional Forest and Woodland properties. GWS Ecological & Forestry Services Inc. (GWS) was retained in January 2002 to undertake a forest resource inventory of the properties and to begin preparation of a comprehensive Regional Forest Management Plan (RFMP) for these properties.

The forest resource inventory was completed in the summer of 2002 and detailed property maps, including area calculations, were finalized by Regional staff during the fall of 2002. Field data were recorded on wildlife utilization, botanical resources, recreational usage and property maintenance issues. Additional information on the natural features and recreational and educational activities occurring on Regional Forests were extracted from various background documents supplied by the Region. Further details on these matters were obtained from concerned individuals and special interest groups.

GWS, in consultation with Regional staff and EEAC, prepared a draft forest management plan which was then revised by Regional staff in conjunction with the Regional Forest Management Plan subcommittee of EEAC. Based upon feedback received, this Plan underwent a series of revisions before being presented to Regional Council. Since public concerns play an important role in the decision making process, the Regional Municipality of Waterloo also presented the draft management plan at several open houses held during the spring of 2006. Public concerns and comments were taken into consideration in the preparation of the final draft of this plan. Additional input will be sought through public consultation in the preparation of site specific operational plans on a property by property basis.

3.0 Forest Management and the Need for a Forest Management Plan

Traditionally, the focus of forest management activities was the production of forest products, namely timber. The Dictionary of Natural Resource Management (Dunster and Dunster 1996) defines timber management as:

The activity involving the allocation of forested lands for harvesting of the timber on that land. Timber management may involve planning, road-building, logging, extraction of merchantable timber for processing off-site and varying intensities of silvicultural activity to encourage another stand of trees to grow back.

The definition concludes with the statement that while “timber management is an important subset of forest management, it is not an equivalent activity.” Forest management is:

The practice of applying scientific, economic, philosophical, and social principles to the administration, utilization, and conservation of all aspects of forested landscapes to meet specified goals and objectives, while maintaining the productivity of the forest. Forest management includes the subset of activities known as timber management, but also involves planning and managing forested landscapes for fish and wildlife, biological diversity, conservation measures, parks, wilderness, recreation, and aesthetic values. Forest management is an all-encompassing activity and is not to be confused with the more restrictive activities associated with timber management. (Dunster and Dunster, 1996)

Traditionally, forests have been seen as producing economically valued materials such as timber, maple syrup, and game. Such products lend themselves readily to measurement and quantification systems which track inventory, growth and yield, as well as removal and replacement processes (natural or artificial). Forest management as a scientific endeavour was developed in Europe in the mid to late 1800s by economists interested in regulating forest development to ensure a predictable and orderly flow of products, particularly timber.

Today, within urban and urbanizing areas such as the Region of Waterloo, forests are valued more in terms of non-consumptive services and values they provide to society. Among the “forest products” enjoyed by many members of society are:

- opportunities for passive recreation (i.e. walking, bird-watching, bicycling);
- enhancement of property values;
- aesthetically pleasing landscapes;
- moderation of urban "heat island effects" through shading and cooling; and
- improvement of urban air quality by trapping pollutants and the release of oxygen

Even less tangible, but nonetheless products of forests are the ecological processes and conditions such as groundwater recharge and natural areas of plant and animal habitat which are responsible for providing indirect benefits such as clean drinking water and homes for native plants and animals that are unable to exist in close proximity to human development.

Ensuring that such services and values are maintained is complicated by the fact that they are often less easily quantified (in terms of amounts and economic value) than the more traditional ones and, indeed, often conflict with extractive activities such as timber harvesting.

The management of forest resources is a complex process as forests are made up of smaller vegetation units referred to as "stands" that can be characterized by size, tree species mixtures, and disturbance history. Stands are defined as “a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit” (Helms, 1998). The number and arrangement of stands within a forest can be seen as a collage of states and conditions of both biotic (living) and abiotic (non-living) components.

Similar forest stand types may be found at different locations across the landscape or in different stages of development which gives forests both spatial and chronological attributes. Because of the range in stand attributes, it is important to know the make up and distribution of all of the forest’s components before any forest management activities are undertaken. Since trees as individuals and groups (stands) will react in different ways to silvicultural treatments or interventions depending on species, age and site conditions, it is important to understand the consequences of forest management actions on forest development.

Forest management planning begins by characterizing the present condition of the forest and then developing a series of activities designed to satisfy the owner's long-term goals. Forest management planning includes the following:

- Developing a realistic and achievable set of goals and objectives for the forest;
- Conducting an inventory of the forest and mapping and cataloguing the various stands and features;
- Re-evaluating the goals and objectives for management based on inventory and current/local conditions (e.g. forest product markets, processing capabilities of local mills);
- Developing and organizing a series of interventions and activities to take place at different times and places based on current forest/stand conditions and desired outcomes;
- Ensuring that sensitive and significant site features are protected and that mitigation measures are employed in the event that damage to trees or occurs;
- Developing a monitoring program to ensure that the forest develops as intended; and
- Making provisions for corrective actions in the event that forest development proceeds along an undesirable trajectory.

The intent of a forest management plan is to ensure that interventions and activities are scheduled in such a way that the owner's goals and objectives are met. As result, a forest management plan needs to contain both strategic and tactical components with long-range aspirations being balanced by specific on-the-ground actions including restoration activities, silvicultural operations for harvesting and regeneration, and trail development (if desired).

A forest management plan provides the forest owner a template for monitoring the growth and development of the forest. If it appears over time that forest development is not proceeding along the desired pathway, corrective measures or perhaps a re-evaluation of the objectives may be required.

To ensure that the ecological health and function of forest stands is not compromised by forestry activities is also part of an ongoing monitoring program specified within the forest management plan. If it appears that an activity that has been undertaken within the forest is resulting in an undesired development pattern (i.e. it does not conform to the goals or objectives), mitigation measures may have to be taken to restore the stand or forest onto an acceptable developmental pathway or that some planned activities may have to be re-evaluated.

In summary, a forest management plan is a mechanism by which a landowner organizes and coordinates all the elements required to realize the long and short term goals for his or her forest property.

3.1 Purpose and Scope of the Regional Forest Management Plan

Under the MNR Agreement Forest program, forest management was focused on timber production with other forest values being afforded lower priority. This was in keeping with the direction provided by the provincial Forestry Act which defines forestry purposes as “the production of wood and wood products, provision of proper environmental conditions for wildlife, protection against floods and erosion, recreation and protection and production of water supplies.” Today, resource managers in urbanizing areas like Region of Waterloo are required to take into account a wider range of interests and integrate multiple forest values into management plans. In fact, there are a number of cases in which management activities may be specified that are not very conducive to the production of marketable products. For example, many of the forest tracts in Waterloo Region have been designated Environmentally Sensitive Policy Areas (ESPAs) which places a priority on ensuring the continuing health and ecosystem function of the forest. Management activities designed to maintain or enhance forest ecosystem health and function do not always maximize timber production.

Although the Regional Official Policies Plan (ROPP) lists one of the goals for the Regional Forests as "timber production according to sustainable forest management practices," timber management for its own sake is **not** seen as an acceptable goal in publicly owned woodlands. In the approach taken by this management plan the following factors means that that timber will a by-product rather than the primary product of forest management:

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3.2 Structure of the Regional Forest Management Plan

The entire Regional Forest Management Plan will consist of several elements or modules. This document:

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3.3 Policy Context of the Regional Forest Management Plan

The Regional Forest Management Plan integrates the management of the forest for "forestry purposes," as defined in The Forestry Act, with other relevant federal and provincial legislation, provincial and Regional policies and documents which are discussed below.

3.3.1 Federal Legislation

Migratory Birds Conservation Act (1994).

The Migratory Bird Convention Act (MBCA) implements a 1916 treaty between Canada and the United States, in which the two countries agreed to adopt a co-ordinated system to protect migratory birds from indiscriminate harvesting and destruction. While the MBCA was originally intended to prevent the poaching (i.e. the deliberate killing of birds outside of established hunting seasons), and egg collecting of migratory bird species, recently it has also been interpreted to also include the protection of habitat during specified breeding seasons. While construction activities have been specifically cited as potential causes of habitat destruction, forest management activities can also be placed into this category. As part of the forest management planning process in the Regional forests, due diligence will be taken to protect migratory bird birds from harm during all silvicultural activities.

Fisheries Act (1985)

The federal Fisheries Act defines fish habitat as: “spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes.” Hence, these habitats include the quantity and quality of water in streams, rivers and lakes, as well as the total surroundings in which plants and other life forms interact to make life possible for fish.

Fish habitat is to be protected from Harmful Alteration, Disruption or Destruction (HADD) which has been defined by the Department of Fisheries and Oceans (DFO 1998) as: “any change in fish habitat that reduces its capacity to support one or more life processes of fish.” Public bodies and private landowners are required to comply with the DFO’s 1986 Policy for the Management of Fish Habitat which articulates its primary goal as fish habitat conservation, under the guiding principle of “no net loss in the productive capacity of habitats.” Other goals of the policy are fish habitat restoration and the development or improvement of fish habitat. Administration of the Fisheries Act and its implementing policy is carried out by the DFO in consultation with the GRCA. However, any work around water that could affect stream flow, channel configuration or flood storage (e.g. installation of culverts or bridges etc.) would likely require a permit from MNR under *The Public Lands Act* or *The Lakes and Rivers Improvement Act*, and/or a permit from the GRCA. Any forestry activities must therefore be carried out in ways that do not cause negative impacts on fish habitat or the hydrological regime of natural waterbodies.

3.3.2 Provincial Policy Statement

The Provincial Policy Statement (PPS) came into effect on March 1, 2005 under the authority of Section 3 of the Planning Act. The PPS provides policy direction on matters of provincial interest related to land use planning and development through municipal Official Plans and the processing of development applications. While not technically subject to the PPS this plan seeks generally to be consistent with the Natural Heritage Policies relevant to the Region of Waterloo’s Regional Forests.

While the PPS does not impose limitations on the implementation of normal forestry activities, it may have relevance to certain kinds of recreational developments and/or activities commonly undertaken in forested areas that could potentially have a negative impact on significant ecological features and functions.

3.3.3 Regional Official Policies Plan

Developed under the guidance of the PPS, the Regional Official Policies Plan (ROPP) contains many policies which address municipal concerns. The ROPP contains the environmental and resource policies to which the RFMP must conform.

Policy 5.4.6 of the ROPP lists the objectives for managing the Regional Forest system in order of priority:

- a) The conservation or enhancement of significant natural features and functions, particularly where Regional Agreement Forests lie within the Natural Habitat Network or exhibit "Carolinian forest", old growth, or interior habitat attributes;
- b) Passive recreation including trails for nature appreciation, hiking and cross-country skiing;
- c) Outdoor education and research;
- d) Timber production according to sustainable forest management practices; and

- e) Hunting, fishing, horse-back riding and mountain biking where expressly permitted.

The policy concludes with the statement “*Notwithstanding the above, it is recognized that trees and other vegetation may be removed, or destroyed by authorized cutting or burning to achieve the above objectives.*”

In recent years, the Region’s EEAC has discussed appropriate management objectives for Regional Forests, and in particular the application of Policy 5.4.6. The basic question is whether the stated priorities in the policy should be applied to each woodland individually or to the Regional woodland system as a whole. If the former, then proposals to harvest timber or enhance mountain biking opportunities might be considered to be inappropriate for any tract. If the latter, environmental conservation would be the overriding goal for the system, with consideration given to timber management or more active recreational uses in tracts that do not exhibit high ecological values. For example, a number of tracts located within ESPAs or near Provincially Significant Wetlands contain conifer plantations, many of which are low in vigour and ecological function and/or value. On the other hand, Walker Woods is not an ESPA, but exhibits high ecological values as it has been managed for maple sap production and the presence of old sugar maples. This provides a rationale to argue against using a blanket approach to forest management with respect to conservation, recreation, and timber management. While the overall priority for managing the Regional Forests should remain conservation, it may be argued that it is appropriate to make this a lesser priority in some of the tracts where recreation or timber production can produce a greater benefit to the public. This approach will be taken in determining goals for the whole system of Regionally owned woodlands.

Furthermore, ROPP Policy 5.4.7 states that “The Region will encourage good stewardship practices to manage public and private woodlands on an ecosystem basis, which not only recognizes the economic value of the timber, but also acknowledges the importance of woodlands as groundwater recharge areas and habitat for wildlife and vegetation.” In early 2003, a sub-committee of the EEAC wrote that because Waterloo Region is an urbanizing area and because the Region develops municipal planning policy for the protection of woodlands within the Region, it should be a leader in developing a model forest management program that embodies the broader ideals of forest management and serves as an example for other public and private sector woodland owners.

As many of the Regional Forests are located within ESPAs they fulfil some of the criteria listed in ROPP Policy 4.3.2. The intent of the ESPA policies is to protect the areas from “adverse environmental impacts” associated with development. The ROPP defines adverse environmental impacts as:

Changes likely to arise directly or indirectly from development within or contiguous to an element of the Natural Habitat Network that result in widespread, long-term, or irreversible degradation of the significant features or impairment of the natural functions of the designated area.

Adverse environmental impacts on elements of the Natural Habitat Network include: fragmentation; significant increase in perimeter-to-area ratios; disruption of corridors and ecological linkages; disruption of ecological relationships; alteration of the structure, functions, or ecological interrelationships of a natural habitat which sustain representative community associations or populations of significant species; compaction or trampling of soils; and increased potential for the introduction of invasive non-native species.

This argues for a careful approach to identifying the environmentally significant features and functions of the respective Regional Forests. Forest management operations and the

development of trails and visitor parking lots should not result in adverse environmental impacts within the Natural Habitat network of which the Regional Forests are an important element.

3.3.4 Grand River Conservation Authority Wetland Policy

In 2003, the Grand River Conservation Authority (GRCA) adopted a new wetland policy to protect wetlands not designated as Provincially Significant Wetlands. In the case of the Regional Forest Management Plan, the wetland policy would apply to any forest lands located such that management activities require work to occur adjacent to or within wetlands. In all such instances the appropriate work permits will need to be applied for prior to commencement of activities.

3.3.5 Regional Tree By-law

The Regional Tree By-law (By-law 05-078) sets minimum standards for tree cutting in “woodlands,” as defined in the By-law. All of the Regional Forests qualify as woodlands. Normally, the By-law prohibits the felling of under-sized trees, or cutting that reduces the basal area (stocking) of the woodland below 15 square metres per hectare (15 m²/ha). The By-law does, however, provide for forestry operations outside these guidelines provided it is done according to “good forestry practices.” In keeping with the recommendation of the EEAC subcommittee, any tree cutting in Regional Forests will be according to good forestry practices rather than the minimum standards of the Regional Tree By-law. By doing so, the Region will set a good example of woodland stewardship and be a leader in developing a model forest management program.

3.4 Forest Sustainability Certification and Sustainable Forest Management

Forest certification is a process by which the performances of on-the-ground forestry operations are assessed against a predetermined set of standards. There are three certification standards currently in use in Canada.

The Forest Stewardship Council's Principles and Criteria for Forest Management provide a foundation for the development of region-specific forest-management standards. Independent certification bodies, accredited by the Forest Stewardship Council (FSC) conduct impartial, detailed assessments of forest operations at the request of landowners. If the forest operations are found to conform to FSC standards, a certificate is issued, enabling the landowner to bring product to market as "certified wood", and to use FSC trademark logo.

In Canada, the Canadian Standards Association (CSA) has developed operating standards for a wide variety of industries. In response to heightened awareness in forest management practices, the CSA developed Canada's National Standard on Sustainable Forest Management Standard, CAN/CSA Z809. The Sustainable Forest Management (SFM) approach is designed to "maintain and enhance the long-term health of forest ecosystems for current and future generations". The CSA Standard Z809 for sustainable forest management takes into account environmental, social and economic factors. Under the CSA Standard, continual improvement is necessary in all aspects of forest management and public participation is required throughout the planning process. Agencies seeking CSA certification must make practical demonstrations that their forest management practices are sustainable, and prove their long-term commitment to those practices.

A third certification standard used in Canada is the Sustainable Forestry Initiative (SFI) program. The SFI which was adopted as an official standard by the American Forest & Paper Association (AF&PA), integrates silvicultural activities with the protection of wildlife, plants, soil and water quality

and a wide range of other conservation goals. Environmental principles, objectives and performance measures are reviewed and evaluated relative to the protection and conservation goals by an external review panel comprising representatives from the environmental, professional, conservation, academic and public sectors.

While it may not be necessary to obtain certification for the Regional Forests as a marketing approach due to limited quantities of marketable products, it may be of some value to have the management assessed against the FSC and CSA standards to demonstrate the validity of the practices being used and to set an example for other private and public woodland owners.

3.5 Goals

Based on the interpretation of the ROPP policy, the goals and objectives for the Regional Forest Management Plan have been established as follows:

Management Goal

To conserve, enhance, and where feasible, restore woodland ecosystems to reflect the native biodiversity of the respective parts of the Region of Waterloo in which the Regional Forest tracts are located while at the same time accommodating appropriate recreational, educational, social activities which do not jeopardise the health or sustainability of the forests.

Ecological Objectives

- To place the highest level of protection, conservation and management on Regional Forests that contain: ESPAs, Significant Woodlands, or other parts of the Natural Habitat Network.
- To conserve native species and habitats representative of the Region's native biodiversity with particular attention to habitats and species within Regional Forests that exhibit any of the following characteristics: Carolinian habitat, Old Growth trees and Woodlands, Rare Species, Significant Wildlife Habitat, Interior Forest Habitat, Wetlands, Groundwater Recharge/Discharge Zones, High Quality Forest Habitat, Slopes and Valleys, Creeks and Streams, Locally Significant Species, Wildlife Corridors, Unusual Habitat.
- To maintain and enhance healthy, sustainable forest ecosystems with a range of successional stages and diversity of forest communities.
- To restore plantations with low vigour and low ecological function to healthy woodlands consisting of representative native species.
- To carry out active management activities using suitable techniques including ecological restoration and silvicultural prescriptions (i.e. tree cutting, prescribed burning), and where feasible implement measures to control or eradicate introduced species that threaten the health and integrity of Regional Forests.

Social and Educational Objectives

- To provide recreational opportunities and visitor facilities which do not damage native vegetation and wildlife habitat, impair the productivity of the forest, degrade soil or water, or cause conflict with other users or adjoining property owners.
- To demonstrate examples of good forestry practice in order to promote good woodland stewardship on private and public lands.

- To use the forests to promote greater understanding and appreciation of woodland ecosystems by the public at large.
- To provide opportunities for *bona fide* ecological and forestry research provided it does not jeopardise significant species or habitats or the sustainability of the forest.
- To provide for effective public consultation in the formulation and implementation of management objectives.

Legal Objectives

- To maintain forests in such a manner as to prevent potential threats to the health and safety of users.
- To ensure that management activities in Regional Forests conform to applicable federal, provincial, and municipal legislation and policy.

Economic Objectives

- To develop realistic capital and operating budgets for the forest system.
- To obtain a fair economic return from the sale of any forest products or other services that may result from management activities.

In short, the goals and objectives for the Regional Forests lean more toward ecological and social values than economic. This is not to say that economic returns will not be considered, but rather that decisions will not be made based primarily on an economic basis. In some instances, in the interests of improving forest health and stand quality over the longer term, this may well result in trees of lower economic value being cut for firewood rather than higher quality trees being taken for sawlogs or veneer logs. It is, however, recognized that it is difficult to put an economic valuation on aesthetics, ecosystem function or educational opportunities. By taking this approach, the Region of Waterloo will be able to demonstrate good forestry practices and a sound stewardship ethic. In fact, it is proposed that parts of several of the Regional Forests (Doon, Sandy Hills) be used as forest management demonstration sites with the management activities being conducted in co-operation with the Waterloo-Wellington Woodlot Owner's Association and the Waterloo Stewardship Network.

4.0 General Description of Regional Forest Properties

4.1 Property Location, Area and Status

The Regional Municipality of Waterloo covers 133,600 hectares with the 16 Regional Woodland properties comprising 435.4 hectares or approximately 0.3% of the total area. The majority of the Regional Forest properties are located in the southern half of the Region, particularly in the Townships of North Dumfries and Wilmot, and the Cities of Cambridge and Kitchener (Figure 1). Slightly more than half of the Regional Forests were acquired under the Agreement Forest Program between 1944 and 1984 (Table 1). After the Region was created in 1973, other properties containing woodlands were gradually acquired for a variety of purposes other than forestry. These woodland properties include existing and former landfill sites, the Region's Operations Centre, Doon Heritage Crossroads, three woodland donations, and one conveyed as a condition of development approval.

