3.0 Conservation of Biological Diversity

3.1 Background

The conservation of biological diversity (biodiversity) reflects the importance of maintaining the forests of FML 01 in a condition to ensure that they will continue to support the variety of organisms endemic to the area. An important feature of the forests of the FML is their dependence on the dynamic processes of disturbance and renewal which determine the populations, species, forests types and age classes which make up the forest ecosystems. For the FML, which is located in the boreal forest region of Canada, these processes include fire, insects, disease, wind and ice. Forest management strategies and objectives established by Tembec for maintaining biological diversity reflect this reality.

The assessment of impacts on biodiversity has been undertaken within the context of the three major values:

- Ecological diversity: which responds to the issue "will we still have the same ecosystems we started out with as a result of forest management activities?";

- Species diversity: which responds to the issue " will we lose or put into a vulnerable state any of the native species?"; and

- Genetic diversity which responds to the issue "will the gene pool narrow as a result of forest management activities?".

In assessing potential impacts of the proposed forest management activities and related mitigation on biodiversity, the activities are assessed in the context of the components comprising biodiversity, in terms of vegetation communities, but also in terms of terrestrial and aquatic wildlife habitat requirements.

Three impact implication matrices have been prepared to identify the potential impacts of activities on the conservation of biological diversity and are presented at the end of this Section in Tables 1, 2 and 3:

Table 1 Ecological, species and genetic diversity of vegetation communities
Table 2 Species diversity of terrestrial wildlife
Table 3 Species diversity of aquatic and amphibian wildlife

3.2 Ecosystem Diversity

3.2.1 Introduction

Ecosystem diversity is reflected in the variation that exists within components of the forest that, together, form ecosystems. These components are represented in Table 1. As noted earlier, ecosystems are dynamic and constantly changing in response to interactions amongst the various components and associated features, as well as in response to disturbance and

stress agents. In the case of the boreal forest in which the FML is situated, the principal agents of disturbance are forest fire, insect infestation and timber harvesting.

3.2.2 Data Adequacy and Gaps

In preparing the FSP a variety of sources of information were consulted. These include:

- Description of the biophysical resources of FML 01 (Sections 3)
- MC Forest Inventory (FRI) including forest tree species and age class description (Section 5.9.4 and Map 5.2.6 & 5.2.7)

Provincial and other sources of information include:

- On-going update of MC Forest Inventory by the Province including forest tree species, site productivity, stand age and height and age class
- Manitoba FEC system (V-types) has been put in place as a first approximation for the Provincial forest resource, including FML 01

On-going Operational Sources include:

- PHA including mensuration data, FEC V-type, soil description, silviculture prescriptions and other values

These sources of information represent the best information currently available for the vegetation resource of FML 01. Tembec undertakes regular updating of the provincial FRI by incorporating harvest, road construction and renewal activities with the Province providing updates relating to forest fire and insect/disease depletions (WDS – 001). This information is essential for the monitoring of ecological diversity. The information also provides Tembec and MC with the data necessary to undertake wood and wildlife habitat supply sustainability modeling which enables the Company to undertake projections related to the effects of their forest management activities on ecological diversity **(**FSP Section 4).

Tembec recognizes the limitations inherent in the current information available from the MC Forest Inventory, and have taken steps to improve the information base. The Company implements a Pre-harvest Assessment (PHA) program which is undertaken on all sites prior to harvest (WDS – 002, MC 2003). In addition, information from sources such as regeneration and Free-to-Grow (FTG) surveys will continue to improve on the forest inventory database.

The management objectives for the conservation of biological diversity, in Section 5.2.1.1 of the FSP, combined with the Indicators and Targets monitored in Criterion 1 of the annual Local Level Indicators reports (Sec 15, Tembec 2009) provides the framework to be utilized for monitoring of indicators for measurement of progress towards targets established in the FSP. Indicators developed to represent ecological diversity will provide improved data regarding the components referenced in Table 1 as the monitoring program is implemented throughout the FSP 20 year period.

3.2.3 Forest Management Activities Assessment

Planning

Planning of forest management activities is carried out to ensure strategies for achieving the company's ecosystem biodiversity objectives are addressed. Evaluation of these activities incorporates review of the reasonableness of planning procedures given the data and understanding available to make these decisions. The location and design of operating blocks and associated cutblocks, sustainability modeling and the collection and application of information for decision making has implications for ecological diversity at the landscape level. The manner in which operations are planned to be carried out relative to the patterns of disturbance and renewal that occur in the natural forest determine the nature and degree of impacts.

Harvest and renewal planning can result in significant alterations to the forest composition, landscape patterns and fragmentation at the landscape level. The design of operating blocks and associated cutblocks for subsequent logging operations requires the incorporation of non-timber environmental values to mitigate impacts related to alteration of forest composition and age class structure, landscape patterns and fragmentation. These impacts also translate to impacts on wildlife habitat described later in this EIS.

- Harvesting of the trees from a given cutblock area results in a disturbance to the site. In combination with the subsequent renewal activity the stand is turned over to an earlier successional stage. Prompt forest renewal of all harvested sites with suitable tree species to renew the area back to its previous condition, as outlined in the silvicultural prescriptions of the FSP (Section 5.14.3, WDS-008) and required by MC, will provide mitigation for this activity on a site basis. At the landscape level, FSP management objectives to maintain old forest level targets and large contiguous core forest areas (FSP Section 5.2.1.1.1) are intended to assist in achieving the pre-industrial condition analysis (FSP Section 4.2) will provide mitigation.

- Design of cutblocks to utilize naturally occurring stand boundaries, incorporate retention of stand structure components and selection of stands for harvest meeting timber utilization standards and associated stand age requirements provide mitigation related to disturbance patterns resulting from natural fire, insect and disease events (WDS – 010, WDS – WI – 003, 004, 005, 006, 010, 011 and 048).

- In a study by Gluck and Rempel (1996) in which they compared a clearcut and wildfire landscape in northwestern Ontario 10 years after fire and from 5 to 12 years after harvesting, where they investigated differences in vegetation community classes on the two landscapes, they found varying degrees of difference in the composition of open water, herb/shrub, shrub/tree, conifer mixed wood and dense conifer between the clearcut and wildfire landscapes. While no difference was noted in the composition of emergent marsh, tree/shrub, deciduous, open jack pine and pine between the two landscapes.

- In addition to timber harvesting, contribution to the overall pattern of ecosystem disturbance and recovery also occurs as a result of forest fire, wind, insects and disease. Kimmins (1992) notes that although each of these disturbances is accompanied by its own set of ecological effects, they all cause a return of the forest to an earlier stage of succession. It is further noted that the differences between the ecological condition of areas resulting from these various forms of disturbance will decrease over time (successional convergence), eventually becoming relatively unimportant (Kimmins 1992). In FML 01 it is noted that the role of fire has been, and will continue to be, a significant agent in the renewal of the forest. Across the FML, a total of approximately 1,000 to 2,500 hectares have been harvested each year (FSP Table 5.1). Over the past century, an average of 6,750 hectares of forest land is burned annually and an average of 7,400 hectares has burned annually since the establishment of the FML in 1979 (FSP Table3.6). The continuing, and significant presence of fire across the FML will ensure a continuing balance of natural disturbance regimes occur across the landscape. In the study by Gluck and Rempel (1996) described above, they reported that the clearcut landscape resulted in larger patches at lower density and more variability compared to the wildfire landscape which resulted in a greater number of smaller sized patches. They also noted the clearcut landscape had a greater number of mature forest-water interfaces typically due to leave reserves around waterbodies.

- Within the FSP a management objective for the maintenance of residual structure in harvest areas (FSP Section 5.2.1.1.2) and the LLI framework indicators have been developed to monitor the forest composition of FML 01 in terms of forest types and seral stages (Sec 15, Indicators 1.1.1.1) and the number and size of forest patches (Sec 15, Indicators 1.1.1.3) . These measures will assist the Company and others in monitoring changes in forest composition and ecological diversity for FML 01.

Sustainability modeling, undertaken in the preparation of the FSP, can result in significant impacts to species composition and age class structure of the forest based upon implementation of timber harvest levels determined as sustainable from the modeling.

- Results of the modeling are derived based upon an established current forest inventory and predictions of forest growth and yield and regeneration responses following harvest. These inputs to the modeling, and the modeling system itself, determine, to a great extent, the calculated sustainable timber harvest level, and thus, can lead to significant impacts on future forest composition and landscape patterns dependent upon their reliability.

- Mitigation during the modeling process occurs through:

  - Use of the best available data in developing predictions of growth and yield and regeneration response for application in the model. MC used data local to FML 01 in the development of model inputs for the base case analysis (FSP Sec 4.1). Tembec utilized the MC base case model files and incorporated operational and environmental

considerations in determining a sustainable harvest level (FSP Section 4.3) which was lower than the sustainable harvest level determined by MC.

- The model utilized by MC (Woodstock™) has been used in a number of applications across the boreal forest in Saskatchewan and Alberta, in addition to its use in Manitoba. The sustainability modeling undertaken by MC builds upon previous experience gained in other areas of Manitoba and elsewhere in the boreal forest.

- The modeling process undertaken by Tembec utilized the MC Woodstock™ files and incorporated additional constraints around species harvest requirements and old forest objectives (FSP Section 5.2.1.1.1) and then converted those files for use in Patchworks™ which allowed for a spatial analysis and incorporation of a landscape target to maintain large contiguous core forest areas (FSP Section 5.2.1.1.1) in determining a sustainable harvest level below that prescribed by MC (FSP Section 4.3.2).

- Re-curing analysis of the sustainable harvest level will be undertaken for every subsequent FSP. Intermediate analysis will also be undertaken should major fire events result in a substantial change to the forest composition and age class structure from that which had been forecasted from the previous FSP modeling work. This adaptive management approach to determination of the sustainable harvest level allows for incorporation of improved forest succession and growth and yield data as time moves forward and future FSPs and associated modeling work is undertaken.

- Forest estate planning models have become an important tool in forest management planning. These tools enable planning staff to undertake complex analyses which include a number of non-timber factors that would otherwise be difficult to incorporate. The models also facilitate the development of scenarios which can be used to test the impacts of various parameters on forest management objectives. Modeling activities associated with the FSP followed this approach. Modeling outputs for consideration included:

  - Netting down of the available landbase to incorporate consideration of buffers providing reflection of non-timber values (FSP Section 4.1)

  - Incorporation of habitat suitability index (HSI) units for representative wildlife species (FSP Section 4.1) and the establishment of a management objective target for habitat levels (FSP Section 5.2.1.1.1)

  - Incorporation of requirements for the necessary flow of species to the Pine Falls mill complex (FSP Section 4.3)

  - Incorporation of a management objective for the maintenance of old forests (FSP Section 5.2.1.1.1)

  - Incorporation of a management objective for the maintenance of large contiguous core areas (FSP Section 5.2.1.1.1)

- Incorporation of a management objective for the maintenance of habitat for Woodland Caribou which is listed as Threatened by the Manitoba Endangered Species Act (MESA) and Canada's Species at Risk Act (SARA) (FSP Section 5.2.1.1.1 and 4.3)

- Resulting future forest condition reflecting forest composition and age class structure (FSP Section 4.3)

- Determination of sustainable harvest levels for 200 years into the future (FSP Section 4).

- Improved growth and yield information would assist greatly in improving the usefulness of the models for application to sustainable harvest levels and for subsequent use in habitat supply and other ecological effects modeling. Such improvements to database information and modeling applications are a key part of adaptive management. Tembec has indicated their support in moving forward with development of a co-operative Permanent Sample Plot program with MC to improve upon the growth and yield data over time.

Forest management activities can result in a significant impact upon the forest landscape in terms of alterations to the natural landscape patterns including fragmentation and effects upon connectedness resulting from the implementation of harvest designs. As described by Rempel and McNicol (1999), the "natural disturbance paradigm" is suggested as an approach to minimize risk in maintaining endemic biodiversity on a landbase for which forest management activities are planned. The approach of utilizing natural disturbance as a "guiding model" is based upon the ability of plants and animals to evolve and adapt to landscape patterns created through natural disturbances. To apply the natural disturbance model, requires guidance for planners to design harvest operating areas without diverging substantially from the concept of approximating a natural pattern across the landscape. It is further suggested by Rempel and McNicol (1999) that results of future analysis be utilized as indicators of SFM.

Research trials, conducted by the Manitoba Model Forest, for the design of timber harvest practices that best approximate a wildfire disturbance regime (Ehnes 1999A, 1999B and 2000) were established on the basis of the thesis research conducted by James Ehnes on the FML (Ehnes 1998). The principle objective of the research trial was to assess landscape harvest designs and site specific prescriptions that would help harvested areas look, feel and operate like a natural forest as soon as possible. Two experimental harvest areas and one forest fire control area were established on the FML with the objective to monitor the areas over time and to assess if and when the two disturbance types converged in terms of ecosystem function. The first full re-measurement of the permanent sample plot locations has been completed and an assessment report is pending to the MBMF.

- Landscape patch and connectedness analysis, which has been undertaken for Ecoregion 90 of the east side of FML 01 in conjunction with the EBM Pilot Project (MC 2002) provides analysis of the size of patches and their size distribution for the landscape. These patches are the result of all the varying types of disturbance that occur including timber harvesting

as well as fire, insect and disease and other disturbances. Ehnes (1998) conducted a similar analysis of large fires that previously occurred on the FML in order to develop a landscape harvest prescriptions similar to the patch size distribution of Rempel in the EBM Pilot Project.

- Planning for areas to be logged can be expected to result in a mosaic of patches of varying spatial configurations, with ages dependent on year of harvest and subsequent renewal, across the landscape. It is recognized that these patches may, in situations where large areas of uniform stands exist, have edges, which are somewhat straighter and more abrupt than would be expected from a natural disturbance. At the same time it is noted that the boreal forest is a landscape made up of a mosaic of patches of varying sizes and ages primarily resultant from previous natural disturbances. Tembec's procedure for the design of harvest boundaries follows natural stand boundaries and terrain features to the extent possible. Where possible the harvest design will make use of natural boundaries and differences in forest age class structures to design cutblocks (WDS-010).

- At the local site level prompt forest renewal as described in silvicultural prescription procedure (WDS-008), and required by MC, will mitigate the impact of logging activities in terms of fragmentation by bringing the area back into the forested landscape to an earlier successional stage.

- As part of the adaptive management process, the Company is committed to monitoring gains in ecological understanding in these processes, through their support and participation of the Manitoba Model Forest and other avenues, for future modification of their planning and logging practices as appropriate.

- As part of the LLI framework indicators have been established, with related targets, for measurement of the number and size of forest patches (Section 15, Indicator 1.1.3.1) road densities by watershed area (Section 15, Indicator 1.1.3.3), natural and anthropogenic depletions by watershed area (Section 15, Indicator 3.1.4.2). These monitoring functions will provide Tembec with an important tool to assist in future planning activities and mitigation of landscape level impacts of planning of roads and harvest design.

- Sustainability modeling (FSP Section 4.3) was conducted, for management objectives in the FSP, to maintain large contiguous patches of forest (FSP Section 5.2.1.1.1) and maintain patches of habitat for Woodland Caribou (FSP Section 5.2.1.1.3). These objectives will assist in developing landscape patterns similar to natural disturbance patterns.

- At the landscape level a further potential mitigating process relating to forest composition and landscape patterns and fragmentation is the Provincial Protected Areas Initiative. This program is directed at selecting and placing aside from resource extraction activities, including timber harvesting, areas representative of Manitoba enduring features and designated such areas as protected areas.

- The establishment of such areas as protected status would provide areas of boreal forest representative of the forests of FML 01 within which planning and implementation of harvesting operations would not occur providing areas with composition and landscape patterns unaffected by these activities.

- Manitoba has also prohibited commercial timber harvesting, in addition to the designated Protected Areas, in the remaining portions of Nopiming Provincial Park. Although these areas still allow mining and hydro electric activities, the majority of the prohibited landbase will provide areas with composition and landscape patterns unaffected by harvesting.

- Within the LLI framework, Indicator 1.1.4.1 (Section 15) provides for measurement of the proportion of each ecoregion, represented in FML 01 that is in protected status. This indicator assists in monitoring of this process for FML 01.

- One feature of regulated planning for logging activity which tends to contrast with natural disturbance patterns is the distribution of patch size, which tends to be more uniform and generally smaller than those which occur through fire disturbance. The current MC 100 hectare cutblock guideline (MC Forestry Branch Circular No. FEM 13), may itself contribute to this situation in Manitoba's boreal forest as it creates a harvest cutblock size objective against which all cutblocks are evaluated. Kimmons (1992) makes the observation that in nature, fire, insects, disease and wind disturbances result in forest patches of given age and species composition that range from very small to very large and that to promote landscape diversity a diversity of clearcut sizes and shapes should be used. This concern was identified in the sustainability modeling process (FSP Section 4.1) and Manitoba adopted a maximum 250 hectare cutblock size.