Most of the former Agreement Forests and other woodland properties are open to the public, except for the Cambridge and Waterloo Landfill sites and the Operations Centre. In addition, access to Dean's Lake is via a right-of-way across private property which is at present restricted to Regional employees.

A summary of forest conditions on all Regional properties indicates that productive forest land accounts for 374.8 hectares or about 86% of the total area (Table 2). Non-productive forest land covers 47.9 hectares and consists mainly of wetlands including marsh and treed fen some of which are Provincially Significant Wetlands (PSW). Non-forested land (11 hectares) includes grassland and active agricultural land while ponds cover 1.7 hectares, most often in association with wetlands. Within the productive forest land the predominant species are Red Pine, Sugar Maple, White and Norway Spruce, Red Oak, Silver and Red Maple and White Pine. Nearly half of the productive forest land (48%) comprises conifer plantations of varying sizes with Red Pine being the predominant species. Jack Pine, White Pine, Scots Pine, European Larch and spruce are found in varying amounts. There are small Black Walnut and Black Locust plantations found at Dean's Lake and Petersburg Regional Forests respectively.

4.2 Physical Environment

4.2.1 Climate

Waterloo Region is located within the Huron Slopes and South Slopes climatic regions (Brown et al. 1980). The Huron Slopes region occupies all of the northern and central portions of Waterloo Region, while the Township of North Dumfries is the only area located in the South Slopes region. Highway 401 roughly marks the dividing line between these two climatic regions. The area north of Highway 401 receives substantially more precipitation (particularly snowfall) than the area to the south. There is only a relatively small increase in the mean annual temperature from Wellesley and Woolwich Townships to North Dumfries but there is a significant increase in the length of the growing season and the frost-free period. This is likely due to slightly lower elevations in the south and the moderating influences of Lakes Erie and Ontario.

Climatic conditions in the Carolinian zone are somewhat more favourable for tree growth. Several "southern" species such as White Oak, Shagbark Hickory, and Sassafras grow in the forests of this area but are seldom if ever found north of Highway 401.

4.2.2 Landforms

Sedimentary bedrock underlying Waterloo Region was deposited as mud in the sea during the late Silurian and Early Devonian Eras about 400 million years ago. During the Pleistocene Ice Age (13,000 to 25,000 years ago), glaciers from the Huron-Georgian Bay and Ontario-Erie basins advanced and retreated across South-western Ontario. As the ice lobes moved back and forth, massive quantities of clay, sand, silt, gravel and boulders were deposited and reworked by moving glaciers and flowing meltwater. Over time, this created a landscape consisting of moraines, kames (sand hills) plains, river valleys, and kettle lakes. Eventually, the Region's soils were developed from the weathering of the glacial deposits. The Regional Forests are located on a representative selection of the landforms that characterise the Regional landscape (Table 3).

The Region of Waterloo ranges in elevation from 434 metres above sea level (masl) in the north to 251.5 masl. in the Grand River valley at the Region's southern boundary. The moraines define the watersheds of the major tributaries of the Grand, Conestogo, Nith, and Speed Rivers.

4.2.3 Biodiversity

The various Regional Forests contain natural habitats representative of the Region's native biodiversity (Table 4). Within these habitats are a number of species of flora and fauna considered Regionally significant. The various types of habitat are protected under Provincial, Regional, and Conservation Authority policy, and the federal Fisheries Act. Provincially Significant Wetlands occur within three Regional Forests and smaller wetlands and treed swamp or lowland forests occur on several others. Marshes and ponds are also found on some of the Region's Regional Forests and woodland properties.

Twelve of the sixteen forests form part of ESPAs. ESPAs have been designated by the Regional Municipality of Waterloo because they contain rare or high quality habitats and sustain Regionally significant species. The greatest assemblage of significant species is known to occur in the Sudden, Drynan, Sandy Hills, Hilborn, and Cambridge landfill properties. Rare plants such as Buttonbush, Leatherleaf, Bog-laurel, High-bush Blueberry, and Northern Pitcher Plant are prevalent in wetlands, while Drynan, Gibney, Dean's Lake, and Hilborn sustain upland Carolinian species such as Squawroot, Big Bluestem, Burning Bush, Panicked Tick-trefoil, and Sassafras. The Sandy Hills forest is known to contain several rare species of ferns.

The Regional Forests are also known to sustain Regionally significant species of breeding birds and "Birds of Conservation Priority" identified by the Province. These include such species as Hairy Woodpecker, Veery, Ovenbird, Northern Waterthrush, Scarlet Tanager, Pine Warbler, and White-throated Sparrow. Sandy Hills, Sudden, and the Hilborn forests are particularly noteworthy in this regard.

The Drynan and Sudden forests are renowned for the diversity of their herpetofauna. Species known to inhabit these tracts include Jefferson Complex Salamander, Four-toed Salamander, Red-spotted Newt, Northern Water Snake, Pickerel Frog, and Eastern Ribbon Snake.

Apart from "significant" habitats and wildlife, the Regional Forests and woodlands also contain a wealth of other wildlife habitat. The Drynan and Cambridge Landfill properties contain open marsh areas which provide nesting and feeding habitat for waterfowl. Field observations indicate that White-tailed Deer overwinter at the Sudden, Townline, Sandy Hills, and the Cambridge Landfill properties. Mammals such as racoon, muskrat, fox, and coyote are known to make use of Regional Forest properties.

Five Regional Forests contain fish habitat. Schneider's Creek flows through Doon Heritage Crossroads and the Doon Regional Forest. This watercourse is far from pristine in that it receives

stormwater from the upstream urban area, and is prone to flooding. It provides warm water fish habitat for such species as White Suckers, Creek Chubb, Rock Bass, and minnows. The Townline, Sudden, and Sandy Hills tracts serve as headwaters for small local streams. An intermittent warm water stream that flows through the Macton Regional Forest carries water from drainage ditches and tile drains and provides habitat for several species.

4.2.4 Mineral Resources

There are currently no mining activities being undertaken on Regional Forests although the Gibney, Dean's Lake, Sudden, and Drynan tracts are wholly or partly in "Mineral Aggregate Resource Areas" designated in the ROPP. Also, the Petersburg tract is known to have a significant potential deposit of mineral aggregates. However, the mining of sand and gravel is prohibited within an ESPA by the ROPP.

4.3 Past Operations

4.3.1 Tree Planting

All of the properties purchased under the Agreement Forest Program had some cleared agricultural land on them and these open areas were usually reforested within a few years of acquisition consistent with the purpose of this program. Most tree planting work was carried out during the period from 1945 to 1965. Conifers (in particular Red and White Pine and White Spruce) were most commonly used for reforestation purposes although some hardwoods (e.g. White Ash, Black Cherry, Black Walnut and Black Locust) were planted, usually in mixture with conifers. Less frequently planted conifer species included Norway Spruce, Jack Pine, Scots Pine and European Larch.

In 1989 Red Oak was underplanted in corridors located in deteriorating Scots Pine plantations at the Sandy Hills Tract. Underplanting with Red Oak was also carried out in an oak/hickory stand at the Drynan Tract in 1993 subsequent to a prescribed burn within a portion of this area.

4.3.2 Tending Activities

Periodic harvest and/or improvement cutting has been carried out on Regional Forests from about 1966 to 1994 (Table 5). Sawlogs and fuelwood were removed from Agreement Forests during selection cutting operations. Prior to Regional ownership, tree removal took place at Walker Woods and the Hilborn Knoll. It is uncertain whether harvesting that occurred at the Cambridge Landfill was undertaken by the Region or the former owner.

Prior to 1975 there were very limited markets for small dimension conifer logs (boltwood) or pulpwood in south-western Ontario with the result that relatively little thinning work was undertaken (Table 6). Market conditions improved somewhat from 1975 to 1990 and consequently a significant amount of commercial thinning was undertaken. Although boltwood and pulpwood were the principal products removed, small volumes of utility poles and log home timbers were also harvested. Since the early 1990s only one commercial thinning operation has been carried out in a conifer plantation because of a lack of markets for small diameter material and declining MNR involvement with Regional Agreement Forests.

During the 1970s and 1980s, a limited amount of pre-commercial thinning was carried out in conifer plantations under subsidized Federal government programs. Some pruning was carried out to improve timber quality in Pine plantations from about 1970 to 1985 also using various government sponsored employment programs. Red and White Pine crop trees were manually pruned usually in

two stages, first to a height of approximately 2 m and then later to 5 m. In recent years pruning has not been undertaken mainly due to a cessation of the subsidy programs.

In May, 1992, a prescribed burn was carried out in an oak/hickory stand at the Drynan Tract. The objective was to destroy the established understory of maple, ash, basswood, Hop Hornbeam and various shrubs, in order to stimulate regeneration of the shade-intolerant oaks and hickories. Four areas within the 4.5 hectare stand were burned. Six years later (April 1998), a second prescribed burn was undertaken in these same areas to further reduce competing woody vegetation. To date, the results have been less than satisfactory.

4.3.3 Physical Improvements

Physical improvements such as trails, roads, fences and recreational facilities exist within most of the Regional Forests (Table 7). Several former Agreement Forests had gravel and/or grass access roads constructed to facilitate management activities. These roads were cut and graded using bulldozers and many were partially gravelled. Regional Forests without forest access roads generally have good external road access and there is adequate internal access so that no significant constraint is placed on future forestry operations. Narrower earth trails can be found on all properties except the Macton Tract. Today, these trails are primarily used by a variety of recreational users of the woodlands.

Gates and/or barriers (i.e. rocks, posts etc) have been placed at the road or trail entrance to several properties in order to restrict unauthorized access by motorized vehicles and to deter the illegal dumping of refuse. Parking facilities have been established at five of the Regional Forests that are officially open to the public. Standard Regional signage with respect to permitted uses has been erected at most of the Regional Forest properties.

Fire protection ponds were previously dug on the Sudden, Drynan and Petersburg Tracts. On other Regional Forests on-site sources of water are generally limited.

Most Regional Forests have Paige or barbed wire fencing along most of their property boundaries. However, the fencing is generally old and in fair to poor condition and along some property boundaries cannot be detected at all.

Chain link fencing has been erected along most property boundaries of the landfill sites and at the Doon Heritage Crossroads and is generally in good condition.

4.4 Forest Protection

4.4.1 Insects

Historical records and recent field observations indicate that conifer plantations have periodically sustained insect damage. However, in most cases, the severity of this damage appears to have been light to moderate and local in nature. Seven insect pests have been identified as causing damage in conifer plantations. These include European Pine Shoot Moth, White Pine Weevil, Pine Root Collar Weevil, Pine Spittlebug, Spruce Gall Aphid, Larch Sawfly and Larch Casebearer. The Sandy Hills tract has experienced the greatest problems with insects since it comprises an extensive conifer forest in which many pure stands were established. European Pine Shoot Moth and White Pine Weevil have caused stem deformation to pines (Red, Scots and White) growing in this area.

With respect to the hardwood forest, there is no past or present evidence of significant insect damage. There is, however, the potential for future problems, particularly from the Forest Tent

Caterpillar and Gypsy Moth which have previously been present at low levels on several Regional Forests. Both of these insect pests can cause severe defoliation of upland tolerant hardwoods. Although defoliated trees will usually produce a second flush of leaves, tree diameter growth is significantly reduced and vigour declines, thus making trees more susceptible to attack from other damage agents. Trees that are in a poor state of health prior to defoliation often decline and die as a result of leaf loss. Repeated defoliation in successive years can be especially devastating to Sugar Maple which is a preferred host of the Forest Tent Caterpillar along with Trembling Aspen, Red Oak and White Birch.

Recently, two new insect pests that have the potential to cause significant changes to the landscape have made an appearance in Ontario. The Emerald Ash Borer and the Asian Long-horned Beetle, both which are native to Asia, are believed to have entered North America from China as eggs or larvae contained in packing crate materials. As a result, stricter regulations concerning the use of solid wood packing material from China have been established. Neither of these two species have natural predators in North America, and it may be several years before native predator species adjust their diets to include this new food source and provide some control measures. Although the Asian Long-Horned Beetle which was discovered in Toronto in 2003 has apparently been eradicated through timely intervention, the Emerald Ash-borer is thought to be slowly spreading across south western Ontario. First identified in Essex County in 2002, by 2006 it had spread into Chatham-Kent and the Lambton and Elgin. Monitoring of ash trees for evidence of the Emerald Ash Borer within Regional forests and across the Region is being conducted on an informal basis. Although management objectives may require alteration for some forest stands should an outbreak of Emerald Ash Borer occur within the Region, it is unlikely that any of the Regional forests would see the level of stand decimation experienced in some of the nearly pure ash stands found in Essex and Chatham-Kent Counties.

4.4.2 Tree Diseases

In upland tolerant hardwood stands found at the Operations Centre, Hilborn Knoll, Doon Heritage Crossroads and Waterloo Landfill, *Eutypella* and *Nectria* cankers are frequently observed particularly on the trunks of Sugar and Red Maple.

Eutypella canker is a fungal disease characterized by depressed, bark-covered areas surrounded by a bulge of callous tissue. In trees less than 12 cm diameter at breast height (dbh) it can cause mortality by girdling but on larger trees this canker is perennial and as it enlarges with the host it becomes an entry point for decay.

Nectria canker is easily identified as older and larger cankers often become target-shaped with annual callous ridges surrounding a central depressed and flattened area. *Nectria* canker usually does not kill infected trees, although it does reduce the value of the tree for veneer and also decreases the merchantable volume.

Eutypella and *Nectria* cankers usually form on the lower portion of the trunk and wind breakage at the canker is common. Both of these diseases can be controlled by removing cankered trees during regular cutting operations.

Armillaria root rot was identified in the hardwood stands of McLennan Park, Waterloo Landfill and Dean's Lake. This root disease is commonly found on oak, maple, and aspen, as well as pine and spruce. *Armillaria* can cause mortality by girdling at the root collar or killing the major roots. At this time there is only localized damage and hence the situation only requires monitoring. Dead and dying trees should, however, be removed during scheduled cutting operations.

White Pine Blister Rust is the most significant disease affecting conifer plantations in Regional Forests. It is readily recognized by the development of swollen cankers on the branches or trunk and a heavy flow of resin emanating from these cankers. If the canker girdles the stem everything above the canker dies. White Pine Blister Rust was identified at five Regional properties where it has caused localized mortality to White Pine. Controlling the spread of this disease should be possible through the implementation of a regular thinning program.

Other conifer tree diseases such as Diplodia (tip blight) and Cytospora (stem canker) are present in the Regional Forests though none are currently having a noticeable impact on the forest.

Tree decline is another cause of reduced growth and/or death affecting trees in Regional Forests. Periodic occurrences of decline and death of oaks over widespread areas have been recorded since 1900. These outbreaks are caused by a complex interaction of environmental stresses and pests and given the generic title of oak decline, oak dieback, or oak mortality. Trees affected by oak decline show a general and progressive dying back from the tips of the branches.

As in most decline diseases, trees are weakened by environmental stresses such as drought, waterlogging, or frost or by pests such as defoliating or sucking insects. Trees on ridge tops and in wet areas suffer most severely from drought while frost often affects trees growing in valleys and frost pockets. Weakened trees are then invaded and killed by insects and diseases that cannot successfully attack healthy trees. Usually the progression of decline is slow, occurring over several years.

While factors such as drought and frost cannot be controlled in forest settings, management can reduce their effects. Thinning can reduce competition for moisture and nutrients and promote better physiological condition of the remaining trees. Silvicultural practices designed to encourage species best adapted to the site can help reduce the effects of drought or frost. Removal of weak and dying trees may also reduce or delay population build-up of the two-lined chestnut borer.

Decline diseases are also noted in conifers. One example is Red Pine pocket decline which is similar to oak decline in that it is actually a complex involving several species of root and lower stem-feeding insects, along with associated fungi. A sequence of events is initiated which creates "pockets" of progressive mortality of one to several trees. Thinning of stands may play a role in this disease in that a primary feeding site for the beetles is freshly cut stumps as well as healthy trees nearby. As the beetles feed on stumps and tree stems, fungal spores are deposited from their bodies onto stumps as well the uncut stems. Fungi spread into the roots and to neighbouring trees through root grafts. As standing trees are weakened by the fungal infection they can become attractive to secondary insect infestations. Pocket decline appears to be almost nonexistent in unthinned stands. In the past, borax was used to treat stumps during plantation management in order to restrict the entry of fungi into the root systems. While borax is no longer available for forestry operations, the Canadian Forest Service is conducting research into alternative control methods. Until a solution is found, plantation thinning and management will require caution and vigilance.

4.4.3 Wildlife

To date, wildlife populations have not caused a negative impact to the health of the Regional Forests. Deer were frequently observed but overall their browsing does not appear to be having an adverse effect on the forest understory. One exception is in the Gibney tract where it appears that deer browsing may be reducing the growth of Burning Bush stems to such an extent that they are being overtopped by other herbaceous species. The competition further reduces their ability to grow to the extent that the continued presence of this uncommon Carolinian species is jeopardized.

Rabbit browsing on lower stems and branches, mouse girdling of tree regeneration, and squirrel damage in the upper canopies of a variety of hardwood species are found throughout the Regional Forests, however, the damage is not of major significance and at this time does not warrant consideration of control measures.

Tree cutting and flooding activities of beaver have been negligible which is not surprising given the scarcity of water in Regional Forests. In light of these conditions, there is no need at present to implement any wildlife control measures.

4.4.4 Flooding

To date flooding has caused problems at only one Regional Forest, the woodlands at the Operations Centre. Grading and filling activities on a neighbouring property have caused a significant change in water levels on the property with the result that many of the trees are dying back as the tree species are not adapted to wet conditions. Where flooding occurs due to human activity, it may be necessary to mitigate the effects by installing drainage ditches or culverts or to reverse the condition responsible for the flooding in the first place.

4.4.5 Fire

Fire has not been a major concern in any of the Regional Forest tracts since camping and cooking fires are prohibited in all Regional Forests. However, there is evidence that fires are part of “bush party” activities that occur occasionally at several of the Regional Forests, particularly Petersburg and Doon. Fortunately, deciduous forest stands tend to be fairly fire resistant, especially during years of normal precipitation. The risks are greater in conifer stands, particularly in declining stands with a higher proportion of dead, dying and/or down material. During hot dry weather, the risk increases even more.

Perhaps the greatest concern is the Doon tract which is surrounded by residential development and has limited access for fire fighting equipment. As part of the management activities of Doon tract, discussions will be held with the City of Kitchener Fire Department to ensure that in the event a fire occurs within the forest, firefighters can efficiently access the site with proper equipment. Similarly, discussions with the other Local Municipalities will also be held to ensure adequate fire protection is available for the other forest tracts.

4.5 Financial and Economic Considerations

4.5.1 Expenditures and Revenues

Until March 31, 2001, the Regional Forests were managed by the MNR. Revenues generated from timber sales were offset against management costs. At the time the Agreement was terminated, the Region’s net deficit was cancelled.

Since the Province announced in 1996 that it would terminate its forestry agreements with the Region and other municipalities, the Region has increased its expenditures on the forests. This was necessitated by the need for the Region to be a prudent landowner rather than as part of a comprehensive operating and maintenance plan for the tracts. For example, to improve public safety and ensure due diligence concerning public liability, signs were erected in 1997, the boardwalk in the Sudden tract has been repaired several times, hazard trees have been systematically marked and felled, and bicycle (free rider) stunts were demolished and removed from the Hilborn,

Petersburg, Townline and Sandy Hills tracts. With the approval of a management plan, the time has come for the Region to develop systematic operating and capital budgets for the forest tracts.

To some extent, the costs of operating the Regional Forests may be offset by revenues from timber sales. While the ROPP policy assigns timber production a relatively low priority for the Regional Forests, there is nonetheless some opportunity for the sale of various forest products (primarily timber) to subsidise desirable stand improvement and ecological management operations. While revenues are unlikely to be sufficient to cover all annual operating expenses, it may be possible to finance some of the necessary capital expenditures in coming years for gates, parking lots, interpretive signage, and significant trail improvements.