- The Manitoba Conservation Forest Practices Committee (FPC) has identified the need to develop a Landscape Design Guideline in order to address landscape level requirements to help maintain ecosystem condition and function at that scale. The FPS has partnered with the MBMF in the development of a draft guideline for review by Manitoba. To commence the guideline development process, The MBMF and the Sustainable Forest Management Network (SFMN) conducted a two day workshop in Winnipeg in April 2008 titled *Forest Landscape Planning and Design: From Science to Implementation.* Tembec was invited to present the landscape component of the sustainability modeling in Section 4.3 of the FSP. Proceedings from the workshop and a pending White Paper on landscape design will assist in commencing with the development of the Landscape Design Guideline. Tembec participates on the FPS and the subcommittee established to develop an initial draft of the guideline for consideration. Once this guideline has been approved by MC, it will provide the necessary guidance for the design and implementation of landscape design.

Information collection and application activities have a significant impact upon landscape level planning and results obtained through implementation. Information collected through various inventory, assessment and monitoring processes provides the basis for decision making from the stand level (e.g. mitigation for cutblock design) to the landscape level (e.g.

sustainable harvest levels). Processes must be in place to collect relevant information and to process and apply it to decisions.

- The Manitoba Forest Inventory provides full coverage of FML 01 with basic timber related data necessary for strategic level planning, including sustainability analysis for determination of sustainable harvest levels. This information is provided to Tembec as required under the FML Agreement with Manitoba and was utilized in the determination of sustainability for the FSP in co-operation with MC, who have primary responsibility for provision and updating of the Provincial inventory. The inventory is revised approximately every 20 years with annual updating for fire, harvest and other depletions including forest renewal. MC undertakes intermediate updates in the event of major disturbances such as a severe fire year. MC incorporated actual stand age into the most recent forest inventory, which was used in the development of the sustainability modeling, as opposed to the pervious use of cutting classes which combined stand age with productivity assignment to forest stands. Tree heights were also incorporated into the forest inventory which along with age will provide more accurate growth and yield information as additional PSP's are established In addition a Provincial Forest Land Inventory Technical Advisory Committee (FLITAC) is in place to provide on-going recommendations for improvement of the inventory, including improved representation of non-timber values. Tembec is a participating member of this committee. Such improvements are important in the context of adaptive management and will provide improvements for application to sustainability modeling. On-going regular updating of the inventory by Tembec and MC is important to ensure that the modeling analysis (e.g. sustainability, fragmentation and patch size), monitoring (e.g. forest composition, age class structure, etc.), and reporting activities that rely upon the inventory provide reliable results.

- The Manitoba Forest Ecosystem Classification (FEC) system provides a tool for application of ecosystem vegetation and soil types to identify forest stands in terms of these parameters and assist in defining and communicating forest management prescriptions. Tembec makes use of the FEC V-type classification process in the application of the PHA program and silvicultural prescriptions (FSP Section 5.1.4.3).

- Tembec has implemented a Pre-harvest Assessment (PHA) program (MC 2003) to provide operational level information at the operating block and cutblock level. This program provides important information for application to non-timber and timber values, supplementing the information available from the Manitoba Forest Inventory, other provincial information sources, the Manitoba FEC and joint planning and other public participation processes (WDS – 002). The PHA data is used for the development of individual Harvest Block Summaries for annual Operating and Renewal Plans and are used in whole by MC, once approved, in the issuance of Work Permits.

Given the approaches relative to FSP management objectives, EMS procedures, LLI indicators and targets and planning to operate within the natural range of variability of disturbances and renewal, the impacts associated with planning activities are mitigable, and in general, provide remedial measures for operations at the landscape level. Modeling

approaches and analysis of disturbance patterns and their application in planning and operations provides positive SFM direction in this regard.

Infrastructure Development

Infrastructure development includes the alteration of forested cover through temporary or permanent removal of vegetation at the site level to provide a location for placement/construction of roads and landings, watercourse crossings, camps, timber storage sites and fuel storage sites. The magnitude, extent and duration of impacts upon components of ecological diversity are related to the permanent or temporary duration of the placement and use of the infrastructure and, in the case of roads, to the class or standard to which the road is built.

All-weather, dry-weather and winter road construction will lead to mitigable to non-mitigable impacts upon vegetation at the site level due to the requirement to remove the overlying vegetation from routes to be developed as roads. The impacts of all-weather roads in this regard are non-mitigable in that the routes are permanent in duration, while many dry-weather and winter road routes are temporary and returned to a vegetated state following their use:

- Clearing and maintenance of road right-of-ways (ROW) results in permanent removal of vegetation, altering the forest cover, for the service life of the ROW.
    - For all-weather roads this results in localized non-mitigable impacts to overstory and understory vegetation, forest stand structure and non-forested areas within the road right-of-way.
        - The extent of this loss is localized, however, to the routes utilized for all-weather roads, and as indicated for the forest composition and landscape patterns at a landscape level, is insignificant and mitigable.
        - Road construction may have site specific effects for some wildlife species (EIS Section1, 3.3.3.2), however, from a vegetation community perspective the impact is insignificant and mitigable given the localized effect and the relatively low road density of 0.2 km./km2 (Section 15, Indicator 1.1.3.3) for FML 01 as a whole.
        - Given their short duration life span dry-weather and winter roads are not considered to have any significant impact in terms of fragmentation of the landscape.
    - For dry-weather roads (Class 3B), generally utilized to provide access within and to cutblocks inside operating areas (WDS - 006), these effects are considered to be mitigable given the short term duration of such roads and minimal grade construction. Typically their use lasts for less than 5 years, after which these roads re-vegetate

naturally, or in the case of routes adjacent to and within cutblocks, are decommissioned and reforested (WDS – WI – 035, 036, 037, and 039).

- For winter roads the ROW generally avoids high ground forested areas, utilizing wetland areas under frozen conditions (WDS – 006). Where crossings of high ground areas is required, impacts are similar to those for dry-weather roads, though further mitigated by frozen ground conditions at the time of construction and use.

    - Some site-specific disturbance to vegetation in riparian areas does occur where routes approach frozen rivers. Mitigation for erosion control at these sites, as described in WDS-WI-026, will assist in re-establishment of natural vegetation following use of the winter road.

    - Construction involves tramping of the road surface to drive frost to depth once freezing conditions are in effect. Routes are then bladed to provide a smooth driving surface. Effects on non-forested areas include localized packing of the surface mat and some disturbance to the peatland surface and understory vegetation as a result of blading activity. Provided that such disturbance is minimized the construction and use of winter roads results in relatively minor impact to the longer-term environmental functioning of the site in comparison to all-weather roads. Recovery and growth of the understory vegetation typically occurs within a few years.

    - On the basis of these procedures impacts are considered to be mitigable given the frozen conditions for construction and use of these roads.

Road and ROW maintenance activities primarily effect site level components of ecological diversity through mechanical brushing or chemical vegetation control along the ROWs of all-weather roads. These activities result in removal of targeted trees and understory vegetation, altering the forest cover that would otherwise occupy the site.

- Such vegetation control maintenance will continue to alter the vegetation and stand structure within the ROW area at a frequency dependent upon level of road use, safety considerations and presence and growth of hardwood tree and shrub species.

- This activity is considered to have an insignificant mitigable impact given the localized spatial extent within the established ROW (WDS - 014).

Permanent and temporary watercourse crossings can lead to site specific impacts to ecological diversity of vegetation associated with wetland areas in which crossings are required for road construction. The extent and duration of such impacts will relate to the requirement for crossing of wetland areas in the course of road construction and mitigation measures put into place.

- Due to the potential environmental consequences and associated need for mitigation measures, crossing of wetland areas in the course of all-weather and dry-weather road

construction is minimized to the extent possible (WDS-WI-023). Increased costs of road development at wetland locations also contribute to the desire to minimize such crossings. Where a high ground route provides an efficient alternative to one requiring crossing of wetlands, the high ground route will generally be utilized.

- Wetland crossings, both permanent and temporary, require the implementation of cross-drainage and ditching to maintain water flows in place prior to construction of the road. Watercourse crossings utilized to provide cross-drainage may lead to alteration of local hydrology and the natural water flow if adequate water flow capacity is not provided or if blockage of the crossing occurs. This in turn can lead to alterations in the local water levels in the wetland thus impacting growth conditions for wetland vegetation in the immediate area.

- Mitigation of such impacts is achieved through proper sizing and placement of culverts and other watercourse crossing structures to ensure flow capacity is adequate and regular inspection of all roads, including wetland and other watercourse crossings, to ensure that flow of water is maintained. This is guided by procedures outlined in *Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat* (MC/DFO) and (WDS-013 & WDS – WI – 025). Through these actions water level fluctuations due to placement of watercourse crossings and associated impacts on wetland ecological vegetation diversity will be insignificant and mitigable.

- For temporary watercourse crossings further mitigation is achieved through removal and decommissioning of crossing structures (WDS – WI – 035 and 036). This allows for the return of natural flows and associated growth conditions of wetland vegetation.

Camp, timber and fuel storage site development results in the removal of the overstory and understory vegetation and altering of stand structure on a localized basis.

- These effects are considered to be insignificant given the limited spatial extent of these activities on the landscape and the relative short duration during which any given area is impacted.

- Follow-up mitigation includes the natural revegetation to previously existing conditions with application of forest renewal measures for such areas contained within or directly adjacent to cutblocks (WDS – WI – 037 and 039).

Decommissioning of temporary infrastructure including dry-weather and winter roads, camps, timber storage sites and fuel storage sites, provides a positive impact to ecological diversity of vegetation through termination of the temporary use of the site for infrastructure and returning the site to productive forest.

- Camp sites are inspected for proper decommissioning following harvest operations (WDS-013). Decommissioning as described in the work instructions (WDS – WI – 035, 036, 037 and 039), includes clearing of the site of all construction materials and

equipment, access control measures, roll-back and re-spreading of woody debris and organic material, site preparation and reforestation activities.

- Such activities positively affect the site of previous infrastructure by removing impediments to re-vegetation and assisting in the return of conditions favorable to renewal of the site. Re-spreading of organic materials from previous road ROW or other site clearing assists in the return of nutrient sources and moisture conditions for tree and other vegetation growth.

- Dry-weather and upland sections of winter roads contained within cutblocks will be re-forested as described in the WDS-039.

- Decommissioning activities can also have a positive influence upon riparian and wetland areas through removal of culverts and other temporary crossing structures, restoring natural drainage patterns, and stabilizing of banks and slopes (WDS – WI – 035 and 036). Such measures can provide opportunity for natural re-vegetation to become established at the site, restoring the natural forest and other vegetative cover.

For the most part, impacts related to infrastructure development occur at the site level. This localized extent, in conjunction with mitigation measures for development and monitoring and maintenance of infrastructure, are such that these activities are not expected to significantly impact the ecological diversity of FML 01. The temporary duration, with follow-up decommissioning, of all infrastructure developments except for all-weather roads, which are utilized to the minimum level required (WDS – 006), further mitigate effects upon ecological diversity, particularly when viewed in a landscape context. Planning activities, including public participation, provide up-front direction in these regards by ensuring that infrastructure is minimized in extent and duration to the standard required to undertake forest management activities for the area being developed.

Harvesting

Harvesting operations, undertaken to extract the merchantable portion of the timber resource, by necessity will result in changes to the tree species composition, age structure and overall forest stand structure of areas harvested by this disturbance mechanism. The manner in which these activities take place relative to the natural stand level disturbance mechanisms and landscape level patterns have implications for ecological diversity at the site and landscape levels. The nature and degree of impacts are determined relative to those arising from natural disturbance mechanisms including fire, insect and disease.

Logging, in the context of variable retention logging (VRL) practices, necessarily results in the removal of most of the merchantable trees, other than those intended for retention as corridors, buffers and wildlife trees, from the defined cutblock area. In extracting the timber resource, logging activities can result in impacts upon the various components of ecological diversity occurring at the stand level including overstory and understory vegetation, stand structure and wetlands and other non-forested areas. Due to the extent of logging activities

across developed areas of FML 01 and the duration of the result of logging on forest stands, this activity has implications at the landscape level as well.

- Logging of trees results in a significant impact to overstory vegetation through alteration of the original stand species composition (due primarily to softwood harvest) and age class structure (due to removal of mature trees). Mitigation of the impacts of logging is undertaken in several ways:

    - VRL practices, including retention of corridors, buffers and wildlife trees, assist in retaining elements of overstory vegetation within operating blocks (WDS-WI-048). Tembec has identified practices to retain this component and move towards measurable targets in terms of levels of retention as part of the adaptive management program (Section 15, Indicator 1.1.3.4)

    - Follow-up forest renewal activity that occurs on each harvested site (FSP Section 5.14.3 & 5.14.4). As indicated in these procedures/instructions, all harvested sites must be regenerated back to similar stand overstory conditions to meet MC regeneration standards. Meeting these standards is a condition of Tembec's FML Agreement with the Province of Manitoba. Regeneration and FTG surveys provide a monitoring process to follow-up progress made for each harvested cutblock (MC 2005 & 2003A).

    - Sustainability modeling analysis undertaken to determine a sustainable timber harvest level assists in mitigation of logging of trees at the landscape level. Modeling analysis is undertaken during preparation of the FSP with MC producing a base case analysis (FSP Section 4.1). Additional analysis conducted by Tembec incorporating constraints regarding species flow, old forests, wildlife habitat and the spatial distribution of large contiguous core areas reduced the sustainable harvest levels below that determined by MC. (FSP Section 4.3). The reduced sustainable timber harvest levels have been utilized in the development of the FSP. Subsequent monitoring of actual harvest levels is undertaken annually to compare to the determined sustainable harvest level (Section 15 Indicator 5.1.1.1).

- Logging activities will have an insignificant impact upon the understory vegetation of cutblock sites, though to a lesser magnitude and duration, at least in the short-term, than the overstory trees. Harvesting and renewal practices do not deal directly with the understory vegetation component of the forest. Mitigation processes are directed towards retention of this component while harvesting and renewal operations are undertaken.

    - Following harvesting, the understory will follow a similar successional path in terms of its recovery to the pre-harvest state to that of the tree overstory in response to changes in the light, moisture regime and other environmental conditions that occur on the site following harvesting. In terms of ecological diversity, disturbance and renewal are driving forces in the creation of a mosaic of forest stands of varying tree and understory vegetation composition and stage of succession. In this regard the logging

activity of forest stands including the trees and the understory is mitigated through the prompt forest renewal of these sites as well as the capacity of the boreal forest to adapt to disturbance. Much of the research undertaken to date comparing successional pathways of understory vegetation on logged sites versus natural fire origin sites have focused on the very early successional stages. Youngblood and Titus (1996), indicate that in general the compositions of plants that develop following natural disturbances differ from that following harvesting. The post harvest/fire vegetation assessment being conducted by Ehnes for the MBMF (report pending) will benefit forest resource managers in developing harvest and renewal strategies based upon a fuller understanding of successional pathways from stand origin to maturity.

- EMS practices include retention of understory vegetation (WDS-WI -006 & 048) with appropriate selection of operating equipment, operating season and incorporation of understory vegetation values in conjunction with other values for the site (e.g. protection of ephemeral streams and associated vegetation (WDS – WI – 007). Such practices include protection of advanced softwood regeneration, where it occurs, to capitalize on this source of natural regeneration and minimize loss of advanced timber growth (WDS – WI – 006).

- As a reflection of the impacts of logging upon the overstory and understory vegetation, a significant impact upon forest stand structure occurs at the stand level. Impacts and mitigation are a result of the combination of processes described for the overstory and understory.

  - In addition to retention of wildlife trees and understory vegetation, further mitigation to approximate natural processes including design of uneven cutblock boundaries to match up with natural stand boundaries where practical, as described in WDS – 010, are in use by Tembec at this time.

- Logging activities can have an insignificant and mitigable impact upon wetlands and other non-forested areas where disturbance to these areas occurs in conjunction with logging being undertaken in adjacent forested areas.

  - Such areas are not targeted for logging activity, aside from potential disturbance as a result of forwarding or skidding of timber through areas. Mitigation of this concern is described in WDS – WI – 002, 007 & 048 relating to limiting of operations to within prescribed and approved cutblock boundaries, the protection of drainage areas and the retention of non merchantable areas.

  - Winter use of such areas may be permitted under frozen conditions as approved.

  - The LLI framework includes Indicator 1.1.2.1 & 3.1.2.3 (Section 15), which tracks the mitigation applied, and follow-up results, for sensitive types of sites in logged areas. Such sites would include wetland area within and adjacent to cutblocks. This will assist Tembec in review and implementation of procedures in the context of adaptive management.

- At the landscape level, logging activities can have a significant impact upon forest composition and landscape patterns as a result of the removal of overstory vegetation. Mitigation of these impacts takes place at the planning and logging operations stages including measures described earlier and above.

    - At the planning stage sustainability modeling incorporates retention of old forest targets and representative forest composition and age classes to maintain sustainable timber harvest levels into perpetuity (FSP Section 4.3). Prompt forest renewal as described in the FSP Section 5.14.3 is a significant element of this process.