Over 40% of the Regional Forests comprises conifer plantations. Normal plantation management requires that plantations be periodically thinned in order to ensure continued growth and production of quality timber. The objective of each successive thinning is to produce larger sized and higher value timber until the final thinning removes high value sawlogs and other large sized products such as utility poles. Many of the older plantations in the various Regional Forests have already undergone thinning operations and in many cases the trees are vigorous and showing good increases in height and diameter. Some of these stands have matured ecologically as well and are providing breeding habitat for a variety of birds. Other plantations have experienced decreased growth rates and are in need of a second or third thinning, while still others are at a point where soil nutrient deficiencies have resulted in a lack of growth and even die-off.

Unfortunately, many of the younger stands planted in the 1960s and 1970s have never been thinned, and are experiencing extremely slow growth rates due to the high level of competition for resources. In such stands there is a need to catch up on years of neglect by scheduling plantation thinning or clearing operations in the first few years of the Management Plan. The thinning or clearing operations can be used to either increase the growth on the conifer species and/or to speed up the process of conversion to a hardwood or mixedwood stand type.

Thinning activities in plantations can be expected to generate some revenues through the sales of pulpwood. The revenue can be used to fund non-commercial stand improvement operations and capital expenditures. Once stand management activities are back on track, ongoing thinnings and stand improvement cuts have the potential to generate a stream of revenue at some time in the future.

Stand improvement and management programs in hardwood stands will entail tree harvesting which may result in a variety of sizes and qualities of logs, at least some of which can be commercially sold. For example, sawlogs from species such as Sugar Maple, Black Cherry, Red Oak, and Black Walnut can be sawn into lumber or flooring or made into veneer for furniture. Lower quality logs of these species as well as less desirable species such as Beech, Basswood, White Birch, White Ash, Silver Maple, and Poplar can be used for industrial products such as pallets, crates, and mining timbers. Cull and low quality hardwood stems and branches can be sold for firewood.

5.0 Forest Resource Inventory

5.1 Inventory Procedures and Results

Prior to the initiation of fieldwork in 2002, the Agreement Forest maps and inventory data prepared by the MNR in 1990 were reviewed and forest stands were identified on air photographs supplied by the Region. On the MNR property maps, forest stands were delineated and a brief description of stand characteristics was provided (i.e. tree species composition, average basal area and tree diameter, age of plantations). For the Regional properties that had not been previously inventoried (i.e. they were not included in the Agreement Forest Program), forest stand boundaries were interpreted on air photographs in order to facilitate subsequent fieldwork.

All Regional Forests were surveyed by GWS staff during the late winter/early spring of 2002 using systematic sampling procedures. This involved walking transects along compass bearings through stands identified on recent air photographs. Sample plots were established at fixed intervals along the transects. The number of transects and sample plots taken per stand varied with the forest cover types, the area of the stand and the variability in forest conditions encountered. The intensity of sampling ranged from 2 plots per hectare to one plot for 2 hectares.

At each sampling point a prism with a basal area factor of $2\text{m}^2/\text{ha}$ was used to determine the species composition, size class distribution, and basal area stocking (a measure of stand density) of acceptable versus unacceptable growing stock (AGS vs. UGS). AGS and UGS status are based on the potential of the tree stem to be used for commercial timber products, primarily saw and/or veneer logs. At each sampling point measurements were made on representative dominant and co-dominant trees in order to accurately determine tree diameter at breast height (dbh), age, total height and merchantable lengths for trees of sawtimber size. Information was recorded on the species and density of tree regeneration and shrub cover encountered, as well as topographic and soil conditions. Notes were made on tree health and quality, wildlife species and habitat features, recent logging activities, recreational usage and the need for silvicultural treatments or property improvements.

During the spring and summer of 2002 all Regional Forests were re-visited to confirm stand data and mapping, and to obtain supplementary information on wildlife activity, recreational use and management requirements. Based on the results of this final field checking, updates were made to the forest inventory data and maps as required. Some stands previously identified by MNR were subdivided to create new stands while others were amalgamated to make larger, more operable silvicultural units. Finally, all stands were re-numbered in a logical fashion to reflect the current mapping.

The inventory work conducted 2002 was similar to that of the previous MNR inventory in that it was primarily timber based and much of the evaluation of tree condition (e.g. AGS vs. UGS) reflects that orientation. It is proposed that in the future, all Regional Forests are evaluated using an ecological approach and that the Ecological Land Classification (ELC) system be adopted.

5.2 Regional Forest Data Sheets

Forest Data Sheets have been prepared for each of the sixteen Regional woodlands. The first part of each sheet contains basic information on the respective woodlands including location, size, features of concern, general management goals and considerations. The second part consists of a map(s) of the forest showing stand boundaries and numbers. The third part contains a summary

table describing the area, composition, age class structure, stocking, and regeneration of each stand within the woodland. The Forest Data Sheets can be found in Appendix A attached to this document.

5.3 Forest Stands and Working Groups

The Ontario Ministry of Natural Resources defines a forest stand as “an aggregation of trees occupying a specific area and uniform enough in species composition, age and arrangement to be distinguishable from the forest on adjoining areas” (MNR, 2000). A stand represents the fundamental unit of forest management and may be assigned to a “working group” based on the predominance of tree species by relative density based on cumulative cross-sectional area at breast height (basal area). There are 14 working groups identified in the Regional Forests. The general characteristics of each working group are briefly outlined as follows.

5.3.1 Red Pine

Red Pine plantations are generally established as pure stands or else planted in mixture with White Pine and/or White Spruce. They are typically found on undulating to rolling terrain with calcareous, well drained, loam to sandy loam soils. Hardwood regeneration, especially Black Cherry and White Ash, has become well established in the understory of most plantations. Stands of Red Pine generally comprise pole-sized to small sawtimber trees. They are capable of yielding moderately high volumes of merchantable materials including sawlogs, utility poles and log home timbers.

5.3.2 Hard Maple

Stands dominated by one or more of the so-called “hard” maples, usually Sugar Maple, but also including Black Maple, are found on most Regional properties, typically on undulating to hilly terrain with well drained loamy soils. Hard Maple usually occurs in mixed stands with White Ash, American Beech, Red Oak and Red Maple. Many stands are characterized by an uneven size class distribution although some stands exhibit the desirable distribution with a larger number of trees with smaller diameters to fewer trees with larger diameters. These stands generally contain moderate to high volumes of good quality hardwood timber with desirable tolerant hardwood regeneration adequately established in the understory of most stands.

5.3.3 Spruce

Spruce plantations are fully stocked to overstocked with immature trees. White and Norway Spruce were planted in pure stands or in a mix with White Pine and occasionally other conifers. Hardwood regeneration is negligible in most Spruce plantations due to high densities which results in few opportunities for seed germination and establishment. Economic products in these stands are primarily boltwood/pulpwood, although some stands could yield moderate volumes of sawlogs.

5.3.4 Red Oak

Red Oak stands are found on four Regional properties. A fifth stand contains a substantial oak component (30%), but is primarily a mixed hardwood stand and could be managed to promote oak as the dominant species. Oak stands are mainly established on rolling to hilly topography with well drained, loamy soils that are often droughty and relatively infertile. Red Oak grows in mixed stands in association with Sugar Maple, American Basswood, American Beech, White Ash and White Birch. Some stands are nearly even-aged and generally immature while others exhibit an all-aged condition. The Red Oak stands contain moderate to high volumes of good quality sawlogs, veneer logs and fuelwood. Regeneration is moderately dense in most stands but tends to consist of tolerant hardwoods such as Sugar or Black Maple, White Ash, Red Maple, Hop Hornbeam and American Beech. Oak regeneration is insignificant in all stands despite MNR efforts to promote oak regeneration at the Drynan and Sudden tracts.

5.3.5 Soft Maple

Several stands of soft maple (Red and/or Silver Maple) are found on Regional properties and these stands always occur in lowland areas on poorly drained mineral and/or organic soils. Red and Silver Maple always occur in mixed stands and are commonly associated with other hardwoods such as Trembling Aspen, Yellow Birch, Red and Black Ash and White Elm. Regeneration is generally satisfactory and it consists of the same species as found in the overstorey. Merchantable volumes are relatively low and fuelwood is the major product currently available.

5.3.6 White Pine

Stands of White Pine were entirely created from the reforestation of abandoned farmlands, except for three small stands that were naturally established at the Cambridge Landfill. Where White Pine was planted, it was usually combined with White and/or Norway Spruce, Red Pine, Jack Pine and Scots Pine. In natural stands, White Pine grows in association with White Ash, White Birch, American Basswood, Black Cherry, Red Oak and Hop Hornbeam. All White Pine stands are immature and contain moderate to high volumes of merchantable boltwood/pulpwood and small to medium sized sawlogs. Where hardwood seed sources are nearby and thinning has been carried out, satisfactory advance regeneration of hardwoods has usually become established.

5.3.7 White Cedar

All three stands of White Cedar are naturally established on lowland and/or transitional sites. Cedar grows in mixed stands in association with Red Maple, Trembling Aspen and/or Balsam Poplar, Red Ash and White Elm. All stands are immature in age although dominant and co-dominant trees range in size from pole timber to small sawtimber. Cedar and mixed hardwood regeneration is abundant in the understory. Cedar posts and poles are the main products found in these stands although small sawlogs and hardwood fuelwood are also available.

5.3.8 American Beech

Two American Beech stands are found on Regional properties and are characterized by small sawtimber sized trees. Major species growing in association with American Beech include White Ash, Sugar, Black, and Red Maple, Hop Hornbeam, Black Cherry, Red Oak and White Pine. Advanced hardwood regeneration is well established in the understory. Sawlogs, veneer logs and fuelwood can be harvested from these stands.

5.3.9 Jack Pine

Five small Jack Pine plantations were established in three of the Regional Forests with Jack Pine being mixed with Red Pine, White Pine, White Spruce, European Larch, Black Cherry, White and Red Ash. The majority of these plantations are approaching maturity with desirable hardwood regeneration established in the understory.

5.3.10 Trembling Aspen/Balsam Poplar

Trembling Aspen/Balsam Poplar stands are naturally established mostly on a mix of upland and/or transitional sites. They tend to be young to immature in age (i.e. less than 60 years old) and commonly grow in association with Black Cherry, White Ash, Red Maple, Bur Oak and White Elm. These same species are typically found in the understory.

5.3.11 Scots Pine

Three Scots Pine plantations are found on the Sandy Hills tract. Trees growing in association with Scots Pine include Jack Pine, White Pine, Black Cherry, White Ash and Sugar Maple. The Scots Pine and Jack Pine are mature in age. The density of the Scots Pine varies considerably in these areas due to past thinning and/or salvage operations. Desirable hardwoods (e.g. Red Oak, White Ash, Black Cherry and Sugar Maple) have become artificially and naturally established in the understory although their density is only low to moderate.

5.3.12 Other Upland Hardwoods

A variety of hardwood species that typically occur in small mixed stands on upland sites are referred to as the "Other Upland Hardwood" working group. Dominant species in these stands include Black Cherry, White Ash, Black Walnut and Black Locust. Maturity and density vary considerably in these stands as does the type and amount of advance regeneration. Management activities in these areas is likely to produce fuelwood as the primary forest product.

5.3.13 Other Lowland Hardwoods

Stands dominated by Green or Black Ash and Yellow Birch are aggregated in the "Other Lowland Hardwood" working group. These stands are generally characterized by trees of immature sawtimber sizes. Regeneration density is low to moderate. As with upland hardwood stands, fuelwood will be the primary product of management activities, although some sawlogs may also be produced.

5.3.14 Other Conifer Stands

The "Other Conifer" working group includes three plantations of European Larch and one of Eastern Hemlock. All of these stands are small in size (i.e. 0.3 to 1.1 ha. and occur on a variety of upland and transitional sites. The stands tend to be immature but contain significant volumes of sawtimber. Shade tolerant hardwoods have become well established in the understory.

5.4 Forest Site Productivity

Forest stands were classified into one of five site classes based on their height and age data (Taylor and Jones, 1985). With this classification scheme, which is well suited to most of Southern Ontario, class 1 sites are the most productive while class 5 sites are the least productive. For some species not listed in this table it was necessary to interpret their site class ratings from other species that are silviculturally similar. For example, Jack Pine and Scots Pine site classes were interpreted from the Red Pine classes.

Inventory data indicate that Red Pine, Jack Pine, Scots Pine and other conifers are mostly found on class 3, 4 and 5 sites (Table 8). Sugar Maple and American Beech stands are all established on class 2, 3 and 4 sites. Red Oak, Other Upland Hardwoods, White Pine and Spruce stands grow mainly on a mix of class 4 and 5 sites while White Cedar, Red and Silver Maple and Other Lowland Hardwoods are almost entirely found on site class 5. In contrast, Trembling Aspen/Balsam Poplar is mostly growing on class 1 and 2 sites.

The low percentage of stands found on class 1 and 2 sites is not surprising since the most productive lands in Waterloo Region are typically devoted to agricultural production. In contrast, many of the former Agreement Forests were generally acquired due to marginal agricultural capability. The Regional Forests are, nonetheless, well suited to the production of quality hardwoods, particularly Sugar Maple which usually exhibits a low proportion of heartwood to sapwood which potentially increases the yield of high grade lumber and veneer. Most conifer plantations have grown at an acceptable rate, except for stands of White and Norway Spruce, Jack Pine and Scots Pine. Although Red Pine height growth has generally been satisfactory, several stands have recently experienced nutrient dieback and mortality as they were planted on soils too heavy and/or calcareous to sustain good long-term growth. Given these growing conditions and the fact that Red Pine, Jack Pine, Scots Pine and Norway Spruce are not native to Waterloo Region, most conifer plantations should be gradually converted to the native hardwoods which originally characterized the natural forest. In any event, tolerant hardwoods will readily invade these conifer plantations assuming there are nearby seed sources and sufficient light and moisture to ensure establishment of seedlings.

5.5 Forest Age Classes

Regional Forests are characterized by immature timber with 91% of the area covered with stands 21 to 80 years old (Table 9). Stands less than 20 years old comprise only about 1% of the total area and there is no area that is classified as barren and scattered. Only a few stands of Sugar Maple, Red Oak and White Pine are considered mature with dominant and co-dominant trees being around 90 years of age.

5.6 Wetlands and Water bodies

Provincially Significant Wetlands occur in five Regional Forests (Drynan, Sudden, Townline, Cambridge Landfill, Hilborn Knoll) while five other properties (Sandy Hills, Waterloo Landfill, Petersburg, Walker Woods, Operations Centre) contain small locally significant wetlands (Table 4). Hardwood swamps are encountered more frequently than conifer or mixedwood swamps. Ponds occur both as isolated features and in association with other wetland types. Most ponds are man-made, particularly on the former Agreement Forests. Forestry operations should generally be unnecessary in wetlands. If tree cutting is to be carried out in wetlands it must not result in any adverse effects to the ecological functions and values of these sensitive areas.

5.7 Significant Plant Species and Habitats

Many plant species of national, provincial or regional significance have been documented within Regional Forests. Properties with the most noteworthy assemblage of significant plants include the Sudden, Sandy Hills, Drynan, Gibney, Hilborn Knoll and Cambridge Landfill. Rare wetland plants such as Buttonbush, Leatherleaf, Bog-Laurel, High-bush Blueberry and Northern Pitcher-Plant are most prevalent at the Sudden tract and Cambridge Landfill while the Drynan, Gibney and Hilborn Knoll exhibit several upland species (e.g. Squawroot, Big Bluestem, Burning Bush, Panicked Tick-trefoil, Northern Prickly-Ash etc.) many of which are typical of the Carolinian Forest Region. In contrast, the Sandy Hills tract is characterized by the presence of several rare ferns including Ebony Spleenwort, Male Fern, Interrupted Fern and Northern Beech Fern.

The most significant vegetation communities found on Regional properties consist of the two PSWs noted above and the Red Oak stands which are representative of Carolinian Forest.

All management activities will be undertaken with the intention to improve, wherever possible, the diversity of habitats and species. Restoration of native habitat will be undertaken as needed to ensure that representative habitat types are not lost through neglect. For instance, efforts will be made to ensure that the Oak savannah previously found at the Hilborn Regional Forest is restored and that an oak understory is established in the Red Oak stands at Drynan and Sudden Regional Forests either through prescribed burns or through a specialized tree cutting and tending prescription.

5.8 Fish Habitat

Five Regional Forests provide fish habitat. Schneider's Creek flows through Doon Heritage Crossroads and the Doon tract before it discharges into the Grand River. This watercourse receives much stormwater from urban developments and is very prone to flooding. It provides warmwater fish habitat for species such as White Suckers, Creek Chub, Rock Bass, Minnows and Darters. The Townline and Sudden tracts provide source areas for small coldwater to coolwater streams that discharge from these areas. An intermittent, warmwater stream that likely provides fish habitat flows through the Macton tract. This watercourse is fed by upstream drainage ditches and tile drains.

Forest management activities will be carried out in such a manner that water quality and quantity in streams and creeks within the Regional Forests is maintained or enhanced. The use of low impact management techniques within stream buffer areas will protect sensitive riparian zones while encouraging vegetation growth along stream corridors can help moderate water temperatures and provide habitat for a variety of species that are important in aquatic ecosystems.

5.9 Significant Wildlife Species and Habitats

Several Regionally significant birds have been observed nesting in Regional Forests including the Sharp-shinned Hawk, Hairy Woodpecker, Veery, Ovenbird, Northern Waterthrush, Warbling Vireo and Scarlet Tanager. The Sandy Hills tract represents an extensive conifer forest which provides breeding habitat for several forest interior birds including Pine Warbler, Mourning Warbler, Red-breasted Nuthatch, Golden-crowned Kinglet, and White-throated Sparrow. While the provincially significant Cooper's Hawk has been observed at the Sandy Hills tract, raptor stick nests were not observed during 2002 fieldwork, nor were stick nests noted on other Regional properties.

Provincially and Regionally significant herpetofauna utilize the wetland and adjacent upland habitats found at the Sudden and Drynan tracts. The provincially significant Jefferson Salamander has been reported inhabiting the Sudden tract. Several Regionally significant reptiles and amphibians also inhabit this area, including the Yellow-spotted Salamander, Four-toed Salamander, Red-spotted Newt, Bull Frog, Pickerel Frog, Northern Water Snake, Smooth Green Snake and Eastern Ribbon Snake.

Based on field observations and existing documentation, White-tailed Deer overwinter at several of the Regional properties and in all cases utilize adjacent forested areas during this critical period of the year.

The Drynan tract and Cambridge Landfill are the only properties that have sufficient marsh and/or open water to provide fair quality waterfowl habitat. Canada geese and puddle ducks such as Mallard, Black Duck, Wood Duck, Blue and Green-winged Teal may potentially use these wetlands for nesting and/or feeding purposes. Marshes and swamps found on these properties and in other Regional Forests provide critical habitat for furbearers such as muskrat, racoon, red fox and coyote. To date, beaver have not been observed inhabiting Regional Forests.

In accordance with good forestry practice, forest management activities must be conducted in ways that do not disturb significant wildlife species or render key habitats less suitable, especially during the breeding season. Appropriate buffers or reserves, wherein little or no cutting is permitted must be clearly established around sensitive wildlife habitats prior to the initiation of logging operations or other forestry activities. Trails and travel zones must be established in locations where damage or disruption will be minimal at best.

6.0 Public and Stakeholder Consultation

The public consultation process was initiated with the formation of an EEAC Subcommittee during the spring of 2001. This Subcommittee was formed to review the results of the forest resource inventory, assess management objectives, issues and options and help facilitate public and stakeholder input to the preparation of the forest management plan. EEAC Subcommittee inspections of Regional Forests commenced in the late summer of 2002. Prior to these site inspections the Forestry Consultant supplied Regional staff with an itemized account of management issues to be addressed at each property. Regional staff then accompanied EEAC Subcommittee members on site inspections along with GWS staff who were also periodically in attendance. As a consequence of these site visits the EEAC Subcommittee which consisted of David Schmitt (Chair), Ron Donaldson, Joanne Toth and Deanna Zenger prepared a report (P-EEAC-SC-03-01) in January 2003 which dealt with many philosophical issues pertaining to management goals and objectives for Regional Forests, appropriate public usage and various ecological concerns. This report and subsequent correspondence helped to guide the preparation of the draft and final reports.

During the spring of 2006, public information sessions were held at the Regional Administration building, the Wilmot Township office, and the North Dumfries Township office. The sessions were well attended with between 20 and 25 individuals attending each session. Display boards were set up presenting images (aerial imagery and photographs) of a number of the Regional Forests. Summary sheets of the individual forest tracts were available as handouts for those who were interested in learning more about one or more of the woodlands. A PowerPoint presentation was made outlining the purpose, approach and overall goals of the RFMP and a question and answer session was held at the conclusion of the presentation. Each individual was asked to fill out a comment form to be submitted before leaving or it could be returned by mail.

Attendees were also asked whether they were interested in being placed on a contact list and whether they would be interested in participating in follow-up sessions during the preparation of detailed stand management prescriptions.

In addition to the public information sessions, the draft plan was presented to the Environmental Advisory Committees of the following local municipalities: Waterloo, Cambridge; Kitchener, and the Township of Woolwich. These advisory committees function in a manner similar to the Region's Ecological and Environmental Advisory Committee in providing advice on planning applications dealing with environmental issues. It was felt appropriate that due to their interest and expertise, it was appropriate to also ask these groups for their comments and recommendations regarding the RFMP.

There was a high level of interest expressed in the management of the Regional Forests and at each session a wide range of questions was presented to Regional staff. Many of the questions and comments have been used to shape and refine this document and will also be used in the preparation of the 5-year Management plan documents. The interest expressed by the general public reinforces the need for the Region to involve the public in the Management process and also helps to emphasize importance of shifting the management away from timber and forest based goals to a more comprehensive set of values held by the residents of the Region of Waterloo.

7.0 Forest Management Issues

For the purposes of the Forest Management Plan, forests are not being viewed as just stands of timber but highly complex ecosystems dominated by large woody vegetation. As ecosystems, they respond to changes in a wide range of parameters including non-biological (e.g. climate or hydrology), biological (e.g. natural life cycles of organisms, or the introduction of new organisms such as plants or diseases), and human activities (e.g. forest management). From a human perspective, forest responses can be classified as either an improvement or deterioration in any of a number of criteria such as health, aesthetics, or productivity with regard to desirable products. The following sections contain a series of observations and comments regarding conditions and developments within the Regional Forest system. There are several indicators of stagnancy or decline which will need to be addressed through management activities in order to maintain or enhance ecological health and function as and where required.

7.1 Ecological Management

7.1.1 Significant Environmental Features and Functions

The Region's woodlands comprise a variety ecological features and functions sustaining an array of native flora and fauna. The significance of the ecological features is reflected in the fact that many of the woodlands are designated as ESPAs. Forest management activities, as well as recreation and research goals must not jeopardize the continuance of these conditions upon which the plant and animal species depend.

7.1.2 Inadequate Oak and Hickory Regeneration in Carolinian Forest Stands

Oak-hickory stands representative of northernmost regions of Carolinian forest habitat are found in Sudden, Drynan, Hilborn Regional Forests. Despite the relative abundance of mature oak and hickory in these stands, they are regenerating poorly because seedlings of these species do not grow in the shade of other trees. Instead, shade tolerant species such as Sugar Maple, American Beech, White Ash, and Hop Hornbeam have become established in the understory. Without significant ecological disturbance, these stands will in time naturally convert to shade tolerant species, and much of the Carolinian character and ecological significance of these woodlands will disappear. As the Carolinian habitat and species are significant attributes of the ESPAs in which they are located, there is a clear and pressing need to manage these stands in order to promote oak and hickory regeneration.

If oak and hickory regeneration is achieved in the Carolinian stands, action may have to be taken to control deer and rabbit populations as oak seedlings are much more attractive food for these species than maple or beech seedlings.

7.1.3 Invasive Non-native Species

Many of the forest stands, whether natural native hardwoods or conifer plantations, have been extensively colonised by invasive non-native plant species. Common Buckthorn, and to a lesser extent Glossy Buckthorn, Tartarian Honeysuckle, and Autumn Olive are present in the understory of most if not all of the Region's woodlands. To an even greater extent, the ground flora is being invaded by such non-native species as Garlic Mustard, Celandine, Dame's Rocket, and Coltsfoot. In some localities, these species have become so established that they are preventing native trees and other herbaceous species from reproducing. In the interests of the long-term health and sustainability of the forests, these species must be contained if not eradicated.

7.2 Stand Management

7.2.1 Conifer Plantations

Some of the conifer plantations in the Regional Forests have been thinned at least once since being planted. In many of the thinned plantations, the remaining trees are growing well and have the potential to continue to develop and mature. At the same time, native hardwoods such as White Ash, Sugar Maple, and Black Cherry have seeded into these plantations, and begun the process of conversion to an ecologically more desirable mixed forest stand type.

In other cases plantations have not been tended and the stands are now at undesirable densities. The intense competition for light, moisture and nutrients results in the trees being unable to maintain sufficient foliage which reduces vigour and growth. As a result, the trees exhibit very slow growth, even to the point of stagnation. Low vigour trees also become susceptible to insect and disease infestations which may result in death. Management objectives in such stands include some manner of thinning to encourage growth on the remaining trees and to improve the overall health of the stand. Thinning regimes can range from light to extensive, depending on whether it is desired to maintain the coniferous nature of the stand for the time being or to speed conversion to a mixed wood stand type.

On many of the Regional Forest properties pines were planted on soils unable to sustain good long-term growth. As a result, several plantations have experienced localized dieback and mortality due to the condition known as nutrient dieback. Regularly scheduled thinnings can be used in stands where dieback is not severe and/or mortality is not widespread, however in extreme cases, widespread cutting and artificial stand re-initiation (planting) will be required. It is likely that merchantable timber will be able to be salvaged during such operations, and some economic return generated.

Finally, some conifer plantations, most notably at Gibney and Macton Regional Forests, have sustained minor damage from strong winds. Where appropriate, downed trees that pose a hazard to the general public have been removed as part of the hazard tree removal program. Other environmental damage agents such as snow and ice have minor impacts on Regional Forests.

7.2.2 Conversion of Conifer Plantations

Many of the conifer plantations consist of non-native species (e.g. Scots Pine, European Larch, Norway Spruce) or species planted on sites not suited to their long term growth (e.g. Red Pine, White Pine, White Spruce). In addition, they may be overdue for thinning with trees exhibiting poor vigour becoming targets for insect or fungal infestations. The degree to which native hardwoods are colonizing conifer plantations depends on such factors as the density of the canopy, proximity of seed sources, and shrub competition. Individual stands will have to be assessed to determine the most appropriate methods to manage the conversion to native hardwoods.

7.2.3 Hardwood Stand Improvement

There is a great variation in quality among the Region's hardwood woodlands. Some are in excellent health, while others contain excessive numbers of diseased or dying trees, exhibit poor natural regeneration, or are overrun with non-native species. Since none of the hardwood stands have been tended in many years consideration will be given to implementing forestry operations to address the

above-noted problems. Specifically, it is recommended that diseased and dead, or dying, trees be removed especially where they pose a hazard to human users, in particular along trails and roadways. Additionally, trees may be harvested as required in order to improve the structure (e.g. age, diameter, and species distribution) of the woodlands and to promote natural regeneration of desired native species.

7.3 Recreational Impacts

Waterloo Regional Forests are used for diverse recreational activities. Passive recreational uses such as walking, hiking, snowshoeing, wildlife viewing, nature study and photography occur to some extent in most of the Regional woodlands, even those which are officially closed to the public. Where forest access roads and/or well maintained trails are available, pedestrian use generally increases along with other non-motorized trail uses including cross-country skiing, mountain biking and horseback riding.

Cross-country skiing occurs most frequently at the Doon, Drynan, Petersburg, Sandy Hills and Sudden tracts due to the hilly terrain and good quality trails. Mountain biking has become quite popular in the Region, and these same properties appear to be heavily used for this purpose. Several unauthorized new trails have been established at the Petersburg Tract and the Waterloo Landfill, and “free-riding” stunts including bridges, jumps, elevated ramps and other structures have been found at the Petersburg, Sandy Hills and Townline tracts. Such structures have been dismantled, at considerable expense, because of ecological damage being caused by this activity (i.e. vegetation trampling, soil erosion, disturbance to wildlife etc.). At present Regional staff are exploring options to accommodate recreational mountain biking at Petersburg Tract. Discussions are underway with the Waterloo Cycling Club regarding how cyclists needs and desires can be appropriately incorporated with the other allowed uses of Petersburg. An analysis of the informal biking trails was conducted in the fall of 2005 under the supervision of an International Mountain Biking Association (IMBA) trail crew. The results of the analysis will be to develop a plan that, subject to approval by Regional Council, would result in the formation of a network of both multiple use and primarily biking trails complete with ratings for levels of difficulty. Options for trail development and maintenance are also currently being explored.

Equestrian use of Regional Forests is greatest at the Dean’s Lake and Sandy Hills tracts since boarding stables and/or equestrian facilities are located in close proximity. Both properties also provide a good network of trails which seem to be maintained in good condition, presumably by the horseback riders.

Hunting was formerly allowed on the majority of Agreement Forests as this activity was consistent with provincial wildlife management objectives. However, heavy recreational and educational use on a number of properties (Townline, Sudden, Doon, Sandy Hills, Drynan and Gibney) during the mid 1980’s prompted the Region to close them to hunting. At present, hunting is not prohibited only at the Macton Tract and it also occurs on a very small scale at some properties that are officially closed to public use such as the Waterloo Landfill and the Operations Centre. As hunting activity apparently occurs to some extent on other Regional properties that lack signage regarding permitted uses (e.g. Gibney and Walker Woods), it will have to be determined whether this use is appropriate for these forests.

Motorized recreational vehicles including snowmobiles, all-terrain vehicles (ATVs), off-road motorcycles, and four-wheel drive vehicles, are restricted from all Regional properties, except the Sandy Hills tract where snowmobiles are allowed to travel on one designated trail. Although ATVs and motorcycles are not permitted on Regional properties they have been observed operating at

several forest tracts, both on- and off-trail. Signage, entrance barriers and/or fencing have not been entirely effective in keeping motorized vehicles out of these areas.

Bush parties, which often involve campfires, appear to be limited to the Doon tract and the southern portion of the Waterloo Landfill site.

Public parking lots are only available at five Regional Forests and most of these facilities appear to be inadequate relative to the demand. Gates and barriers have been placed at trail entrances to all of the more heavily used properties (see Table 7), however, over time these have been neglected and fallen into varying states of disrepair. Regional signage prohibiting unacceptable activities has been placed at all properties open to the public, except Walker Woods, Gibney, and McLennan Park. Although there is no signage on permitted activities at the Doon Heritage Crossroads there is no need for it given the perimeter fencing and limited pedestrian day use of this area.

Public washroom facilities and garbage containers are not available at any Regional properties other than Doon Heritage Crossroads. Garbage dumping and littering continue to be a problem around parking lots and trail entrances, particularly of the more frequently used properties.

Encroachment onto Regional property has been a recurring problem particularly at McLennan Park and the Doon tract. Lawns and gardens have been extended across property boundaries, and brush, grass clippings, leaves, old sod, barbeque ashes, and other garbage (e.g. waste lumber, scrap metal, plastic products etc) have been dumped in the forest.

The access roads and trails found in almost all Regional Forests that are open to the public are generally in good condition, although some have been significantly eroded in moderately to steeply sloping sections. Trail maintenance in the form of tree and/or brush removal is required in most of the Regional Forests in order to facilitate the safe passage of pedestrians and bikers. Trail extensions, upgrading and/or new trail construction is being recommended to enhance recreational use at Walker Woods, Gibney, Townline, Macton, and Doon Heritage Crossroads.

7.4 Education and Research

Over the past twenty years the Drynan and Sudden tracts have been heavily used by the Waterloo Region District School Board and the Waterloo District Catholic School Board for outdoor education and/or recreational purposes. Both primary and secondary school groups have utilized these properties. More recently, school groups have also visited the Petersburg tract to participate in a variety of outdoor activities.

Students from the University of Waterloo, Wilfred Laurier University and the University of Guelph have used the Sudden Tract for various ecological research projects. The prescribed burns at the Drynan tract during the 1990's provided research opportunities for MNR staff as understory vegetation plots were established in burn areas. The City of Waterloo has recently established a Wildlife Study Area Plot in an immature conifer plantation at the Townline Tract as a control site with which to compare conditions in the Forested Hills ESPA adjacent to new subdivisions.

7.5 Agriculture

Gibney and Macton both have unforested areas that have been used by neighbouring farmers for agricultural purposes. Under the MNR, annual rents were collected, however, over the past few years this has not occurred, in fact, there has been little to no contact with the farmers at all.

At Gibney, an experimental agroforestry site was established in the early 1990s, with oaks planted in rows alternating with agricultural crops. Beginning in 1992, the Region has attempted to establish prairie grasses along the southern edge of the woodland but with little success. It is recommended that a restoration plan be developed along with a commitment for funding for this property. The Brant Stewardship Network is currently developing a savannah prairie restoration project and there is a possibility that the Region of Waterloo can make use of the expertise that this organization is developing.

The agricultural area at Macton comprises approximately 2 hectares immediately adjacent to Manser Road. Common crops over the past few years have included hay and mixed grains. As the Macton is already the smallest Regional Forest, and in need of extensive management due to poor stand conditions (untended conifer plantation), it is recommended that the entire area be managed as woodland, with tending operations in the plantation itself and planting of the open field with appropriate (hardwood) tree species.

In addition, for many years a beekeeper has been allowed to place his beehives in the plantation proper at Macton tract. Although this small scale honey production operation does not generate any revenue for the Region it has not caused any damage to the forest, nor has it resulted in conflicts with other users of the area.

7.6 Financial Considerations

Since 1998, the Regional Forests have had a modest operating budget of less than \$10,000. For the most part this has been utilised to pay for the removal of hazard trees. In 2002-03, several hundred trees in five tracts (Doon, Drynan, Hilborn Knoll, Petersburg, and Sudden) had to be felled in the interest of public safety. At this time, it is necessary to develop realistic budgets to maintain the forests adequately and install the required capital improvements. Revenues generated from the sale of timber products resulting from various management operations can be used to offset at least some of the operating and capital costs.

Plantation thinning and conversion operations can generally be expected to generate some merchantable timber, although most of the trees to be harvested will be small dimension conifers of little or no commercial value. Given the lack of forestry operations since 1994, there is a substantial backlog of plantation work that needs to be done in the near term. If such operations are not carried out in a timely fashion, the plantations will produce little or no return on the original investment in tree planting, and, of greater concern, conversion to hardwoods will be delayed.

By contrast, in stands where the primary objective is the improvement and management of hardwood stands, substantial amounts of revenue can be generated through harvesting activities so long as ecological values are not jeopardised. In most of these stands however, there is less urgency than in the conifer stands to harvest in the next few years.

8.0 Property Management Issues

In contrast to forest management, property management refers to the responsibilities the Region has as a landowner to protect its forest properties, ensure the safety of the visiting public, and budget for required infrastructure. A number of issues dealing with the management of the Regional Forests as properties are presented below.

8.1 Property Boundaries

Many properties have boundaries that are not readily discernible. In some cases, lack of well defined boundaries may not be of great importance due to obvious changes in cover type on adjacent properties or the presence of extensive wetlands. Nevertheless, eight properties are potentially at risk of trespass logging due to the presence of high value hardwoods on Regional property and adjacent private lands. These properties include the Waterloo Landfill, Operations Centre, Walker Woods, Sudden, Drynan, Townline, Petersburg and Dean's Lake. In these cases, boundary definition should be improved through spray painting or flagging boundary trees, or erecting marker posts and/or signs. On the other 4 properties with indistinct boundaries (e.g. Sandy Hills, Hilborn Knoll, Doon and McLennan Park) there is potential for further encroachment from neighbouring landowners or other kinds of abuse in the absence of clear demarcation.

8.2 Gates

Most of the tracts have access lanes or trails. Some have been gated in the past in order to exclude unauthorised vehicles which may endanger other users, damage trails, and carry refuse for illegal dumping. A number of the gates have become decrepit or are absent altogether. It is recommended that all Regional Forest access points be gated or blocked off altogether (by bollards or large stones) in order to control the entry of vehicles.

8.3 Parking Lots

Only five of the woodlands have usable parking lots. If the Region wishes to promote public use and enjoyment of the forests, consideration must be given to improving or creating parking facilities. Even where parking lots currently exist, there is a need to improve their design for safety and convenience. For example, the Petersburg tract has become increasingly popular with mountain bikers many of whom park their vehicles at the forest entrance. At present the parking lot can accommodate approximately four or five vehicles, however. On some weekends there are up to 20 vehicles at this location, with the result that the cars are parked alongside the laneway leading to the forest entrance. This laneway also provides access to the adjacent gravel pit and vehicles parked along the sides create problems for gravel truck drivers, especially as there is also an unsignalised rail crossing of the laneway. This is perhaps the most pressing example of the need to expand and improve facilities at the various tracts for the safety and enjoyment of the public.

8.3.1 Signage

Formerly, the Regional Forests were identified with brown wooden signs erected by the MNR. Many of these signs have decayed and collapsed. In 1997, the Region erected small metal signs at the entrances to identify the land as a Regional Forest and specify some basic rules. These signs are generally intact, but a few have had to be replaced over the years where they were stolen or vandalised.

There is a need for distinctive and informative signage at all major forest entrances designed identify them as Regional Forests. The signs should contain the name of the forest, some historical information, notable natural features, basic rules of behaviour, a map of the trails and contact information. It is recommended that over time information kiosks be erected at the entrance to all publicly accessible Regional Forests.

8.3.2 Rubbish and Litter

Household garbage, landscaping materials, discarded furniture, tires, and construction waste have been dumped in parking lots and inside some of the Regional Forests. Such dumping is unsightly and tends to encourage others to dump additional refuse. Litter and debris left by forest users are occasionally encountered within the forests. Nevertheless, most visitors appear to be responsible and do not litter, in fact there are many who remove litter deposited by others. The use of gates or other restriction of access will discourage the entry of vehicles carrying garbage.

Dumping at entrances will likely continue to be a problem in the future and is best addressed by prompt removal in order to discourage copy-cat behaviour. The use of garbage receptacles has been considered but are not recommended as they tend to be either used as receptacles for bags of household garbage, or where they are of suitable form or size, to be stolen for use as burn barrels. The current system of monitoring and picking up of small amounts of litter and debris by Regional staff during regular visits will be continued unless otherwise indicated.

8.3.3 Municipal Addresses

Only one or two of the forest tracts have municipal addresses (i.e. green and white numbers displayed at roadside). Regional staff initiated the addressing process late in 2002, but the process is slow. It is nonetheless important that all tracts have municipal addresses in order to provide ready identification for access by emergency crews. In addition, addresses assist the public, especially first time visitors, to locate the tracts.

9.0 Forest Management Plan

9.1 General Provisions

The Goals and Objectives for this Plan are consistent with the priorities articulated in the ROPP

The Goal is:

To conserve, enhance, and where feasible, restore woodland ecosystems to reflect the native biodiversity of the respective parts of the Region of Waterloo in which the Regional Forest tracts are located while also accommodating appropriate recreational, educational, social activities which do not jeopardise the health or sustainability of the forests.

This section will provide more detailed strategies and general directions for achieving the goal and the specific objectives that derive from it. The objectives identified in the ROPP are in bold, followed by a brief discussion of the strategies that will be employed.

9.1.1 Ecological Objectives

- **To place the highest level of protection, conservation and management on Regional Forests that contain ESPAs, PSWs, Significant Woodlands, or parts of the Natural Habitat Network.**

Twelve of the sixteen forests form part of ESPAs (Table 4). The Region is now working with Ontario Nature (formerly the Federation of Ontario Naturalists) to develop scientifically valid criteria for “significant woodlands.” In the absence of approved criteria, this management plan will consider the remaining four tracts as “significant woodlands.” Walker Woods is a high quality natural woodland which is part of a larger rural woodland complex, and may reasonably be expected to meet future criteria for significance. The Operations Centre woodland has been adversely affected by drainage changes resulting from local development activity, but it is also part of a larger wetland and woodland complex. The Macton and the Kitchener Landfill woodlands are smaller and more isolated. It will have to be determined at a later date whether they fulfill the as yet undetermined criteria for significance. In each case forest management activities and recreational facilities will be evaluated so as not to result in adverse environmental impacts to the respective tracts.