    - FSP management objectives are spatial modeling at the landscape level to provide for the maintenance of large, contiguous core areas and woodland caribou habitat areas across the FML over time (FSP Section 4.3 & 5.2.1.1).

    - VRL practices intended to approximate natural disturbance patterns provide assistance at a cutblock, operating block and operating area level. These planning procedures (WDS – 010) and operating practices (WDS – WI – 004, 005, 006, 007 and 048) also contribute at the landscape level in creating a more natural mosaic of stands and stand edges.

Woody debris management actions can have an insignificant impact upon forest stand structure in terms of the elements of woody debris retained across harvested areas relative to those left by natural disturbances. Standing snags, fallen logs and pieces of woody material form a component of stand structure, particularly as it relates to use by some wildlife species, described later in this EIS.

- VRL practices to incorporate retention of snags and other wildlife trees (WDS – WI – 004 & 048) provide mitigation to retain these elements following logging operations.

- Retention of woody debris from limbing and topping within the harvest area, as required by MC, or the spreading of woody debris resulting from log or chip processing at roadside provides processes to ensure distribution of logging debris across cutover areas (MC 2005A, WDS – WI – 012 & 037).

Harvesting activities have implications for impacts at the stand level and across the landscape in terms of logging effects as compared to the occurrence of natural depletions, principally fire. The harvesting methods employed by Tembec are typical of those used throughout the boreal forest in Canada and are used in conjunction with the clearcut silviculture system, arguably the system best adapted to the boreal forest where most of the stands are fire origin and relatively even-aged. The reproductive strategies utilized by the forest tree species and the resulting landscape patterns consisting generally of even-aged stands, principally from fire disturbance, are the factors taken into account in applying the clearcutting system to the harvest and renewal of boreal forest stands (Youngblood and Titus 1996). In a review of clearcutting as a regeneration method in the boreal forest, Youngblood and Titus (1996) suggest that so long as site specific mitigating practices such as those proposed in the FSP and

EMS are implemented, the clearcutting method is a valid forest management tool. In undertaking harvesting operations Tembec applies a variable retention logging (VRL) methodology to the standard clearcutting system as a component of its SFM program. VRL encompasses a number of measures that combine to provide mitigation of the impacts of harvesting upon ecological diversity. Mitigation of the impacts of harvesting activities upon ecological diversity are provided by the combined actions of PHA to identify values for management, logging practices to retain elements of stand structure and utilize natural stand edges in cutblock design, forest renewal practices to complement natural renewal processes of the boreal forest and harvesting based upon determined sustainable levels from wood supply modeling.

It is further noted that the extent of harvesting activities across FML 01 as compared to the disturbance that occurs as a result of forest fire is relatively insignificant. A maximum of 3,000 hectares of forest may be harvested annually upon full implementation of the FSP, as determined by the sustainability modeling in Section 4.3 of the FSP. This compares to an annual average of 7,400 hectares of forest that has burned over since the establishment of the FML. The on-going effect of fire and its role in the ecosystem of the forest of FML 01 provides further mitigation of the impacts of harvesting through the continuing natural disturbance and renewal processes that occur on these areas.

Forest Renewal

Forest renewal operations for harvested forest stands are undertaken to complement natural renewal processes in regenerating forest covertypes harvested for timber. The manner in which these activities approximate and take advantage of natural renewal mechanisms relative to the natural stand level disturbance and renewal mechanisms and landscape level patterns have implications for ecological diversity at the site and landscape levels. The nature and degree of impacts are determined relative to those arising from natural renewal mechanisms, particularly fire.

Site preparation and scarification activities, while positive in terms of assistance to regeneration of trees, can have some insignificant implications for understory vegetation that has been retained through the logging operations on the cutblock.

- The preparation of an appropriate seedbed microsite for the establishment and growth of natural or planted seed and/or planted seedlings provides a positive impact for re-establishment of overstory vegetation by approximating the effects of forest fire disturbance in creating mineral soil exposure. The disturbance created by logging alone is less effective in creating such conditions as compared to fire.

In undertaking site preparation or scarification treatments on harvested cutovers potential impacts can occur to understory vegetation that has been retained through VRL practices at the logging stage. The magnitude and extent of such effects upon understory vegetation will vary by the type of site preparation method chosen for each site. The use of disc trenching or drag chaining will generally result in a greater extent and magnitude of disturbance to vegetation as opposed to spot scarification, such as a bracke mounder, but disturbance is

limited to the area of the trench created only. MBMF research (MBMF 1997) found that disc trenching, in conjunction with a broadcast application of glyphosate, provided the best performance in terms of seedling survival and growth on upland sites. Based on the positive result of improved seedling performance and the minor difference between patch or continuous furrow scarification, the continued use of disc trench and drag chain site preparation should have an insignificant impact on understory vegetation.

- Ground herbicide application will also result in disturbance and removal of understory vegetation to target application areas. In all cases, the overall management targets for the site, including retention of understory vegetation (stand structure) and forest renewal requirements must be considered, in addition to site operating constraints, in choosing site preparation and scarification methods to be applied. Damage from equipment action and herbicide application on the site occupied by the vegetation can be mitigated through continued emphasis upon equipment choice, careful practices at this stage of operations, design of the site preparation or scarification pattern and the low volumes of herbicide used in ground application as described in the EMS procedures WDS – WI – 027, 028, 029, 031 and WDS-014.

- At the landscape level, these site preparation and scarification activities positively impact forest composition through assertive action being taken to complement and accelerate natural renewal processes for each site. Such actions will assist in maintaining the softwood and softwood-mixedwood stand components across the forest as compared to the dominance of hardwoods that may otherwise occur as a result of the competitive advantage that hardwood species generally have in renewal of previously mixedwood sites following logging.

Tree establishment activities generally provide positive benefits at both the stand and landscape level in following up on site preparation activities to renew each site. The difference in magnitude of disturbance between fire and logging often necessitates site preparation and scarification activities as well as planting of seedlings to renew the harvested forests. Undertaking these actions generally provides a positive benefit through accelerated establishment and growth of new trees on the site.

- Tree establishment begins and accelerates the process of renewing the overstory vegetation component of harvested stands and initiating development of this component of stand structure. While planting of seedlings may often involve only one or two softwood tree species, consideration of planting requirements and reliance upon natural establishment is initiated at the planning stage including input from the PHA assessment of previously existing tree species composition (WDS – 002). This information allows for determination of planted species requirements as compared to reliance on in-filling from natural on-site seed and advanced growth. Beyond those trees that are planted on a site, in-filling of other species present will occur over time. In determining planting requirements Tembec is guided by the target of reforesting all sites back to their previous covertype composition (FSP section 5.14.3). Such processes provide mitigation for this potential stand level impact which is insignificant overall.

- As with site preparation and scarification activities, tree establishment activities positively impact forest composition at the landscape level through assertive action being taken to complement and accelerate the natural renewal processes for each site. Such actions will assist in maintaining the softwood and softwood-mixedwood stand components across the forest as compared to the dominance of hardwoods that may otherwise occur as a result of the competitive advantage that hardwood species generally have in renewal of previously mixedwood sites following logging. Tree establishment also provides the additional positive benefit of assisting in sustainability of the timber resource through maintenance of productivity on sites that otherwise may take longer to re-establish softwood forest cover

Mechanical and chemical stand tending activities undertaken to influence stand development and growth can be considered relative to natural stand dynamics that take place in boreal forest stands following fire and other disturbances.

- Mechanical stand tending utilizing manual brush saws is used to reduce the number of stems of the softwood trees and remove competing hardwood trees to promote optimal growth of the remaining standing trees.

    - Positive benefits can occur for the developing overstory. This practice, generally undertaken for cleaning softwood plantations of competing hardwood species or on jack pine stands where it is essentially an acceleration of the reduction in stem density that occurs in these stands throughout the early to mid seral stages of succession.

    - The impact of this activity is considered to be insignificant and mitigable as it relates to understory vegetation, in terms of removal of some competing shrubs that may occur during tending activities.

    - At the landscape level such stand tending actions can assist in maintaining the softwood composition of the forest through stand level targets to retain softwood composition and meet renewal targets relative to original species composition prior to harvest.

    - Overall it is important to note that in addition to the stand tending process approximating the naturally occurring thinning process at the stand level, this process is undertaken on a selected basis only as described in the FSP Section 5.14.4.7, WDS-WI-030 & 031

- Chemical stand tending is undertaken on a selected basis on sites where regenerating hardwoods such as trembling aspen and balsam poplar as well as shrubs and grasses are able to re-establish much more quickly than the softwood species that were originally a component of the stand. On such sites chemical stand tending is an important tool to ensure that stand establishment will meet provincial standards of stand species composition relative to the original stand prior to harvest.