- **To conserve native species and habitats representative of the Region’s native biodiversity with particular attention to habitats and species within Regional Forests that exhibit any of the following characteristics: Carolinian habitat, Old Growth trees and Woodlands, Regionally Significant Species, Significant Wildlife Habitat, Interior Forest Habitat, Wetlands, Groundwater Recharge \ Discharge Zones, High Quality Forest Habitat, Slopes and Valleys, Creeks and Streams, Locally Significant Species, Wildlife Corridors, Unusual Habitat.**

As the steward of lands containing significant species and habitats, the Region bears a responsibility to ensure that these elements of our natural heritage are maintained and/or enhanced for future generations. It is also expected to set a standard of care for private and other public sector owners of environmentally significant lands.

The type of stewardship will vary depending upon the particular circumstances of each forest tract. In some sensitive areas, (e.g. rare salamander breeding habitat), it will be preferable to avoid or keep human intrusion to an absolute minimum. On the other hand, the oak stands which are naturally succeeding to a tolerant hardwood type will require active management in order to maintain

them. In other cases, ecological restoration will be required to transform degraded or significantly human-altered habitats back to more representative natural systems. This may even necessitate re-introducing species which have become locally extirpated. Areas requiring such active conservation measures must be identified and mapped, with an analysis of current conditions, a rationale for a potential course of action, and a comprehensive set of management options.

Perhaps the biggest ecological management challenge in the Regional woodlands is the maintenance of oak-dominated forests. Upland oak forest is one of the most difficult vegetation communities to consistently regenerate successfully, regardless of the silvicultural system used. In the Carolinian Life Zone (Deciduous Forest Region) which extends across the southern part of Waterloo Region mid-tolerant oaks (e.g. Red, White and Bur Oak) are commonly associated with shade intolerant hickories (e.g. Shagbark, Pignut and Bitternut Hickory), as well as other hardwoods and White Pine. The majority of existing Oak-Hickory stands are the result of severe cutting and/or fire in the past. MNR previously carried out silvicultural treatments on former Agreement Forests that were designed to secure advance oak regeneration. Their work focused on partial cutting using group selection or group shelterwood methods but they did little or no pre- or post-cut control of undesirable competing trees and shrubs in the understory. More recently MNR initiated experimental prescribed burns in portions of an oak stand on the Drynan tract in an attempt to stimulate oak and/or hickory reproduction, but the results have not been satisfactory in that the program was ended after only several years.

The Red Oak stands found on Regional Forests contain 30 to 60% oak and they generally occur on dry to fresh sites of medium quality which make them well suited to the perpetuation of oaks. However, the understory comprises mainly tolerant hardwoods rather than advanced regeneration of oak. Given these stand and site conditions, and Regional concerns for the maintenance of Carolinian forest as well as the protection of associated significant plants and animals, the application of the group selection silvicultural system is considered most appropriate for the maintenance of these stands. Under this system, gaps or openings, which are about equivalent in diameter to the height of the dominant trees, are periodically created in the overstorey in order to provide suitable sites for the germination and establishment of shade intolerant trees. Care must be taken, however; to minimize the impact on associated woodland plants and animals along with potential impacts to recreational users. Nevertheless, for the group selection system to achieve desired regeneration of oak and other mid-tolerant to intolerant hardwoods, there must be a strong commitment to control undesirable competing tree reproduction and shrub growth in the understory. Prescribed burning, cutting, and/or the controlled use of herbicides may be required to achieve the necessary overstorey and understory removal. There are also a number of other accepted restoration activities that may be utilized and evaluated for successful re-establishment of the desired vegetation types and ecological processes.

- **To maintain and enhance healthy, sustainable forest ecosystems with a range of successional stages and diversity of forest communities.**

The Regional Forest properties exhibit a range of successional states from the open field at the south end of Gibney to the older growth woodland at Doon Heritage Crossroads. The successional status of the oak-dominated woodlands has already been discussed. There is similarly a range in successional status within the various conifer plantations. While it is desirable to convert most of the conifer plantations to native hardwood forest, from an ecological perspective it is preferable that some particularly fine mature conifer stands such as those at Sandy Hills be retained as conifer stands in order to sustain the significant plants and breeding birds which inhabit them.

- **To restore poorly structured plantations with low ecological function to woodlands consisting of representative native species**

In general, the long term objective for conifer plantations is to provide a suitable environment for the eventual establishment of tolerant hardwoods. As noted in the previous item, there are several instances where it may be undesirable to force a conversion to hardwoods due to the ecological status of the plantation. In such cases it may be more desirable to retain the stands as they are and allow them to progress through natural successional stages in order to maintain the bird population until such time that conditions become unsuitable for them.

The silvicultural objective of stand conversion will be accomplished through a series of periodic thinnings. Many plantations have received a first thinning while others have not. Successive thinnings will be conducted at approximately 10-year intervals to maintain satisfactory densities and provide optimum growth and development of residual trees. Thinnings may be required less frequently in plantations that already have a large component of hardwoods (e.g. Red Oak, Black Cherry and White Ash).

Thinnings may take the form of partial removal in which entire rows of trees are taken, or they may be based on individual tree selection. Selection thinning will mostly be “from below,” that is, the removal of diseased, deformed and low vigour trees (as indicated by suppressed and intermediate crown classes), along with undesirable species. Jack Pine and Scots Pine will be discriminated against during thinnings, while White Pine, Red Pine, spruce, larch and hardwoods will be favoured. Hardwoods will be released from conifer competition whenever possible, and will not be cut unless they are of poor quality since they are required as a seed source.

If natural regeneration of hardwoods does not become established in plantations after several thinnings, direct seeding or underplanting may be required to ensure a successful conversion to hardwoods.

Although the overall objective is to convert conifer plantations to tolerant hardwoods, conifers such as White Pine should be maintained as a viable component of the hardwood forest. Furthermore, on some sites which are only marginal for good hardwood growth (e.g. moist to wet sites, dry infertile sites etc.), it may be desirable from both a forestry and ecological point-of-view to develop and maintain mixedwood stands (e.g. mixtures of White/Red Pine, White Cedar and hardwoods). Such mixed wood stands ensure that greater habitat diversity is available to wildlife and dependent ground flora.

Plantations of Scots Pine and Jack Pine typically represent poor quality material as do many Red Pine plantations that are suffering from nutrient dieback. These areas should be cut and replanted with more suitable species, especially White Pine, White Cedar and White Oaks. Alternatively, if satisfactory hardwood regeneration has become established in these plantations and the conifers are in poor health, nothing may be required other than to allow the conifers to die and the hardwoods grow-up between them.

- **To carry out active management using appropriate prescription tools including ecological restoration and silvicultural techniques, and where feasible, actively work towards controlling any introduced species that threatens the integrity the Regional Forest.**

There are a variety of techniques available to conserve, enhance, and restore the native biodiversity of the Regional Forest system. These include tree cutting, prescribed burning, soil scarification, and tree planting.

The establishment and spread of invasive non-native species is a growing concern. Common and Glossy Buckthorn and Garlic Mustard are two of the most wide-spread and aggressive of the non-native species. Buckthorn is a very aggressive, shade tolerant, alien shrub that is abundant in the understory of many tolerant hardwood stands and conifer plantations. Buckthorn grows rapidly on dry to moist sites and prolifically produces seeds which are readily spread by birds. Since Buckthorn competes with and suppresses desirable hardwood regeneration, consideration should be given to implementing appropriate control measures (i.e. direct stem injection of an approved herbicide) designed to eradicate or at least reduce populations of this species on Regional Forests.

Like Common Buckthorn, Garlic Mustard is shade tolerant and a very prolific seeder. It effectively out-competes native woodland wildflowers and can quickly become dominant in the ground flora of upland forests. It is now abundant on several properties and appropriate control measures (i.e. hand digging and/or spraying with herbicides) should be implemented where feasible in order to minimize the spread of this species. As seeds remain viable for at least five years, any eradication program must be based on a consistent multi-year commitment.

9.1.2 Social and Educational Objectives

- **To provide recreational opportunities and visitor facilities which do not damage native vegetation, impair the productivity of the forest, degrade soil or water, or cause conflict with other users and adjoining property owners.**

Many residents of the Region enjoy visiting Regional Forests to walk the trails or cross-country ski. Such use results in little or no impact to the forests, and provides a physically and emotionally satisfying, but low-cost recreational experience to citizens of all ages and from all walks of life. Promoting such passive or non-consumptive recreational uses is a major priority of this plan. This will involve the installation or improvement of facilities such as trail signage, parking areas, and trails.

Passive recreational activities are generally compatible with forest, fish and wildlife management operations. These activities are therefore considered acceptable on all Regional Forests that are open to the public, including the forested portion of the Waterloo Landfill site which is separated from the active landfill and recycling centre by a chainlink fence.

The demand for cross-country skiing opportunities has increased significantly over the past 20 years. This sport may be divided into back-country versus in track skiing which is performed on trails groomed by snowmobiles. Back-country skiing is done on relatively narrow trails that are not groomed, or it may be done in the absence of trails. In-track skiing is characterized by a wider trail which is needed to facilitate the manoeuvring of track setting equipment. To date, there are no Regional properties with groomed cross-country ski trails.

- **To demonstrate examples of good forestry practice in order to promote good woodland stewardship on private and public lands.**

Practicing good woodland stewardship indicates the Region's responsibility for ensuring that parts of our natural heritage are maintained for future generations and to set a high standard of care that can serve as an example to other public and private landowners. In order to do this, it is important that all management activities are carried out with an eye to maintaining or enhancing the ecological values inherent in the woodland. Proper and thorough documentation of goals, objectives, baseline conditions and management activities will be required in order to provide a record of forest development over time and to establish indicators of success and/or failure. The development and

implementation of well-designed monitoring programs will be essential in tracking the progress of forest relative to the indicators chosen.

Good stewardship will necessitate that management activities are carried out in such a manner that damage to the forest floor and residual stand are avoided or at least kept to a minimum. This will require attention to the seasonal timing of operations as well as taking precautions in the acts of tree felling and tree removal. While the level of care required may carry an economic penalty, it is nonetheless important to demonstrate that economic returns are not the Region's primary motive for forest management.

- **To provide for effective public consultation in the formulation and implementation of management objectives.**

Many Regional residents use the Regional Forests and are interested in staying informed regarding their management. It is therefore important to involve the wider community in the planning and implementation of forestry activities. Open houses and information sessions have been used to obtain public input and comment regarding the Regional Forest Management Plan as well as to provide education and information about the Regional Forests.

- **To provide opportunities for *bona fide* ecological and forestry research provided it does not jeopardise significant species or habitats or the sustainability of the forest.**

The Regional Forests have long been used for research and education. A major federal forestry research project was located in the Sandy Hills tract from 1957 to 1974. A number of university students have conducted research projects in some of the other tracts. In addition, school groups and scout and guide troops have used some of the tracts for educational purposes.

Outdoor education and research will continue to be allowed on Regional properties and appropriate educational usage by primary and secondary schools will be encouraged because there is no better place for students to learn about nature than by being actually surrounded by it.

With respect to ongoing MNR and City of Waterloo research on Regional Forests, the MNR and the City will be requested to identify the approximate location of all active permanent sample plots on Regional maps and annually confirm in writing their interest in continuing to collect data from these areas. Any new research proposals of municipal, provincial and federal governments, or universities and colleges must be submitted to the Region for review and approval. Researchers will be requested to submit reports of their findings to the Region so that there is a record of their work, and the Region is made aware of results which may affect how future management activities are carried out. Much research has been carried out on Regional lands in the past without the Region being aware of it or receiving copies of final reports.

9.1.3 Legal Objectives

- **To ensure that management activities in Regional Forests conform to applicable federal, provincial, and municipal legislation and policy.**

All activities that take place in the Regional Forests will be monitored to ensure strict compliance with the legislation, policies and regulations discussed earlier. Good stewardship has not only ecological implications, but also a societal aspect through adherence to applicable laws and policies.

- **To maintain forests so as to prevent potential threats to the safety of users.**

Since the Regional Forests are for the most part open to the public, the safety of users is of utmost importance. All management activities must be carried out in such a manner as to reduce risk to the public both at the time of operation and afterwards. In addition, potential hazards and threats will continue to be monitored and removed in systematic fashion.

9.1.4 Economic Objectives

- **To develop realistic capital and operating budgets for the forest system.**

Developing realistic budgets for Regional Forests and Woodlands will require an acknowledgement that years of little or no management activity have created conditions where investments will need to be made if the various properties are to be brought up to acceptable standards. A number of property issues will require capital outlay in the first years of the Management Plan. Surveying and marking property boundaries, installing gates, barriers and signs, installing, enlarging and improving parking facilities, and maintaining and improving trails are some of the high priority capital budget items to be addressed within the first 5-year operating plan (2007-2011).

Revenue generated from timber sales is unlikely to balance the capital costs over the short term, and it is also likely that forestry operations in immature and declining plantations will not produce significant income for the foreseeable future and may even incur net costs.

- **To obtain a fair economic return from the sale of forest products which may result from management activities.**

While the emphasis of forest management in Regional Forests and Woodlands is not to generate revenue, there will be opportunity to realize income from the sale of firewood, pulpwood, sawlogs and veneer logs. Sales of forest products will be conducted on the open market following generally accepted practices in the local forest products industry. Such sales may involve seeking bids for sales of marked standing timber or selling firewood contracts on recently harvested woodlots. Highest bids will not necessarily be the ones accepted as there will be a need to evaluate the work quality of the contractor submitting the bid. If a contractor with a lower bid offers a higher quality of care in performing the required work, the overriding goal of maintaining ecological quality will prevail.

It is also possible that there will be instances where management activities on a property may incur costs rather than realizing income even though a saleable product may result from the operation. An example of this may be a thinning operation where a low volume of merchantable timber results even after extensive tree felling.

Similarly, the removal of hazard trees is unlikely to result in a profit as the trees removed tend to be spread over a significant area and few of the trees have merchantable volume. Nevertheless, this activity is justified in terms of reducing risk to users and hence reducing the Region's liability.

9.2 Guiding Principles & Operational Guidelines

This section will outline the principles and guidelines that form the basis for implementing the forest management objectives of this plan. Not all principles and guidelines will be applicable in every situation or every stand or forest.

9.2.1 Good Forestry Practices

The MNR publication **A Silvicultural Guide to Managing Southern Ontario Forests** (MNR 2000, as updated), will serve as the technical reference guide for all management activities in the Regional

Forests and woodlands. This publication provides a summary of appropriate management actions for stand types found in Southern Ontario Forests. It is a compendium of research findings from a wide range of sources and provides strategies for ecological and timber management objectives.

9.2.2 Timber Production

While previous management plans have accorded high priority to timber management, the ROPP policy gives it lower priority than environmental conservation and passive recreation. This is appropriate in light of the comparatively small size of publicly accessible forests in relation to the Region's steadily growing population, and the fact that many of the tracts are known to sustain ecologically significant features and functions. Timber production is acceptable only as long as it does not jeopardise the ecological and recreational values of the woodlands and contributes to the overall enhancement and sustainability of the woodlands. In fact, timber may be best viewed as a by-product of forest management initiatives intended to promote healthy, self-regenerating, ecologically diverse woodlands.

9.2.3 Areas of Concern

The MNR defines an Area of Concern (AOC) as "an area adjacent to an identified value that may be affected by some (or all) forest management activity" (MNR 2000). A forest value is defined as "a benefit or condition of the forest that is linked to a specific geographic area, that could be of interest from various points of view, and which may need to be protected as a result of timber management activities." On Regional Forest properties, the values which need to be protected include those lands determined to be within PSWs, ANSIs and/or ESPAs, as well as other areas that exhibit significant flora and fauna, critical fish and wildlife habitats, old growth forests, Carolinian forests, permanent water bodies, springs/seepage areas, steep slopes and unique geological features. Culturally important recreational trails, such as the Grand Valley Trail, also represent a forest value to be protected.

9.2.4 Water bodies and Fish Habitat

Water bodies and adjacent riparian zones provide critical habitat for fish and many species of wildlife. Riparian vegetation provides shade, stabilizes banks, traps sediment before it enters streams and contributes food to aquatic ecosystems. It is therefore important to avoid any significant disturbance to riparian zones. To provide appropriate protection for these sensitive habitats, buffer strips are to be established adjacent to all water bodies according to the following guidelines:

- Where slopes are of 10% or less, buffer strips are to extend 30 m (100 feet) back from the bank of a permanently flowing spring or stream, as well as a lake or pond. However, where slopes exceed 10%, the buffer strip is to go on the top of bank or 30 m, whichever is greater.
- For intermittent streams and seepage areas which do not generate year round flow, a 15 m (50 feet) buffer strip will be established outward from their banks. Where slopes exceed 10%, this buffer is to extend to 30m or the top of bank, whichever is greater.

9.2.5 Wetlands and Vernal Pools

The MNR Silvicultural Guide (OMNR 2000) defines a wetland as "land that is seasonally or permanently covered by shallow water, or land where the water table is close to or at the surface. In either case, the presence of abundant water has caused the formation of hydric soils and has favoured the dominance of either hydrophilic or water-tolerant plants." Wetlands have many important biological, hydrological and socio-economic functions and values and may be characterized as swamps, marshes, bogs or fens. On Regional Forests only well treed swamps potentially contain timber of commercial value.

A vernal pool is a confined woodland depression which usually holds water for at least two continuous months during the spring and/or summer, and which is free of adult fish populations. These areas provide essential breeding habitat for a variety of amphibians (e.g. Wood Frogs, salamanders, Red-spotted Newts etc.) and other important wildlife species. They are commonly found in several upland tolerant hardwood stands in Regional Forests.

Forest management activities will be conducted in such a manner that wetlands and vernal pools are given high levels of protection. Wherever possible, machinery and heavy equipment will not be permitted in these areas during the spring and summer months when they are most susceptible to disturbance. Care will need to be taken to ensure that drainage channels are not created resulting in the loss of water which would normally be retained. Restricting management activities to the winter months when the ground is frozen will ensure that the ecological values of wetlands and vernal pools are maintained.

9.2.6 Wildlife Habitat

Forestry operations must be conducted in ways that do not disturb significant wildlife species or their key habitats, especially during the breeding season. Appropriate buffers or reserves, wherein little or no cutting is permitted must be clearly established around sensitive wildlife habitats prior to the initiation of logging operations or other forestry activities. Forestry activities should be scheduled outside the known breeding seasons of the species occupying the woodlands.

Following is a list of guidelines for habitat-based management:

- **Wildlife Corridors:** Forestry operations on Regional Forests must not disrupt existing wildlife travel corridors which extend across and beyond Regional property (e.g. interior forest habitat connections, stream/riparian habitats etc.), and wherever possible should enhance these corridors.
- **Open Areas/Edge Effects:** Small openings in the forest canopy can be created and/or maintained on Regional Forests where feasible in order to improve habitat diversity for wildlife. Openings in the forest canopy facilitate the establishment of edge effect habitat between forest cover types and this is very beneficial to various birds and mammals for breeding and/or feeding purposes. Seeding openings and roadside edges with mixtures of native grasses, wildflowers, and various wildlife shrubs (e.g. dogwoods, elderberry, nannyberry, raspberry etc.) would also be beneficial to wildlife in areas where this kind of vegetation is absent.
- **Stick Nests:** Various large woodland birds (e.g. eagles, hawks, owls, crows, herons) build a platform of sticks (twigs and small branches) in trees for nesting purposes. Since suitable nest trees are usually in short supply, trees with stick nests must not be cut and an appropriate reserve or buffer must be established wherein no tree cutting is allowed during the breeding season of species inhabiting the nest. Appropriate modifications to the management of adjacent areas may also be required to ensure the protection of the stick nest and the nest tree.
- **Cavity Trees:** Trees with cavities provide important habitat for a variety of bird species and mammals. As many of the cavity nesting birds also happen to be Regionally significant species, retaining cavity trees will be a priority and preference will be given to trees characterized by dense wood (ex. Hard maple, oak, and beech) that are 25 to 50cm dbh. In addition, at least one large dead standing tree (snag) should be retained per hectare (along with any nearby trees for safety reasons). Where cavity trees pose a potential hazard for recreational users of the forest (i.e. in close proximity to trails and facilities) these trees will need to be removed in order that human safety is not jeopardised.
- **Naturally established conifer stands:** In hemlock or cedar stands that function as deer wintering areas it is preferable to retain dense clumps of conifers separated by small openings

rather than evenly spaced conifers which provide less effective shelter and reduced opportunities for browse production. Such stands are to be maintained predominantly in conifers.

- **Conifers in Hardwood or Mixed Stands:** In hardwood or mixedwood stands, small clumps of conifers and solitary conifers, particularly Eastern Hemlock, White Pine and White Cedar, are to be maintained and enhanced where feasible. This is especially the case where these stands are part of a large deer wintering area. Although conifers may be cut in these stands for silvicultural, environmental or safety reasons, tree removal should be focused on the hardwood component. Care must be taken to ensure that conifers are retained in mixedwood stands if they are to be kept in this condition.
- **Hardwoods in Conifer Stands:** Scattered hardwoods are to be retained in conifer stands especially poplar or mast producing trees, in order to maintain the diversity of food sources available to wildlife.
- **Mast Producing Trees:** Mast producing tree species commonly found in Regional Forests include beech, oak, hickory, butternut and Hop Hornbeam. As mast is a staple for a wide variety of wildlife, retention of mast producing trees is important. Dominant and co-dominant trees with large, vigorous crowns usually produce the most mast. To help ensure successful pollination and seed formation, trees of the same species should preferably be spaced at distances of less than 50 metres.
- **Supercanopy Trees:** A supercanopy tree is a living tree that emerges above the main canopy of the forest. They are valuable to various raptors for nesting and perching, and also serve as a refuge/bedding site for certain mammals such as racoons and opossums. In addition, these genetically superior trees can provide an important source of seed for the development of desirable regeneration. Wherever feasible and appropriate, supercanopy trees are to be retained in all harvested areas.
- **Downed Woody Debris:** Downed woody debris refers to fallen trees, limbs and branches lying on the forest floor in various stages of decay. This organic material provides important breeding, feeding and escape habitat for various reptiles, amphibians and small mammals. It is also essential for nutrient recycling in the forest. Logging contractors will be encouraged to leave some large cull logs in the bush particularly if they are hollow, as these provide good drumming sites for Ruffed Grouse, as well as shelter and escape cover for various mammals. Tops, limbs and other “slash” should be left on site rather than being dragged to landing areas.

9.2.7 Active Recreation

In addition to the passive or non-consumptive recreational activities which are encouraged in Regional Forests, there are several other recreational activities which are more problematic in that they create impacts upon the natural environment or result in conflicts with other higher priority uses. These include mountain biking, horse-back riding, hunting, fishing, and the use of motorized vehicles such as ATVs and dirtbikes.

- **Mountain-biking:** Beginning in the early 1990s, mountain biking became a popular recreation in woodlands in the Region. Some Regional woodlands, such as the Petersburg tract and the Waterloo Landfill, attract many mountain bikers because they are situated along the Hydro right-of-way (known locally as the “Hydrocut”) running west from the rapidly developing west side of Kitchener-Waterloo. Toward the end of the 1990s, the impacts of mountain biking on these forests as well as other urban woodlands had become a significant concern. Initially, impacts took the form of soil rutting, compaction, and erosion along trails. Within a few years, however, new trails were being blazed through vegetation and up and down steep erodible slopes. In 2002, discussion occurred between responsible members of the mountain-biking community and Regional staff. In the fall of 2003, a sub-committee of the EEAC investigated the problem, and concluded that mountain-biking could be considered in some Regional Forests subject to the following conditions:

- a) That it does not jeopardise Regionally significant plants and breeding birds occurring within the Forest;
- b) That it does not result in unnecessary damage to trees or diminish the commercial value of trees within the tract which might be harvested in accordance with future silvicultural objectives;
- c) That the potential for additional soil erosion on steep slopes within the tract is minimized;
- d) That no unauthorized new trails are created within the forest;
- e) That the design of any trails or constructed facilities ensures reasonable safety to recreational mountain bikers;
- f) That such recreational use does not result in unnecessary annoyance to other recreational users of the tract;
- g) That recreational mountain bike use be designed and regulated so as to minimise additional liability exposure to the Region; and
- h) That use of the tract by mountain bikers avoid annoyance to adjoining landowners;

Since that time, Regional staff has considered examining environmental and legal ramifications of working with mountain-bike clubs to maintain trails in some Regional Forests.

Continued monitoring of the various Regional Forests and Woodlands will need to take place to ensure that illegal activity does not occur. In the event that free-riding stunts are constructed, it will be necessary to remove them promptly and to actively discourage such activities.

- **Horseback Riding:** Horseback riding occurs in some of the tracts. In areas of steep slopes and erosion-prone soils, it has the potential to damage forest trails and cause erosion. Heavy usage can result in sanitation problems for other forest users. In addition, the horse manure serves as a source of seeds from non-native grains and grasses which have the potential to compete with native vegetation.

At low to moderate levels of use, horseback riding has been permitted on all Regional Forest properties open to the public and having suitable trail systems. Equestrian use is most evident at the Sandy Hills and Petersburg tracts. In light of increasing concerns with non-native and invasive plant species being brought into the Regional Forests through horse manure, the practice of allowing horse back riding needs to be given serious consideration. If and/or where the activity is deemed inappropriate, signs prohibiting equestrian use will need to be posted at key trail locations.

- **Hunting and Fishing:** While opening the Regional Forests to hunting on a system-wide basis is not appropriate given their use by other recreational users, it could be argued that there may be situations where hunting might be considered to control deer, rabbits, or other herbivores in cases where grazing pressure is observed to be excessive and detrimental to the health of the forest. If controlled hunts were to occur, they could only be permitted by resolution of Regional Council after consultation with the MNR, adjacent landowners and affected members of the public.

Trapping will not be permitted on Regional property unless it can be demonstrated that actions of a wildlife species is threatening significant ecological values or becoming a nuisance to neighbouring properties. Beavers and other furbearers are part of the natural ecosystem and the alterations they might make within the Regional Forests comprise part of the normal function of their environment.

Although several of the Regional Forests contain fish habitat, fishing has not been an issue to date in the sense that there have been very few reports of it occurring. Most of the fish habitat is limited in extent and quality, with several of the streams being warmwater. However, there is the possibility that bait fishing activity might exist on a small scale. In the interests of conserving local ecological values, fishing will not be permitted in the Regional Forests.

- **Off-road and All-Terrain Vehicles:** Damage to trails, soil, wetlands, vegetation and wildlife caused by motorized recreational vehicles is not consistent with the goals and objectives for the Region's Forests. It can undo management activities particularly with regard to regeneration. All too often the operators of these vehicles show little regard for other users of the forests. Forest tracts will continue to be posted to exclude unauthorized motorized vehicles.
- **Snowmobiling:** While motorized vehicles in general are unwelcome intrusions in Regional Forests, snowmobiles, in limited instances, may be something of a special case. As they are only used during the winter months, they are separated from the soil along trails by snow and ice, and official trails are regularly policed by local snowmobile clubs. In early 1996, Regional Council permitted a local snowmobile club to route a trail along a lane crossing the Sandy Hills Regional Forest, but not along the internal looping trails. To date, there have been no complaints from other members of the public or neighbours, and there is no evident damage to the laneway or vegetation. The agreement has been renewed since that time. Any applications to route snowmobile trails across Regional Forests will be reviewed with regard to their potential environmental impacts as well as impacts on adjoining property owners. Any such application in the future will be considered in light of their potential impacts on the natural environment and will be submitted to Regional Council for approval.

9.2.8 Visitor Facilities:

Regional Forests are intended for day use recreation activities. Amenities such as camp sites, picnic tables and campfire pits are not provided as large social gatherings are not considered desirable in these natural settings. In addition, fires of any sort have been strongly discouraged because of the potential fire hazard associated with conifer plantations. Signs will be posted on all properties to prohibit these unacceptable activities.

Trails, especially in the larger tracts, will need to be marked for easy identification by hikers. Trail maps need to be installed at the major entrances to the tracts. Some of the trails are in rather poor condition due to erosion, and in other localities branches have grown out over trails. Trail management activities will be undertaken in a timely fashion and at regular intervals in such tracts. Hazard assessments will continue to be undertaken in a regular fashion and appropriate actions taken in the interests of user safety.

9.3 Forest Management Implementation

The Region of Waterloo has the staff resources to oversee forestry operations but does not presently have sufficient in-house technical expertise to effectively implement all activities outlined in this Plan. Appropriate arrangements will have to be made with forestry consultants in order to ensure the proposed silvicultural work is properly carried out.

9.3.1 Harvesting

Forest products will mainly come from a combination of stand improvement cuts and thinning operations rather than harvest cuts as such. Consequently, the volume of sawlogs and veneer logs harvested during this operating period will generally be less than the volume of smaller diameter and

lower economic value, assuming suitable markets are available for such products. Revenue from timber sales may be used to offset the costs of forest renewal, tending and protection.

9.3.2 Tree Marking and Cut Inspection

Trees to be harvested will be marked using paint in a standard forestry fashion and following the prescription prepared for each stand. Tree marking provides an optimum level of cut control by clearly indicating the kind and number of trees to be removed are clearly indicated to cutters. Thus, there is a greater chance of achieving desired silvicultural objectives. It also allows contractors to submit realistic bids for carrying out the required work. Regional staff or other certified tree markers working under the direction of Regional staff will carry out tree marking in stands that are scheduled for harvest.

Highly visible spray paint (i.e. yellow, orange or blue) will be used to mark trees for cutting. Trees will generally be marked on three sides and the butt (stump), except possibly in conifer plantations where row thinning is required and less intensive marking procedures may be employed. Marked timber will be individually tallied or otherwise estimated (i.e. determined from sample plots) in order to determine merchantable volumes marked for cutting (i.e. essential for timber sale tenders or negotiations), and to assess whether or not marking is being carried out according to silvicultural prescriptions.

Periodic cut inspections are required to monitor the progress of logging crews and ensure that work is being carried out in accordance with contractual agreements.

9.3.3 Forest Renewal

While natural regeneration is by far the preferred method of forest renewal, there are some instances where tree planting may be recommended to enhance both species and habitat diversity of Regional Forests. During the period of this Management Plan, the focus will be on reforestation of open land no longer required for other uses, as well as existing stands with inadequate advance regeneration in the understory. For example, underplanting openings in Red Oak stands may be beneficial if natural regeneration is unsatisfactory.

Mechanical site preparation (scarification) and/or prescribed burning may be needed to facilitate the establishment of desirable natural and artificial regeneration in stands managed under the group selection or shelterwood methods, or in cases where stands are clear-cut for salvage and/or stand conversion reasons. The need for site preparation treatments will be determined by the amount of slash left after cutting, duff and soil conditions, the type and amount of advance regeneration and available seed sources.

Annual property monitoring will determine whether underplanting is warranted in oak stands that are given various regeneration treatments. Small plantings of wildlife trees and shrubs could also be considered on certain properties with suitable openings if volunteer organizations offered their services to the Region.

9.3.4 Access Road/Trail Maintenance

Most forest access roads were constructed with bulldozers and they were either left with an earth surface or given a coating of gravel. Over time, some of these roads have eroded from vehicular use and storm run-off. As a result, road repairs and upgrades are required at the Petersburg, Sudden and Dean's Lake tracts.

Numerous trails have also been established on most properties. These trails represent open unplanted areas between conifer plantations, major skid trails or the unauthorized creations of recreational users. With the passage of time, roads and trails fill in with brush, overhanging branches, blown down trees and broken limbs. As a result, tree and/or brush removal is periodically required in order to keep roads/trails open so that they can be readily used by management vehicles and pedestrians. Over this 5-year operating period, tree and/or brush removal is recommended for the roads/trails found on six tracts (Drynan, Gibney, Sandy Hills, Petersburg, Sudden and Walker Woods). Trail extensions, upgrades, and/or new trail construction is also recommended at the Walker Woods, Gibney, Townline, Macton and Doon Heritage Crossroads properties. In contrast, trail closures and/or relocations are needed at the Waterloo Landfill, Petersburg and McLennan Park. The wooden boardwalks constructed across wetlands at the Sudden tract will continue to require periodic repairs and/or replacement.

9.3.5 Property Boundary Line Marking

Spray paint on trees, marker posts or fencing are needed to clearly identify the boundaries of most Regional Forests. Eight properties have been identified as high priority areas for boundary line marking because of the risk of trespass. Trespass can occur when tree harvesting or other activities on neighbouring properties encroach onto Regional property resulting in a loss of trees or other impacts. Trespass can also occur when recreational users of Regional properties stray over onto adjoining private property. The properties deemed to be at high risk for trespass include the Waterloo Landfill, Operations Centre, Walker Woods, Sudden, Drynan, Townline, Petersburg, Sandy Hills and Dean's Lake. These properties should have their boundaries marked or, when necessary, surveyed by the end of 2007. The remaining lower priority properties should have their boundaries marked by 2008 to address existing encroachments onto Regional land and limit future problems (e.g. Hilborn Knoll, Macton and McLennan Park). All properties should have their boundaries checked and re-marked over time.

9.3.6 Other Property Maintenance Items

Civic number signs need to be erected on all properties open to the public and signage stipulating permitted and prohibited uses is to be installed on all properties where it is now lacking.

Parking lots will need to be constructed or upgraded at most of the Regional Forests. The design of the parking areas will need to take into account the amount of use expected as well as minimizing adverse impacts on the property. The installation of gates and/or barriers will need to be considered as part of parking lot layouts, both new and upgrades.

Garbage which is located within the various Regional Forests will be removed as part of the management activities. Physical encroachments will be removed as soon as possible. Priority areas for cleanup efforts include McLennan Park, Petersburg, Sudden, Sandy Hills, Doon and the Hilborn Knoll.

At Walker Woods the existing sugar shack should either be repaired so it is safe for public use, or torn down and removed.

9.3.7 Control of Invasive Alien Plants

Most Regional properties have become seriously infested with aggressive non-native plants, particularly Common Buckthorn, Glossy Buckthorn and Garlic Mustard. It will take considerable and sustained effort and expense to rid these properties of these undesirable species, and in some

cases it may be virtually impossible to eliminate them. Control measures must, nonetheless, be initiated or this problem will only get worse. Management efforts should initially focus on properties with relatively small populations of invasive plants that can be more easily eradicated at a reasonable cost. Priority areas for action include the Drynan, Sudden, Sandy Hills, Hilborn Knoll and Doon Heritage Crossroads properties. Mechanical and/or chemical methods of vegetation removal should be carried out as time and funds permit. Once the situation is under control on these properties efforts could then be directed to the forests on the Petersburg, Dean's Lake, Doon, McLennan Park, Cambridge Landfill, Townline and Operations Centre properties where the task is more challenging.

9.4 Forest Monitoring

All Regional Forests must continue to be inspected at least twice each year for property maintenance and liability management purposes. During these inspections, signage is to be checked and/or replaced, and the condition of roads, trails, parking lots, landings, gates, fences and culverts is to be recorded. Log sheets for this purpose have been maintained by Regional staff since 2002. Garbage dumping or other property encroachments should also be noted and general appropriate remedial measures implemented as soon as possible.

Forest health should also be annually monitored to assess possible damage to trees from insects, diseases, wildlife and environmental agents of destruction. The sooner forest health problems are identified the better, in order to prepare timely response and control programs. Based on field observations, the need for special protection measures and/or salvage operations may be realistically assessed. For many insect pests, particularly those that form readily visible egg masses (e.g. Forest Tent Caterpillar, Gypsy Moth, etc.), late fall to early spring is a good time to assess population levels and the anticipated extent of forthcoming tree defoliation.

Along with forest health surveys, regeneration surveys should be undertaken in the summer or early fall following any silvicultural operations to determine whether fill planting or total replanting is needed to ensure the desired tree densities. At the same time evaluations can be made regarding the need for controlling competing vegetation. Group selection cuts in oak stands should also be periodically inspected to ascertain whether there is a need for underplanting. Information collected by these surveys is required to evaluate the effectiveness of forest renewal efforts and determine the need for follow-up treatments.

A pre-planting survey of future reforestation sites should be carried out one year in advance of the proposed planting season to confirm that tree species selected for planting are well suited to site conditions (i.e. slope inclination and aspect, soil depth, texture and drainage, etc.). This will also provide adequate time to order planting stock if required. Grass, weed and brush competition should be noted so that appropriate site preparation treatments (e.g. herbicide spraying, scarification, brush removal, etc.) are implemented.

10.0 Management Plans for Individual Tracts

Prior to initiating forest management activities is the need to initiate a variety of property management activities as discussed in Section 7.0. Surveying property boundaries, upgrading and installing (where needed) parking facilities, erecting gates and signs will begin in 2007, pending approval of a capital budget.

Hazard tree evaluation, marking and removal will continue as in the previous years as part of due diligence.

Five-year management plans will be prepared for the Regional Forest tracts on an individual basis and scheduled according to a priority of needs. An operating plan for the Hilborn Regional Forest (P-06-055) has already been approved by Council and implemented in June, 2006. The Hilborn Regional Forest was obtained by the Region on June 9, 2003 through a 2001 settlement of an Ontario Municipal Board appeal. Under the terms of the arrangement, the Region had three years to carry out an ecological restoration plan in the forest or potentially return it to the developer. In order to ensure timely compliance with the terms, it was necessary to produce the plan prior to completion of this background document.

The five-year plans will present general operating timelines and management objectives detailing priorities and schedules for the period. Also to be included will be management objectives and how they fit with the overall management goals for the Regional Forests and monitoring programs with quantifiable indicators of success that will be used to ensure that the stated objectives are being met.

As the plans are prepared they will be presented to Regional Council for approval. One-year operating plans will be prepared presenting detailed stand prescriptions and harvesting contract details as part of the five-year plans. The one-year plans will be site specific and provide the criteria for tree-marking, disposal of harvesting products, reforestation efforts and control of competing vegetation as required. As they are completed, approved and implemented, the five-year and one-year plans will be appended to this document and serve as a record of management activities.