    - Similar benefits to overstory vegetation and forest composition are anticipated to those described for mechanical stand tending. Maintenance of the softwood composition of

the overstory vegetation component of individual stands and of the overall forest composition is important to maintain sustainable levels of timber production as well as associated wildlife habitat.

- Removal of the target hardwood trees, to the degree this occurs, will result in impacts to hardwoods in the overstory at the stand level, also translating to impacts at the landscape level in terms of forest composition. Given the selective application of chemical stand tending to only those cutblocks requiring these actions to meet established forest renewal targets (FSP, Section 5.14.3 & 5.15, WDS-014), the extent of these impacts is considered to be insignificant and mitigable.

- Similarly, chemical stand tending will impact understory vegetation in terms of removal of targeted hardwood shrubs and small trees. These hardwood losses are significant at the site level and in the short-term, however, they are mitigable through the selective application of this activity to only those sites requiring tending to meet forest renewal requirements, and through carefully controlled application procedures to ensure that mis-application of chemicals to non-targeted areas does not occur (WDS – 014). Further mitigation results from the short-term duration of the impact of the applied chemicals to targeted sites. Following application, renewed growth of hardwoods from sprouting and seed sources is expected to result in re-establishment of hardwood understory vegetation over the next several years on the treated site. The actual intended use of the herbicide application is to provide a short-term window of opportunity for slower growing softwood trees to become established.

As with harvesting, the forest renewal methods employed by Tembec are typical of those used throughout the boreal forest in Canada and have been adapted to capitalize upon the adaptations to major disturbance (principally fire), utilized by boreal forest species in regeneration. The overall strategy to utilize renewal treatments that complement the natural renewal mechanisms of the tree species in FML 01, in combination with the commitment of Tembec to renew all harvested sites, provides positive benefits in mitigating the impacts of harvesting and maintaining the forest composition and age class structure of the forest within the natural range of variability.

Forest Protection

Responsibility for forest protection lies with MC. Tembec cooperates in planning and modifying harvest operations as practical to minimize losses due to insect and disease infestations. The Company provides a Fire Protection Plan each year to assist MC by providing relevant information for the suppression of forest fires on FML 01. Additionally, the Company assists in suppression activities through initial attack activities in fighting fires upon the request of MC or fires that break out in active operating areas. The degree to which Tembec has control over forest protection is thus limited to its co-operative role with MC.

Insect and disease and fire control activities impacts upon the overall forest composition structure of FML 01 are considered to be generally positive in terms of the protection of current ecological diversity values. In undertaking such protection measures an insignificant

impact arises in terms of the effect of these measures upon the natural disturbance processes on the landscape.

- The application of forest protection measures can be a positive impact in terms of assisting in mitigation of harvesting activity through protection of mature timber values and associated ecological diversity. Such measures, in combination with harvesting conducted at sustainable levels, can be expected to result in a generally stable level of forest composition and age class structure, and thereby, ecological diversity.

- Through their suppression of the natural disturbance processes occurring in the forest, forest protection activities may also be viewed as impacting these processes. Considering the extent of area protected through these measures as compared to the on-going level of natural disturbance that continues to occur on the landscape of FML 01 these impacts are insignificant and mitigable. A portion of fires actioned in protection activities are man-caused. Emphasis in undertaking forest protection activities is generally directed at maintaining and protecting particular values, such as non-timber (human, communities, cottages, lodges, parks, etc.) and timber (stockpiled processed timber, areas to which access development investments have been made, and concentrations of identified mature high-value timber). Significant areas of FML 01 and adjacent areas of the boreal forest continue to undergo natural disturbance processes.

Insect and disease and fire control activities are most often directed towards areas of identified values to justify the related expenses of the activity. Through PHA and other forest investigation activities Tembec co-operates with MC in identification of areas of timber values in which insect and disease infestations are found. The Company also participates in fire suppression planning with MC through provision of the Annual Fire Plan each year and in initial attack of fire outbreaks in active operating areas. Application of these measures to areas of high non-timber and timber values by Tembec and MC results in positive impacts to ecological diversity in terms of existing values with insignificant mitigable impacts to natural disturbance processes when considered in a landscape context.

Equipment Use

Equipment use and associated activities can impact upon ecological diversity through the effects of heavy equipment movement on the site resulting in unintended disturbance to vegetation in the understory and wetlands and other non-forested areas.

In-block operations of equipment will result in disturbance to vegetation, other that the intended harvesting of trees, as a result of movement on the cutblock.

- Equipment movement and actions associated with harvest boom motion in the cutblocks will result in some disturbance to understory vegetation, including advanced softwood regeneration where it occurs. Such impacts are insignificant and mitigable when considered in terms of magnitude and extent. The application of VRL practices as described in WDS – WI - 048 takes into account retention of understory vegetation in undertaking logging operations, particularly in association with other values such as

ephemeral streams and wildlife trees (WDS – WI – 004 and 007). The duration of such impacts is relatively short, as re-sprouting and seeding of new growth will generally occur in the following growing season. Further mitigation of the magnitude of such effects occurs through utilization of winter logging operations accounting for approximately 75 % of area harvested by Tembec resulting in snow cover and frozen conditions which further reduce disturbance to this vegetation.

- Equipment and boom movement can similarly result in impacts to vegetation in wetland and other non-forested areas. Except for approved crossing locations associated with access development these locations will generally be considered to be outside of approved operating block and cutblock boundaries and, as described in WDS – 010 and WDS – WI – 002 & 007 will be excluded from cutblock design and subsequent equipment operation.

Equipment use will result in some level of disturbance to vegetation within areas where felling and forwarding/skidding equipment is utilized. Inadvertent disturbance to vegetation occupying these areas in the course of conducting logging or site preparation/scarification activities is mitigated through avoidance of identified high value areas (ephemeral streams, etc.), general application of VRL practices, utilization of winter logging and operating within designed cutblock boundaries. Particular care to follow-up with site preparation and scarification equipment operators to ensure continued avoidance of areas protected during logging operations is identified as an important mitigating factor (WDS – WI – 004, 027, 028 and 029).

3.3 Species Diversity

3.3.1 Introduction

Species diversity is reflected in the variation that exists among the plants, animals and microorganisms that inhabit forest ecosystems. This variation is represented through the components in Table 1 (vegetation), Table 2 (terrestrial wildlife) and Table 3 (aquatic and amphibian). The boreal forest region supports a distinct group of species determined, in part, by the nature of the ecosystem itself, as reviewed in Section 3.2 of this EIS.

Many of the components reviewed for impacts upon ecological diversity in Section 3.2 are also directly relevant to species diversity for the vegetation features of the ecosystem. This material will not be repeated here. Vulnerable threatened and endangered flora will be reviewed and then the focus will be placed upon terrestrial, aquatic and amphibian wildlife species diversity.

The general focus of the review in terms of wildlife components will be related to the potential impacts upon wildlife habitat values that the implementation of the FSP and associated forest management activities are expected to have. Wildlife populations themselves are affected by a number of factors beyond forestry activities including recreational and commercial hunting and fishing levels, provincial regulations and enforcement, poaching activities, and habitat changes occurring as a result of natural processes and disturbances and other land use activities. The principal way, in which forest management activities will impact upon wildlife

populations, as such, is indirectly as a result of public use of roads constructed by the industry for access for harvesting and forest renewal activities. To examine this impact, public use of Tembec access roads has been included for consideration and review as part of the access management activity in the impact implication matrices.

3.3.2 Data Adequacy and Gaps

FSP sources of information include:

- Description of status of vulnerable, threatened and endangered flora for FML 01 (FSP Section 5.7)
- Description of terrestrial, aquatic and amphibian wildlife resources, in terms of habitats and relevant population information, of FML 01 (FSP Sections 3.2)
- Description of status of vulnerable, threatened and endangered wildlife for FML 01 (FSP Section 5.7)
- Habitat supply modeling criteria utilized within timber supply analysis to incorporate the sustainability of habitat supply in determining sustainable timber harvest levels (FSP Section 4.3)

Other sources of information include:

- On-going monitoring of selected wildlife species populations by MC
- Manitoba FEC system (V-types and S-types) in place for Provincial forest resource including FML 01 which assists forest and wildlife managers in communicating values for forest stands relative to timber and wildlife objectives
- High Conservation Value Forest Assessment for FML 01 (Kotak et. al. 2009)
- Woodland Caribou Conservation Strategy for Manitoba (MC 2000)
- Woodland Caribou management strategies for the Owl Lake herd (MBMF 2005) and Atiko/Bloodvein herds (MBMF pending).
- Bird monitoring studies for the MBMF area (MBMF 1994, 1995B, 1996 & 1997B)
- Vascular plant studies for the MBMF area (MBMF 1994B & 2008)

On-going Operational Data Sources include:

- PHA including mensurational data, FEC, V-type, soils, forest health and other values
- MBMF terrestrial biomonitoring project

These sources of information represent the best information currently available for the vegetation species diversity (STE flora) and wildlife resources that populate the ecosystems of FML 01. On going monitoring of wildlife populations by MC, which has responsibility for this function, will continue to provide updated information necessary for management of the various species. Of particular importance in FML 01 is the monitoring of the woodland caribou population.