11.0 References

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12.0 Tables

TABLE 1. WATERLOO REGIONAL FOREST PROPERTIES

PROPERTY NAME	REGIONAL FOREST #	YEAR OF AQUISITION	TOWNSHIP/CITY	LOT	CONCESSION	HECTARES	OPEN TO PUBLIC
Dean's Lake	1	1948	North Dumfries	2, 3	7	21.4	•
Doon	2	1949	Kitchener	Former Waterloo Twp.	B.U.T	29.1	•
Drynan	3	1982	North Dumfries	Pt. 25, 26	8	44.8	•
Gibney	4	1984	Wilmot	Pt. 12	S.S.R	8.9	•
Macton	5	1945	Wellesley	Pt. 9	14	21.5	•
Petersburg	6	1948	Wilmot	Pt. 3, 4	N.S.R	40.5	•
Sandy Hills	7	1945	Woolwich	62, 63 & 76	G.C.T	74.1	•
Sudden	8	1944	North Dumfries	20, 21	8	88.6	•
Townline	9	1951	Wilmot	1	3B, N.E.R	6.2	•
Walker Woods	10	1992	Wilmot	24	1	10.6	•
Cambridge Landfill	11		Cambridge	N/A	N/A	39.8	
McLennan Park (Former Kitchener Landfill)	12		Kitchener	N/A	N/A	4.6	•
Waterloo Landfill	13		Waterloo	N/A	N/A	26.6	
Doon Heritage Crossroads	14		Kitchener	N/A	N/A	5.7	• ¹
Hilborn Knoll	15	2003	Cambridge	N/A	N/A	5.5	•
Operations Centre	16		Cambridge	N/A	N/A	7.5	
N/A Not Applicable		¹ with admission			Total	435.4	

TABLE 2. AREA SUMMARY OF WATERLOO REGIONAL FORESTS IN HECTARES

WATER			1.7
NON-FORESTED LAND			
Grassland	6.0		
Developed Agricultural Land	5.0		
Total Non-Forested Land			11.0
FORESTED LAND			
Non-Productive			
Marsh	19.8		
Treed Fen	22.2		
Brush/Shrubland	5.9		
Total Non-Productive Forest			47.9
Productive			
Working Group		% of Total	
Red Pine	95.4	25	
Hard Maple	69.0	18	
Spruce (White and Norway)	40.0	11	
Red Oak	38.4	10	
Soft Maple (Red and Silver)	32.7	9	
White Pine	29.3	8	
White Cedar	16.7	4	
Beech	10.3	3	
Jack Pine	7.6	2	
Poplar (All)	5.9	2	
Scots Pine	5.5	1	
Other Upland Hardwoods *	7.0	2	
Other Lowland Hardwoods **	14.1	4	
Other Conifers +	2.9	1	
		100	
Total Productive Forest			374.8
Total Waterloo Regional Forest			435.4

* Includes Black Walnut, Black Locust, Black Cherry and White Ash

** Includes Red Ash, Black Ash and Yellow Birch

+ Includes European Larch and Hemlock

TABLE 3. SOIL TYPES ON WATERLOO REGIONAL FOREST PROPERTIES

Regional Forest	Soil Type	Drainage	Parent Material & Landforms	Soil pH		Topography	Limitations to Tree Growth and/or Forestry Operations	Approx. % of Area Covered By Major Soils
				A horizon	C horizon			
Dean's Lake	Mannheim loam	Well drained	30-91cm silt loam over stony loam till on till plains	7.9	7.7	Gently sloping	None	10
	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Very gently sloping to moderately rolling to hilly	Topography	10
	Burford gravelly loam	Well drained	Outwash gravel on outwash plains and terraces	7.2	7.6	Gently sloping to moderately rolling	Droughty, low fertility	10
	Dumfries loam	Well drained	Stony loam till on hummocky end moraine	7.0	7.6	Gently sloping to very steeply sloping	Stoniness, topography, droughty low fertility	40
	St. Jacobs loam	Well drained	30-91cm silt loam over outwash gravel on outwash plains and terraces	7.5	8.2	Level to moderately/strongly sloping	Droughty	30
Doon	Bookton sandy loam	Well drained	30-91cm sandy loam over silty clay on till plains	7.2	8.1	Level to moderately/strongly sloping	Droughty, low fertility	20
	Fox sandy loam	Well drained	Coarse and medium outwash sand on outwash plains and in the Waterloo Sandhills	7.2	7.6	Level to moderately rolling/hilly	Droughty, low fertility, topography	40
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.7	Level to strongly sloping/very steeply sloping	Droughty, topography	40
Drynan	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Moderately/strongly sloping	None	10
	Dumfries loam	Well drained	Stony loam till on hummocky end moraine	7.0	7.6	Moderately rolling to hilly	Stoniness, topography, droughty, low fertility	10
	Granby sandy loam	Poorly drained	Outwash sands in depressions on outwash plains, terraces etc	7.3	7.6	Level to very gently sloping	Excess water, low fertility	10
	Organic soil 30-91cm over coarse materials	Very poorly drained	30-91cm thickness of organic materials over soil materials and bedrock in depressions, etc.	-	-	Level	Excess water	20
	Burford gravelly loam	Well drained	Outwash gravel on outwash plains and terraces	7.2	7.6	Moderately/strongly sloping to very steeply sloping	Droughty, low fertility, topography	50

TABLE 3. SOIL TYPES ON WATERLOO REGIONAL FOREST PROPERTIES

Regional Forest	Soil Type	Drainage	Parent Material & Landforms	Soil pH		Topography	Limitations to Tree Growth and/or Forestry Operations	Approx. % of Area Covered By Major Soils
				A horizon	C horizon			
Gibney	Fox sandy loam	Well drained	Coarse and medium outwash sand on outwash plains and in the Waterloo Sandhills	7.2	7.6	Undulating to strongly sloping/very steeply sloping	Droughty, low fertility, topography	90
	Lisbon sandy loam	Well drained	Coarse outwash sand on outwash plains and in Waterloo Sandhills	7.2	7.9	Moderately rolling to hilly	Droughty, low fertility, topography	10
Macton	Brookston loam	Poorly drained	Silty clay till on till plains	6.5	8.3	Level to very gently sloping	Adverse structure, excess water	10
	Huron clay loam	Moderately well drained	Silty clay till on morainic areas of till plains	7.3	7.8	Gently sloping/undulating to moderately/strongly sloping	Adverse structure	50
	Perth loam	Imperfectly drained	Silty clay till on till plains	6.6	7.8	Undulating	Adverse structure	40
Petersburg	Organic soils >91cm deep	Very poorly drained	More than 91 cm thickness of organic materials in depressions, channels etc	-	-	Level	Excess water	10
	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Gently to moderately rolling	None	10
	Fox sandy loam	Well drained	Coarse and medium outwash sand on outwash plains and in the Waterloo Sandhills	7.2	7.6	Gently sloping to moderately/strongly sloping	Droughty, low fertility	20
	Lisbon sandy loam	Well drained	Coarse outwash sand on outwash plains and in Waterloo Sandhills	7.2	7.9	Moderately/strongly sloping to very steeply sloping	Droughty, low fertility, topography	30
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.7	Gently/moderately rolling to strongly sloping/very steeply sloping	Droughty, topography	30
Sandy Hills (south)	Freeport sandy loam	Well drained	30-91 cm sandy loam over loam till on till plains and drumlins	7.3	7.8	Gently sloping	Droughty, low fertility	30
	Heidelberg fine sandy loam	Imperfectly drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills and on outwash plains	6.6	8.0	Gently sloping	None	10
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Level to strongly sloping/very steeply sloping	Droughty, topography	60
Sandy Hills (north)	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Level to gently/moderately rolling	Droughty	100

TABLE 3. SOIL TYPES ON WATERLOO REGIONAL FOREST PROPERTIES

Regional Forest	Soil Type	Drainage	Parent Material & Landforms	Soil pH		Topography	Limitations to Tree Growth and/or Forestry Operations	Approx. % of Area Covered By Major Soils
				A horizon	C horizon			
Sudden	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Level to moderately/strongly sloping	None	10
	Fox sandy loam	Well drained	Coarse and medium outwash sand on outwash plains and in the Waterloo Sandhills	7.2	7.6	Undulating	Droughty, low fertility	10
Sudden (continued)	Granby sandy loam	Poorly drained	Outwash sands in depressions on outwash plains, terraces etc	7.3	7.6	Level to very gently sloping	Excess water, low fertility	10
	Organic soils 30-91cm over fine materials	Very poorly drained	30-91 cm thickness of organic materials over soil materials and bedrock in depressions, etc	-	-	Level	Excess water	10
	Dumfries loam	Well drained	Stony loam till on hummocky end moraine	7.0	7.6	Gently rolling to very steeply sloping	Stoniness, droughty, low fertility, topography	20
	Tuscola loam	Imperfectly drained	Stratified glacio-lacustrine silt in Waterloo Sandhills and adjacent areas	7.3	7.7	Level to gently sloping	None	20
	Organic soils >91cm deep	Very poorly drained	More than 91cm thickness of organic materials in depressions, channels etc	-	-	Level	Excess water	20
Townline	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Strongly sloping to very steeply sloping	Topography	10
	Fox sandy loam	Well drained	Coarse and medium outwash sand on outwash plains and in the Waterloo Sandhills	7.2	7.6	Gently sloping to moderately/strongly sloping	Droughty, low fertility	20
	Heidelberg fine sandy loam	Imperfectly drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills and on outwash plains	6.6	8.0	Gently undulating	None	20
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Gently/moderately rolling to moderately/strongly sloping	Droughty	50
Walker Woods	Bennington loam	Well drained	30-91cm sandy loam over clay till on till plains	7.6	7.7	Level/very gently sloping to undulating	None	70
	Maplewood loam	Poorly drained	30-91cm silt loam over silty clay till on till plains	7.6	7.8	Level to very gently sloping	Excess water	20
	Tavistock loam	Imperfectly drained	30-91cm silt loam over silty clay till on till plains	7.2	8.2	Level to very gently sloping	None	10

TABLE 3. SOIL TYPES ON WATERLOO REGIONAL FOREST PROPERTIES

Regional Forest	Soil Type	Drainage	Parent Material & Landforms	Soil pH		Topography	Limitations to Tree Growth and/or Forestry Operations	Approx. % of Area Covered By Major Soils
				A horizon	C horizon			
Cambridge Landfill	Granby sandy loam	Poorly drained	Outwash sands in depressions on outwash plains, terraces, etc	7.3	7.6	Level to very gently sloping	Low fertility, excess water	10
	Organic soils >91cm deep	Very poorly drained	More than 91cm thickness of organic materials in depressions, channels etc	-	-	Level	Excess water	20
	Dumfries loam	Well drained	Stony loam till on hummocky end moraine	7.0	7.6	Moderately rolling to hilly	Stoniness, droughty, low fertility, topography	30
	Organic soils 30-91cm over fine materials	Very poorly drained	30-91 cm thickness of organic materials over soil materials and bedrock in depressions, etc	-	-	Level	Excess water	40
McLennan Park (former Kitchener Landfill)	Organic soils >91cm deep	Very poorly drained	More than 91cm thickness of organic materials in depressions, channels etc	-	-	Level	Excess water	30
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Moderately rolling to hilly	Droughty, topography	70
Waterloo Landfill	Brant loam	Well drained	Stratified glacio-lacustrine silts, mainly in the Waterloo Sandhills	7.7	8.2	Gently rolling to strongly rolling/very steeply sloping	Topography	60
	Bennington loam	Well drained	30-91cm sandy loam over outwash gravel on outwash plains, channels, etc.	7.6	7.7	Gently sloping to undulating	None	20
	St. Clements silt loam	Well drained	Silty clay loam till on dissected areas adjacent to till plains	7.6	8.2	Gently/moderately rolling to strongly sloping/very steeply sloping	Topography	20
Doon Heritage Crossroads	Brady sandy loam	Imperfectly drained	Coarse and medium outwash sands on outwash plains, terraces, etc	7.2	7.7	Undulating	Low fertility	30
	Elmira loam	Poorly drained	Silt loam alluvium on floodplains	7.2	7.5	Level to very gently sloping	Flooding, excess water	30
	Lisbon sandy loam	Well drained	Coarse outwash sand on outwash plains and in Waterloo Sandhills	7.2	7.9	Gently/moderately rolling to hilly	Droughty, low fertility, topography	20
	Organic soil 30-91cm over coarse materials	Very poorly drained	30-91cm thickness of organic materials over soil materials and bedrock in depressions, etc.	-	-	Level	Excess water	10
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Gently sloping to undulating	Droughty	10

TABLE 3. SOIL TYPES ON WATERLOO REGIONAL FOREST PROPERTIES

Regional Forest	Soil Type	Drainage	Parent Material & Landforms	Soil pH		Topography	Limitations to Tree Growth and/or Forestry Operations	Approx. % of Area Covered By Major Soils
				A horizon	C horizon			
Hilborn Knoll	Dumfries loam	Well drained	Stony loam till on hummocky end moraine	7.0	7.6	Undulating to gently/moderately rolling	Stoniness, droughty, low fertility	100
Operations Centre	Guelph loam	Well drained	Loam till on drumlins and fluted till plain	7.4	7.9	Gently to moderately sloping	None	10
	Granby sandy loam	Poorly drained	Outwash sands in depressions on outwash plains, terraces, etc	7.3	7.6	Level to very gently sloping	Excess water, low fertility	30
	Kossuth sandy loam	Imperfectly drained	30-91cm sandy loam over loam till on till plains and drumlinized areas	7.0	7.5	Gently sloping	Low fertility	10
	Waterloo fine sandy loam	Well drained	Mainly glacio-lacustrine fine sands in Waterloo Sandhills	7.2	7.9	Level to gently undulating	None	40
	Woolwich loam	Well drained	30-91cm silt loam over loam till on till plains	7.5	7.8	Gently sloping	None	10

Source: Presant and Wicklund, 1971

TABLE 4. ENVIRONMENTAL SIGNIFICANCE OF REGIONAL FORESTS

Property Name	Part of ESPA ¹		ESPA Criteria Fulfilled ³										Wetlands Present		Fish Habitat Present	Comments	
	Name	#	a	B				c					Provincially Significant	Locally Significant			
			ANSI ²	i	ii	iii	iv	i	ii	iii	iv	v					
Dean's Lake	Dean's Lake	65	RL														
Doon	Homer Watson Park	31	PE														•
Drynan	Hungry Hills	48	RL											•	•		
Gibney	Baden Hills	13	PE														
Macton	N/A																•
Petersburg	St. Agatha Forest	15														•	
Sandy Hills	Woolwich Sandhills	1		•	•		•						•	•		•	Regionally significant Earth Science ANSI
Sudden	Sudden Tract	52	PL	•	•	•	•	•	•	•				•		•	Provides habitat for over 40 provincially or regionally significant plants and animals
Townline	Sunfish Lake	10												•		•	
Walker Woods	N/A															•	
Cambridge Landfill	Moffat Creek (proposed)	?												•			
McLennan Park	N/A																
Waterloo Landfill	St. Agatha Forest	15														•	
Doon Heritage Crossroads	Homer Watson Park	31															•
Hilborn Knoll	Portuguese Swamp	72		•	•	•	•	•	•					•			
Operations Centre	N/A															•	

1. ESPA = Environmentally Sensitive Policy Area
2. ANSI = Area of Natural and Scientific Interest which is further distinguished as being a Provincially Significant (P) or Regionally Significant (R), Life Science (L) or Earth Science (E) area.
3. To qualify for designation as an Environmentally Sensitive Policy Area, a natural area must:
 - a) Be identified by the Province as a Provincially Significant Life Science Area of Natural and Scientific Interest, Regionally Significant Life Science Area of Natural and Scientific Interest, or a Provincially Significant Earth Science Area of Natural and Scientific Interest; or
 - b) Fulfil at least two of the following criteria:
 - i) Comprise ecological communities deemed unusual, of outstanding quality or particularly representative regionally, provincially or nationally;
 - ii) Contain critical habitats which are uncommon or remnants of once extensive habitats such as old growth forest, forest interior habitat, Carolinian forest, prairie-savanna, bogs, fens, marl meadows, and cold water streams;
 - iii) Provide a large area of natural habitat of at least twenty hectares which affords habitat to species intolerant of human intrusion; or
 - iv) Provide habitat for organisms indigenous to the Region recognized as natural, provincially, or regionally significant; or
 - c) Fulfil one of the criteria in b) above and any two of the following:
 - i) Contain an unusual diversity of native life forms due to varied topography, microclimates, soil, and/or drainage regimes;
 - ii) Perform a vital ecological function such as maintaining the hydrological balance over a widespread area by acting as a natural water storage, discharge or recharge area;
 - iii) Provide a linking system of relatively undisturbed forest or other habitat for the movement of wildlife over a considerable distance;
 - iv) Serve as major migratory stop-overs; or
 - v) Contain landforms deemed unusual or particularly representative at the regional scale.
4. Individual wetlands are present that are 2.0 hectares or more in size.

TABLE 5. SUMMARY OF PAST HARDWOOD HARVEST/IMPROVEMENT CUTTING

Property	Stand No.	Working Group	Hectares Treated	Year of Harvest	Products Removed	Comments
1 - Dean's Lake	4	Hard Maple	12.4	1970's/ 80's	Fuelwood	Improvement work done by MNR staff and contractors.
3 – Drynan	2	Red Oak	14.5	1966, 1977	Only girdling by MNR staff in 1966. Fuelwood and Sawlogs in 1977.	Stand received prescribed burns in 1992 and 1998 to stimulate red oak & hickory regeneration.
6 – Petersburg	1	Hard Maple	2.3	1977	Fuelwood and Sawlogs	
	8	Black Locust	2.4	Early 1980's	Fuelwood	
8 – Sudden	2	Hard Maple	8.2	Circa 1977, Late 1980's	Fuelwood and Sawlogs	Purpose of cutting was to stimulate regeneration of shade intolerant species, particularly oak.
	3	Red Ash	9.1	1970's/ 80's	Fuelwood and Sawlogs	Only portion north of Spragues Road harvested.
10 - Walker Woods	1	Hard Maple	10.3	1970's/ 80's	Fuelwood	Selective cutting
11 - Cambridge Landfill	1	Beech	5.1	1970's/ 80's	Fuelwood and Sawlogs	Some marked trees were left standing.
15 - Hilborn Knoll	1	Hard Maple	3.8	Late 1980's	Fuelwood and Sawlogs	Cutting was done prior to development of the area.
	2	Red Oak	1.6	Late 1980's	Fuelwood and Sawlogs	

TABLE 6. SUMMARY OF PAST CONIFER PLANTATION THINNING

Property	Stand No.	Working Group	Hectares Treated	Year of Harvest	Type of Thinning	Products Removed	Comments
1 - Dean's Lake	1	Red Pine	6.5	1977	Row and Selection	Pulpwood/ Boltwood	Heavily thinned.
	2	Jack Pine	0.7	1977	Row and Selection	Pulpwood/ Boltwood	Heavily thinned.
	3	Red Pine	1.3	1977	Row and Selection	Pulpwood/ Boltwood	Heavily thinned.
	5	White Pine	0.5	1977	Row and Selection	Pulpwood/ Boltwood	
2 - Doon	1	Red Pine	4.2	Circa 1980	Double Row and Selection	Pulpwood/ Boltwood	
	3	Red Pine	2.5	Circa 1980	Double Row and Selection	Pulpwood/ Boltwood	
	5	Red Pine	1.5	Circa 1980	Double Row and Selection	Pulpwood/ Boltwood	
	7	White Spruce	8.0	Circa 1980	Double Row and Selection	Pulpwood/ Boltwood	
5 - Macton	2	White Spruce	5.6	Circa 1992	Row and Selection	Pulpwood/ Boltwood	Only half of stand thinned.
6 - Petersburg	2	Red Pine	1.7	1980's	Cross-Row Thinning and Selection	Pulpwood/ Boltwood	
	3	White Pine	5.0	1980's	Cross-Row Thinning and Selection	Pulpwood/ Boltwood	
	4	Red Pine	7.5	1987	Cross-Row Thinning and Selection	Pulpwood/ Boltwood	
	5	European Larch	0.3	1980's	Row and Selection	Pulpwood/ Boltwood	
	6	Red Pine	2.8	1980's	Row and Selection	Pulpwood/ Boltwood	
	7	Jack Pine	2.4	1980's	Cross-Row Thinning and Selection	Pulpwood/ Boltwood	
	9	Jack Pine	3.0	1980's	Cross-Row Thinning and Selection	Pulpwood/ Boltwood	

TABLE 6. SUMMARY OF PAST CONIFER PLANTATION THINNING

Property	Stand No.	Working Group	Hectares Treated	Year of Harvest	Type of Thinning	Products Removed	Comments
7 - Sandy Hills	1	Red Pine	5.4	1970's/80's, 1993 – 94	Double Row followed by Selection	Pulpwood/ Boltwood	
	11	White Pine	1.7	1980's	Row	Pulpwood/ Boltwood	Release of white ash understory.
	13	Red Pine	13.8	1984 – 86	Row followed by Selection	Pulpwood/ Boltwood	Removal of shoot moth damaged red pine and decadent Scots pine.
	14	Red Pine	9.3	1970's/80's	Double Row	Pulpwood	
	15	White Spruce	2.7	1984 – 86	Row followed by Selection	Pulpwood/ Boltwood	Removal of shoot moth damaged red pine and decadent Scots pine.
	16	European Larch	0.9	1974	“Widely Spaced” Selection	Pulpwood/ Boltwood	Thinned for seed production purposes.
	18	Red Pine	3.9	1970's/80's	Row and Selection	Pulpwood/ Boltwood	Heavily thinned.
	20	Red Pine	5.3	1970's/80's & 1988 – 90	Row and Selection	Pulpwood/ Boltwood	1970's / 80's thinning by MNR crews.
8 - Sudden	1	Red Pine	10.1	1970's/80's, Circa 1987	Row followed by Selection	Utility Poles, Pulpwood and Log Home Timbers	
	5	White Pine	5.1	1970's, Circa 1982	Row followed by Selection	Pulpwood/ Boltwood	Heavily thinned in 1970's and moderately thinned around 1982.
9 - Townline	1	White Pine	4.7	1989	Row and Selection	Pulpwood/ Boltwood	Objective was crop tree spacing and removal of badly weeviled white pine.