As an on-going part of their sustainability analysis Tembec has incorporated habitat supply modeling criteria and the spatial distribution of woodland caribou habitat areas over time into sustainable timber harvest supply analysis for the FSP.

As described earlier, the Company has initiated a PHA program to be undertaken on all sites prior to harvest (WDS – 002). This information will continue to build the knowledge base for planning decisions into the future.

The SFM Local Level Indicators (LLI) framework provides the framework to be utilized for monitoring of indicators for measurement of progress towards targets established in the FSP. Indicators developed to represent species diversity will provide improved data regarding the components referenced in Tables 1, 2 and 3 as the monitoring program for adaptive management is implemented during the FSP 20 year period. Relevant management objectives for HSI values are in Section 5.2.1.1.1 and for species at risk in Section 5.2.1.1.3 of the FSP. Indicators 1.2.1.3, 1.2.2.1 and 1.2.3.1 (Section 15) from the LLI will provide enhanced data as time moves forward relative to components indicated in Tables 1, 2 and 3, particularly regarding the Owl Lake Woodland Caribou herd, STE species and habitat levels for representative wildlife species referenced in the FSP.

3.3.3 Forest Management Activities Assessment

3.3.3.1 Vegetation Species Diversity (STE Flora)

Planning

Planning of forest management activities, including the location and design of operating blocks and associated cutblocks and roads and the collection and application of information for decision making has implications for species diversity of vegetation in terms of identified STE locations. Processes for the identification of such values with subsequent incorporation in planning processes determine the nature and degree of impacts.

Road and watercourse crossing and harvest and renewal planning could result in significant disturbance to STE flora locations at a site-specific level. The design of road routes and cutblocks for subsequent ROW clearing and logging operations requires the incorporation of any relevant identified STE flora species locations to mitigate impacts related to disturbance of these sites.

It should be noted that there are currently no flora species listed as vulnerable, threatened or endangered by Manitoba Endangered Species Act (MESA) or the Species at Risk Act (SARA) in FML 01 (FSP Section 5.7).

- Given the current status of the vegetation in FML 01, described in Section 3.1 of the FSP, and vegetation species of conservation concern identified by the Manitoba CDC, described in Section 5.7.3.2 of the FSP, the potential for impact is considered insignificant. Identification of STE flora which may be listed in the future can be mitigated through identification during the PHA as described in WDS – 002 and WDS – 007 and adherence to any actions plans which may be developed under SARA. The ongoing MBMF assessment (MBMF 2008) of the rare plant species, listed by the CDC, will quantify their status on the FML and management strategies can be developed for the applicable species.

Information collection and application processes and implementation can result in significant impacts with regard to future potential identification of STE flora species in FML 01 while also being a positive tool for mitigation of these concerns. The use of the PHA program to assess non-timber values for incorporation into planning and implementation of forest management activities is an important tool for identification of STE flora.

- To mitigate potential impacts associated with collection of data and its application, relative to STE flora species, it is important that all proposed road routes for clearing and cutblocks for harvest be assessed utilizing the PHA program prior to clearing or harvest as described in WDS - 002. Application of any identified sites in terms of incorporation into the design for avoidance must follow.

- Within the LLI framework Tembec has included several indicators and targets related to the protection of STE flora and habitats. Indicator 1.2.1.1 provides annual measure of the percentage of cutblocks subject to PHA. The target is to ensure that all cutblocks will be assessed. Indicator 1.2.1.2 annually describes the level of training provided to PHA crewmembers related to STE species for FML 01 with a target of providing such training annually (WDS – 007). Indicator 1.2.1.3 relates to the proportion of STE habitat sites for which appropriate management actions are incorporated into planning and operations. This indicator and its related target will be implemented over time as applicable management actions are developed in consultation with MC and other appropriate specialists. These indicators and targets from the Tembec LLI framework provide approaches and tools to positively mitigate potential future concerns related to STE flora species that may be identified for FML 01 (WDS – 007).

3.3.3.2 Terrestrial Wildlife Species Diversity

Ungulates, Mammals and Birds

Planning

Planning of forest management activities, including public participation processes, planning of operations, sustainability modeling of wildlife species habitat, information collection and application and most particularly, access management, has implications for species diversity of wildlife as represented by the components described in Table 2. Effects of forest management activities upon wildlife habitat as compared to changes incurred through natural disturbance and renewal processes, and implications for wildlife populations arising from public use of forest access roads and access management activities determine the nature and degree of impacts.

Public participation forums, including joint planning and forums with the general public and sportsman provide information and feedback to Tembec regarding approaches to the integration of wildlife habitat considerations into planning for operations and application of access management options to specified road access routes throughout FML 01. Potential impacts of the public participation processes relate to the general interest in the species, sensitivity to human interaction, as well as the relative impact of forestry activities upon each species.

- Generally the public shows a relatively high level of interest in large visible species such as moose, caribou and white-tailed deer. There is a vested interest by First Nations, sportsman, local residents and other interested parties in the sustainable management of large game species.

    - With moose being common throughout FML 01, and responding positively to the effects of harvesting activities in terms of habitat availability, public participation activities are considered to result in an insignificant mitigable impact. Public awareness in the local need for access management to protect positive gains in moose populations in response to newly created habitat is assisted through joint planning processes with First Nation communities and the activities of the MBMF and MC.

    - Woodland caribou occur through FML 01 with several herds identified on the east side of Lake Winnipeg. The relative sensitivity of woodland caribou to human interaction, its listing as a threatened species for MESA and SARA, and the importance of mature softwood covertype areas, also priority areas for timber harvesting operations, indicate a significant impact for this species in terms of public participation in its management. The Owl Lake woodland caribou herd whose range overlaps with a portion of the FML is the subject of a landscape management strategy (MBMF 2005) developed by the Eastern Manitoba Woodland Caribou Advisory Committee (EMWCAC), of which Tembec is a member. The EMWCAC is currently developing a management strategy for the Atiko and Bloodvein caribou herds found in the northern portion of the FML. This partnership approach demonstrates a mitigative approach to this species in terms of public participation. Further mitigation will be on going through joint planning processes for areas occupied by woodland caribou.

    - White-tailed deer, which occurs primarily in the southern and western portions of FML 01 adjacent to agriculture lands, is a popular animal for both hunting and

viewing. Similar to moose, this species benefits in terms of habitat availability from harvesting activities, with public participation being of particular importance in educating people of the need for access management programs.

- Furbearers generate interest due, in particular, to their importance to people engaged in trapping activities.

    - Significant mitigable impacts to furbearers result from the interest in these species with joint planning activities with First Nations contributing in an important way to mitigation development affecting these animals. Particular attention to the design of roads and cutblocks in the vicinity of riparian areas, which are of particular importance to many furbearer species, will assist in mitigation through such public participation.

- Game birds and resident and water birds also generate interest to the public, particularly to First Nations and sportsman.

    - Insignificant mitigable impacts to these bird species can arise due to the potential increased access for hunting of these birds and recognition of the need for access management in conjunction with hunting limits and other regulations. Interaction with the public and MC through joint planning and other forums can promote awareness of the need for these activities.

- Public participation processes involving both Tembec and MC in discussions with public interests are important for successful mitigation to occur. Tembec is in a good position to work with First Nations through joint planning and other interested parties relevant to the role of forest management activities in affecting habitat. In terms of management of populations, the role of MC as regulators and the organization with primary responsibility for wildlife management is important for population management. Access management is an area of mutual interest for all parties to jointly develop and promote for the benefit of wildlife species.

Road and watercourse crossing planning can have impacts related to site-specific infringement of routes through areas of critical wildlife habitats, such as mineral licks and heron rookeries. More general route and road classification issues related to the permanence of the road route and access and disturbance to areas such as wintering areas can also have impacts.