TABLE 7. PHYSICAL IMPROVEMENTS AT WATERLOO REGIONAL FORESTS

Property	Roads (Km)		Trails (Km)	Gates/Barriers	Signs	Parking Lots	Fire Ponds	Boundary Marking				
	Gravel	Grass						Fencing			Painted Trees or Posts	Condition of Boundary Marking
								Paige/Barbed Wire	Chain Link	Cedar Rail		
1 – Dean’s Lake	0.9	0.4	1.1	0	•	0	0	•				No boundary marking in hardwoods on north side adjacent to Dean’s Lake. Old paige/barbed wire fence on south and west sides.
2 – Doon	0.0	2.0	1.2	2	•	0	0	•				On north and east sides fence is generally erect except where replaced by homeowners.
3 - Drynan	2.3	0.3	1.0	1	•	1	4	•				Good fence on south side, except in hardwoods where only remnants are found. No boundary marking on west side. Old fence along north boundary.
4 - Gibney	0.0	0.0	0.6	0	—	0	0	•				Fencing in fair condition on east and north sides
5 - Macton	0.0	0.0	0.0	0	•	0	0	•				Only remnant fence on west side
6 - Petersburg	0.7	2.4	1.1	1	•	1	1	•			•	On east boundary old fence is present, except in hardwoods where only red paint on trees. On west boundary old wire in hardwoods and elsewhere fence is in fair condition.

TABLE 7. PHYSICAL IMPROVEMENTS AT WATERLOO REGIONAL FORESTS

Property	Roads (Km)		Trails (Km)	Gates/Barriers	Signs	Parking Lots	Fire Ponds	Boundary Marking				
	Gravel	Grass						Fencing			Painted Trees or Posts	Condition of Boundary Marking
								Paige/Barbed Wire	Chain Link	Cedar Rail		
7 - Sandy Hills	1.8	0.3	1.9	1	•	1	0	•		•		On the southern portion, property boundaries are generally indicated by a change in cover types, although some old wire and cedar rails are found in areas adjacent to other woodlands. On the northern portion trails and cover type changes identify boundaries, although some remnant wire and posts are still evident in places.
8 - Sudden	3.0	0.0	2.8	2	•	1	2	•				No fence or painted trees on east side but cover type changes generally identify boundaries, except in wetland. Fenceline present on west side.
9 - Townline	0.1	0.0	0.1	1	•	0	0	•			•	Remnant paige wire on west and south sides. Old red paint also on trees on south side.
10 - Walker Woods	0.0	0.0	1.4	0	—	0	0	•				Remnant fencing on north boundary. Paige wire fence on south side, may not be located exactly on the property line. Remnant fence on east side.
11 - Cambridge Landfill*	0.0	0.0	1.3	1	—	0	0		•			Chain link fence is down on north and east sides adjacent to marsh. Also, cut open on west side near scrap yard. Elsewhere fence is good
12 - McLennan Park (former Kitchener Landfill)	0.0	0.0	0.4	0	—	0	0		•			No fencing on any woodland boundary, but chain link fence has been erected along Ottawa Street.

TABLE 7. PHYSICAL IMPROVEMENTS AT WATERLOO REGIONAL FORESTS

Property	Roads (Km)		Trails (Km)	Gates/Barriers	Signs	Parking Lots	Fire Ponds	Boundary Marking				
	Gravel	Grass						Fencing			Painted Trees or Posts	Condition of Boundary Marking
								Paige/Barbed Wire	Chain Link	Cedar Rail		
13 - Waterloo Landfill*	0.0	0.0	3.8	1	—	0	0		•			Chain link fence on east, west and north sides adjacent to open areas. No fence along hydro corridor.
14 - Doon Heritage Crossroads	0.0	0.0	0.6	1	—	1	0		•			Chain link fence recently erected on east and north boundary. Southern boundary has fence located inside village.
15 - Hilborn Knoll	0.0	0.0	0.7	0	—	0	0					No boundary marking evident, other than survey stakes & iron bars located in northwest corner adjacent to Burnett Ave. An old paige wire fence runs through centre of bush.
16 - Operations Centre*	0.0	0.0	0.5	1	—	1	0	•	•	•	•	Remnant paige wire and cedar rail on west boundary except through marsh. One survey stake found on north side.

TABLE 8. SUMMARY OF THE PRODUCTIVE REGIONAL FOREST AREA BY SITE CLASS AND WORKING GROUP IN HECTARES

Working Groups	Site Classes										
	1	%	2	%	3	%	4	%	5	%	Total
Red Pine	0.0	0	14.8	16	23.4	24	10.8	11	46.4	49	95.4
Hard Maple	0.0	0	27.7	40	22.7	33	18.6	27	0.0	0	69.0
Spruce (White & Norway)	2.7	7	4.9	12	0.0	0	5.8	14	26.6	67	40.0
Red Oak	0.0	0	1.6	4	3.0	8	19.3	50	14.5	38	38.4
Soft Maple	0.0	0	0.0	0	0.4	1	0.0	0	32.3	99	32.7
White Pine	3.4	11	0.5	2	0.0	0	11.1	38	14.3	49	29.3
White Cedar	0.0	0	0.0	0	0.0	0	0.0	0	16.7	100	16.7
Beech	0.0	0	10.3	100	0.0	0	0.0	0	0.0	0	10.3
Jack Pine	0.0	0	0.0	0	3.0	40	0.0	0	4.6	60	7.6
Poplar/Aspen	3.9	66	0.9	15	0.0	0	0.0	0	1.1	19	5.9
Scots Pine	0.0	0	0.0	0	0.0	0	2.2	40	3.3	60	5.5
Other Upland Hardwoods *	0.0	0	2.4	34	2.4	34	0.0	0	2.2	32	7.0
Other Lowland Hardwoods **	0.0	0	1.6	11	0.0	0	0.0	0	12.5	89	14.1
Other Conifers +	0.3	10	0.0	0	1.5	52	0.0	0	1.1	38	2.9
Total	10.3	3	64.7	17	56.4	15	67.8	18	175.6	47	374.8

* Includes black walnut, black locust, black cherry and white ash

** Red ash, black ash and yellow birch

+ European larch and hemlock

TABLE 9. SUMMARY OF THE PRODUCTIVE REGIONAL FOREST AREA BY AGE CLASS AND WORKING GROUP IN HECTARES

Working Group	Age Classes						Total
	B&S ⁺⁺	1 to 20	21 to 40	41 to 60	61 to 80	81 to 100	
Red Pine	0.0	0.0	16.1	77.8	1.5	0.0	95.4
Hard Maple	0.0	0.0	0.0	1.5	62.4	5.1	69.0
Spruce (White and Norway)	0.0	0.0	8.5	23.5	8.0	0.0	40.0
Red Oak	0.0	0.0	0.0	0.0	19.1	19.3	38.4
Soft Maple	0.0	0.9	7.3	5.9	18.6	0.0	32.7
White Pine	0.0	0.0	2.6	21.7	1.2	3.8	29.3
White Cedar	0.0	0.0	3.6	1.7	11.4	0.0	16.7
Beech	0.0	0.0	0.0	5.1	5.2	0.0	10.3
Jack Pine	0.0	0.0	0.0	7.6	0.0	0.0	7.6
Poplar/Aspen (all)	0.0	0.2	0.0	5.7	0.0	0.0	5.9
Scots Pine	0.0	0.0	0.0	0.4	5.1	0.0	5.5
Other Upland Hardwoods *	0.0	2.1	1.5	2.4	1.0	0.0	7.0
Other Lowland Hardwoods **	0.0	0.0	1.6	0.0	12.5	0.0	14.1
Other Conifers +	0.0	0.0	0.0	1.2	0.6	1.1	2.9
Total	0.0	3.2	41.2	154.5	146.6	29.3	374.8
% of Total	0	1	11	41	39	8	

* Includes Black Walnut, Black Locust, Black Cherry and White Ash

** Red Ash, Black Ash and Yellow Birch

+ European Larch and Hemlock

++ Barren and Scattered

13.0 List of Acronyms

AGS	Acceptable Growing Stock
ANSI	Areas of Natural and Scientific Interest
AOC	Areas of Concern
ATV	All Terrain Vehicle
BMP	Best Management Practices
CNR	Canadian National Railway
CPR	Canadian Pacific Railway
CSA	Canadian Standards Association
DBH	diameter at breast height
DFO	Department of Fisheries and Oceans
EEAC	Ecological and Environmental Advisory Committee
ESPA	Environmentally Sensitive Policy Areas
FSC	Forest Stewardship Council
GRCA	Grand River Conservation Authority
HADD	Harmful Alteration, Disruption or Destruction
MNR	Ministry of Natural Resources (Ontario)
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetlands
ROPP	Regional Official Policies Plan
SFM	Sustainable Forest Management
UGS	Unacceptable Growing Stock

14.0 Flora Species List

Common Name	Scientific Name	Common Name	Scientific Name
Autumn Olive	<i>Eleagnus umbellata</i> Thunb.	Leatherleaf	<i>Chamaedaphne calyculata</i> (L.) Moench
Balsam Poplar	<i>Populus balsamifera</i> L.	Male Fern	<i>Dryopteris filix-mas</i>
American Basswood	<i>Tilia americana</i> L.	Nannyberry	<i>Viburnum lentago</i> L.
American Beech	<i>Fagus grandifolia</i> Ehrh.	Northern Beech	<i>Phegopteris connectilis</i> (Michx.) Watt
Balsam Poplar	<i>Populus balsamifera</i> L.	Fern	
Big Bluestem	<i>Andropogon gerardii</i> Vitman.	Northern Pitcher Plant	<i>Sarracenia purpurea</i>
Birdsfoot Trefoil	<i>Lotus corniculatus</i> L.	Northern Prickly Ash	<i>Zanthoxylum americanum</i> Mill.
Bitternut Hickory	<i>Carya cordiformis</i> (Wangenh.)	Norway Spruce	<i>Picea abies</i> (L.) Karst.
Black Ash	<i>Fraxinus nigra</i> Marsh.	Panicked Tick	<i>Desmodium paniculatum</i> [L.] DC.
Black Cherry	<i>Prunus serotina</i> Ehrh.	Trefoil	
Black Locust	<i>Robinia pseudoacacia</i> L.	Raspberry	<i>Rubus</i> spp
Black Walnut	<i>Juglans nigra</i> L.	Red Clover	<i>Trifolium pratense</i> L.
Bog-laurel	<i>Kalmia polifolia</i> Wang.	Red Maple	<i>Acer rubrum</i> L.
Bur Oak	<i>Quercus macrocarpa</i> Michx.	Red Oak	<i>Quercus rubra</i> L.
Burning Bush	<i>Euonymus atropurpureus</i> Jacq.	Red Pine	<i>Pinus resinosa</i> Ait.
Button-bush	<i>Cephalanthus occidentalis</i> L.	Sassafras	<i>Sassafras albidum</i> (Nutt.) Nees
Celandine	<i>Chelidonium majus</i>	Scots Pine	<i>Pinus sylvestris</i> L.
Coltsfoot	<i>Petasites sagittatus</i> (Banks ex Pursh) Gray.	Shagbark Hickory	<i>Carya ovata</i> (Mill.) K. Koch
Common Buckthorn	<i>Rhamnus cathartica</i> L.	Silver Maple	<i>Acer saccharinum</i> L.
Dame's Rocket	<i>Hesperis matronalis</i> Brassicaceae	Squawroot	<i>Conopholis americana</i> Wallr. f.
Dogwood	<i>Cornus alternifolia</i> L.f.	Sugar Maple	<i>Acer saccharum</i> Marsh.
Eastern Hemlock	<i>Tsuga canadensis</i> (L.) Carriere	Sweet Chestnut	<i>Castanea sativa</i> Miller
Ebony Spleenwort	<i>Asplenium platyneuron</i>	Tartarian Honeysuckle	<i>Lonicera tatarica</i> L.
Elderberry	<i>Sambucus pubens</i> Mich.	Trembling Aspen	<i>Populus tremuloides</i> Michx.
European Larch	<i>Larix decidua</i> Mill.	Viburnum	<i>Viburnum</i> spp
Garlic Mustard	<i>Alliaria petiolata</i> M. Bieb.	White Ash	<i>Fraxinus americana</i> L.
Glossy Buckthorn	<i>Rhamnus frangula</i> L.	White Birch	<i>Betula papyrifera</i> Marsh.
High-bush Blueberry	<i>Vaccinium corymbosum</i> L.	White Cedar	<i>Thuja occidentalis</i> L.
Hop Hornbeam	<i>Ostrya virginiana</i> (Mill.) K. Koch	White Clover	<i>Trifolium repens</i> L.
Interrupted Fern	<i>Osmunda claytoniana</i>	White Elm	<i>Ulmus americana</i> L.
Jack Pine	<i>Pinus banksiana</i> Lamb.	White Oak	<i>Quercus alba</i> L.
		White Pine	<i>Pinus strobus</i> L.
		White Spruce	<i>Picea glauca</i> (Moench) Voss
		Yellow Birch	<i>Betula alleghaniensis</i> Britt.

15.0 Fauna Species List

Common Name	Scientific Name	Common Name	Scientific Name
Barred Owl	<i>Strix varia</i> Barton.	Opossum	<i>Didelphis virginiana</i> Kerr.
Beaver	<i>Castor Canadensis</i> Kuhl.	Ovenbird	<i>Seiurus aurocapillus</i> L.
Black Duck	<i>Anas rubripes</i> Brewster.	Pickereel Frog	<i>Rana palustris</i> LeConte.
Bluebirds	<i>Sialia sialis</i> L.	Pileated	<i>Dryocopus pileatus</i> L.
Blue-winged Teal	<i>Anas discors</i> L.	Woodpecker	
Bull Frog	<i>Rana catesbeiana</i> Shaw.	Pine Warbler	<i>Dendroica pinus</i> Wilson
Canada Geese	<i>Branta Canadensis</i> L.	Porcupine	<i>Erethizon dorsatum</i> L.
Chickadee	Chickadee ssp	Rabbit	<i>Lepus townsendii</i> Bachman
Cooper's Hawk	<i>Accipiter cooperii</i>	Raccoon	<i>Procyon lotor</i> L.
Coyote	<i>Canis latrans</i> Say.	Red-breasted	<i>Sitta canadensis</i> L.
Creek Chubb	<i>Semotilus atromaculatus</i>	Nuthatch	
Crow	<i>Corvus</i> spp	Red Fox	<i>Vulpes vulpes</i> L.
Darters	Darter spp	Red-shouldered	<i>Buteo lineatus</i> Gmelin.
Eastern Ribbon Snake	<i>Thamnophis sauritus</i> L.	Hawk	
European Pine Shoot Moth	<i>Rhyacionia buoliana</i> Schiff.	Red-spotted Newt	<i>Notophthalmus viridescens viridescens</i> Rafinesque.
Forest Tent Caterpillar	<i>Malacosoma disstria</i> Hubner	Red-tailed Hawk	<i>Buteo jamaicensis</i> Gmelin.
Four-toed Salamander	<i>Hemidactylum scutatum</i>	Rock Bass	<i>Ambloplites rupestris</i> Rafinesque.
Golden-crowned Kinglet	Temminck and Schlegel.	Ruffed Grouse	<i>Bonasa umbellus</i> L.
Great Horned Owl	<i>Regulus satrapa</i> Lichtenstein.	Scarlet Tanager	<i>Piranga olivacea</i> Gmelin.
Green-winged Teal	<i>Bubo virginianus</i> Gmelin.	Sharp-shinned Hawk	<i>Accipiter striatus</i> Vieillot.
Gypsy Moth	<i>Anas crecca</i> L.	Smooth Green Snake	<i>Ophedrys vernalis</i> Harlan.
Hairy Woodpecker	<i>Lymantria dispar</i> Linne.	Grey Squirrel	<i>Sciurus carolinensis</i> Gmelin.
Great Blue Heron	<i>Picoides villosus</i> L.	Warbling Vireo	<i>Vireo gilvus</i> Vieillot.
Hooded Mergansers	<i>Ardea herodias</i>	White Pine Weevil	<i>Pissodes strobi</i> Peck.
Jefferson Salamander	<i>Lophodytes cucullatus</i> L.	White Sucker	<i>Catostomus commersoni</i> Lacepede.
Mallard	<i>Ambystoma jeffersonianum</i> Green.	White-tailed Deer	<i>Odocoileus virginianus</i> Zimmermann.
Mourning Warbler	<i>Anas platyrhynchos</i> L.	White-throated Sparrow	<i>Zonotrichia albicollis</i> Gmelin.
Muskrat	<i>Oporornis philadelphia</i> Wilson.	Wild Turkey	<i>Meleagris gallopavo</i> L.
Northern Water Snake	<i>Ondatra zibethicus</i> L.	Woodpecker	Woodpecker spp
Northern Waterthrush	<i>Nerodia sipedon</i>	Wood Duck	<i>Aix sponsa</i> L.
	<i>Seiurus noveboracensis</i> Gmelin.	Wren	Wren spp
		Veery	<i>Catharus fuscescens</i> Stephens.
		Yellow-spotted Salamander	<i>Ambystoma maculatum</i> Shaw.

16.0 Glossary of Technical Terms

Term	Definition
Agreement Forest Program	A program under which forestlands were managed under renewable agreement by the MNR.
AGS/UGS: Acceptable Growing Stock/Unacceptable Growing Stock	Trees suitable/not suitable for retention in the stand for at least one cutting cycle (15 – 25 years) AGS indicates that the tree is of a commercial species and of such form and quality that it would be saleable for sawlog products at a future date
Basal area	<ul style="list-style-type: none"> • Of a tree: the cross sectional area of the stem of the tree at 1.37 m above the ground. Expressed in m² • Of a stand: the sum of all tree basal areas for a given area. Usually expressed in ²/ha
Boltwood	Short sections of small diameter logs, usually of pulpwood
Calcareous soil	Soil containing ample quantities of free CaCO ₃ and/or other carbonates
Co-dominant tree	Crown class: A tree whose crown helps to form the general level of the main canopy; it receives full sunlight from and comparatively little from the sides
Cull	Any item of production (e.g. logs, trees, lumber or seedlings) rejected because it does not meet certain specifications of usability or grade
DBH: diameter at breast height	The diameter measurement of a tree taken at a point 1.37 m above the ground
Disturbance	An event that disrupts ecosystem, community, or population, structures and changes resources, substrate availability, or the physical environment
Dominant species	Ecology: A species exerting greatest influence on the vegetation community in which it is found by virtue of its life form or great abundance
Dominant tree	Crown class: A tree whose crown extends above the general level of the main canopy; it receives full sunlight from above and partial light from the sides
Duff	Forest litter and organic debris in various states of decomposition on top of the mineral soil
Group selection	A system of periodic partial cutting in which small groups of trees of trees are removed to create openings in the canopy

Hardwood/softwood	Hardwood generally refers to broad-leaved trees while softwood refers to needle-bearing conifers. Not a true reference to texture or density of wood
Individual tree Selection	A system of periodic partial cutting in which individual trees are removed. Tree vigor and risk characteristics determine tree selection. Removal is controlled by basal area.
Mast	Wildlife food source in particular the fruit and nuts of trees and woody shrubs
Plantation	An area of trees artificially established through planting or seeding
Poletimber	Tree of intermediate size, usually DBH is between 10 and 25 cm.
Prism	A glass wedge or prism of a known angle used to select trees for timber sampling and to estimate basal area
Sawlog	A log that meets specified standards of diameter, length and defect for sawing
Scarification	Mechanical removal of competing vegetation or interfering debris; also disturbance of the soil to enhance reforestation efforts
Shelterwood	A system of partial cutting in which a percentage of the overstorey is retained to provide a source of seed and/or protection for regeneration. Upon successful establishment of regeneration the remaining trees are removed. Cutting may occur in more than two steps depending on circumstances
Silvicultural system	
Silviculture	The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands
Size class distribution	
Slash	Treetops and branches left on ground after logging, or accumulating as result of fire, storm, or delimiting.
Stand	a contiguous group of trees sufficiently uniform in age-class distribution, composition, and structure, and growing on a site of sufficiently uniform quality, to be a distinguishable unit"
Tolerant/Intolerant	
Tree marking	Using paint or another mark on tree stems to indicate whether they are to be felled or retained in a harvesting operation
Veneer log	A log that meets specified standards of diameter, length and defect intended for producing veneer through sawing, slicing, or peeling