- The development of all-weather road routes can have an impact on a site-specific basis should routes be chosen which infringe upon important habitats including mineral licks for moose, wintering areas for caribou and cave hibernacula for bats. These potential impacts are considered to be insignificant on a landscape scale and are mitigable through design of road routes to avoid such areas, incorporating information obtained from PHA of routes, as described in WDS – 002 and 010.

Harvest and renewal planning can have impacts related to site-specific concerns arising from harvesting in areas containing critical habitats, as well as the more general relationship of harvesting designs and harvesting and renewal processes as compared to natural disturbance

and renewal processes. The implications for wildlife habitat resulting from the harvest and renewal process as compared to habitat changes and cycling that occur under natural disturbance regimes are important to consider.

- The planning of operating blocks and cutblocks, including their location and design across the landscape is an essential consideration in incorporation of wildlife values at the site, watershed and regional scales. As described in the description of impacts related to ecological diversity, measures undertaken in application of VRL by Tembec (WDS – 010 and WDS – WI – 003, 004, 005, 006, 007 and 048), provide mitigation in terms of retaining in-stand structure elements suitable for use by wildlife species and designing cutblock size and shape to approximate natural disturbance patterns, including:

    - Wildlife tree retention of value for cover, nesting habitat and food sources.

    - Understory vegetation retention, particularly adjacent to wetland areas and ephemeral streams, which tend to be of relatively high value for food and cover requirements for wildlife.

    - Variable buffers and travel corridors for cover and to meet particular wildlife values, such as riparian habitat for many furbearer species.

    - Utilization of natural stand boundaries in development of cutblock design to the extent practical.

    - Management objectives related to harvest block retention targets, old forest targets and core area targets (FSP Section 5.2.1.1).

- The harvest of mature stands with subsequent renewal and growth of shrubs and other understory vegetation results in a disturbance to the site, resulting in changes that impact habitat requirements differently for various species as identified in Table 2. In designing cutblocks to approximate the range of disturbances caused by fire and other natural means, the requirements of wildlife species should generally be accommodated across the landscape. It is important, however, that in order to meet identified critical habitat needs and the needs of species identified to have particular value placed upon them in various areas, that these needs be identified up-front in the planning process. Through discussions with MC and through joint planning and other public participation processes these concerns can be addressed. In this way harvest cutblock design and implementation can incorporate mitigation as described in WDS – 010, WDS – WI - 003 and the Forest Management Guidelines for Wildlife in Manitoba (MNR 1984).

    - For moose and white-tailed deer harvest designs incorporating edge effect, line of sight and distance to cover guidelines (MNR 1984) and the creation of disturbed areas of earlier successional stages in proximity to other undisturbed areas of cover provides for insignificant mitigable and positive impacts for habitat.

- For woodland caribou, harvesting of mature forest reduces the potential for the area to support this species. When late successional mature stands are harvested within these areas the resulting fragmentation can lead to significant effects for woodland caribou (Benoit 1996; Palidwor and Schindler 1995; Cumming 1992; Shoesmith and Storey 1977). Retention of contiguous areas of late successional stands with good lichen cover, including upland forest and treed peat lands, will assist in mitigation of requirements within each herd's range (Cross and Smith 1995). Manitoba's Forest Plan (KPMG 1996), suggests an approach of logging in these areas in a concentrated fashion in given areas while retaining other adjacent areas undisturbed. This will assist in maintaining old growth habitat in the short term while also creating the appropriate conditions for growth of large new blocks of habitat in the future. Areas of traditional use, such as winter habitat and summer calving areas, are of particular importance to these animals and should be retained. The FSP management objective for species at risk (Section 5.2.1.1.3) identifies strategies for the Owl Lake, Atiko and Bloodvein caribou herds. The Owl Lake herd management strategy (MBMF 1995 and 2005) requires the maintenance of 2/3 of the high HSI values, in large contiguous blocks, for the winter range management area. The MC base case wood supply analysis (FSP Section 4.1) incorporated the Owl Lake caribou habitat constraint and Tembec modeled the spatial distribution of large blocks of high habitat (Section 4.3).

- For furbearers, harvesting designs to incorporate retention of variable width buffers in riparian zones is of particular importance in mitigating potential significant impacts. Adherence to the MC riparian area guideline (MC 2008) will mitigate potential significant impacts.

- For bats, identification of cave hibernacula through PHA, with follow-up design to avoid identified cave sites will mitigate potential significant impacts.

- For Raptors, identification of nesting locations through PHA for incorporation into harvest design, along with general application of variable width buffers in riparian areas will mitigate potential significant impacts.

- For Neotropical Migrant Birds (NTMB), concerns of potential fragmentation of forested habitat lead to potential significant impacts for these species. Terborgh (1989, *in* W.R.C.S, 1996) reports that impacts include among others, habitat loss and fragmentation and nest parasitism by cowbirds accelerated by forest fragmentation. These impacts caused by the removal of forests are reported to contribute to the declining population of some of these species. Planning approaches to approximate natural disturbance regimes, and differences between the forested landbase as a result of harvesting and subsequent renewal versus permanent change in forest status from clearing for agriculture and other uses, provide mitigation for NTMBs. Indicator 2.1.3.3 of the LLI framework reports upon the status of the forested landbase of FML 01 on an on-going basis, providing a related method for following up in this regard by Tembec. This combines with Indicator 3.1.4.2, which relates to the amount of area in each watershed in a disturbed state, to assist in monitoring and adapting harvest and renewal locations and designs to mitigate these concerns. FSP Section 5.7.2.2

identifies avian species of conservation concern on FML 01 and addresses the eighteen recommendations arising from the MBMF breeding bird survey (MBMF 1997B) which further mitigates concerns regarding NTMB.

- The report by Wildlife Resource Consulting Services (MBMF 1997B) continues with a regional perspective that cutover areas may have a positive effect on avian communities in regions dominated by continuous forest cover. They report that sufficient area of suitable forest habitat would still exist in forest development areas and the creation of new (cutover) habitat would serve to increase the local abundance of forest edge and field species since this habitat may be unavailable over extensive forest regions.

- For resident and water birds, concerns relate to harvesting in proximity to riparian habitats, mitigated through application of variable width buffers (MC 2008) to riparian areas in harvest design.

- Management of disturbance levels, including harvesting, at the watershed scale will assist in maintaining stable habitat levels at this scale to maintain sustainable local breeding populations. This will facilitate dispersal back to young forested areas as they develop and also provide corridors for animals to move between adjacent watersheds. As part of the LLI framework, Indicator 3.1.4.2 provides on-going measurement of harvest levels at the watershed level with a target of no greater than 30% of each watershed to be in a disturbed state at any time. FSP management objectives to maintain 20 % of the FML in large contiguous core areas and to maintain old forest targets (FSP Section 5.2.1.1.1) also assist in maintaining stable habitat levels.

- To meet wildlife and other management objectives, various harvest designs including cut and leave patterns and larger cutblocks with corresponding larger leave areas are utilized in FML 01 and are described in WDS – 010. This variation in size and shape of cutblocks across the landscape along with the FSP management objectives to maintain 20 % of the FML in large contiguous core areas and to maintain old forest targets (FSP Section 5.2.1.1.1) will assist in duplicating the mosaic created by natural disturbances.

Sustainability modeling and analysis can be used to determine the level of habitat values across the landscape included in the analysis. In addition, these tools have been incorporated into the timber supply modeling system to incorporate these values in determination of the sustainable harvest level for FML 01. The modeling process can result in significant impacts to wildlife species habitats based upon implementation of timber harvest levels determined as sustainable from the modeling. These impacts relate not only to the wildlife species for which each model has been developed, but also to species utilizing similar habitat features.

The basic premise is that the abundance of different species of wildlife is related to the habitat availability and, by modeling changes in habitats, we can indirectly model changes in wildlife abundance. There is considerable discussion amongst wildlife experts as to reliability of such modeling and the relationship of habitat availability as an indicator of species abundance. However, HSI models are useful tools for using key habitat requirements to estimate the

projected relative abundance of species. A panel of provincial experts forming the Manitoba Forestry/Wildlife Management Project (MFWMP) has undertaken a screening exercise to choose species for developing HSI models and have developed nineteen models for a variety of representative species in Manitoba (Kuhnke and Watkins, 1999). Six of these models (woodland caribou, moose, pileated woodpecker, marten, magnolia warbler and ruby crowned kinglet) have been used for consideration in sustainability modeling.

- Results of the habitat modeling are derived based upon features of the established current forest inventory as they relate to habitat. These inputs to the modeling determine to a great extent, the calculated sustainable timber harvest level, and thus, can lead to significant impacts on future wildlife habitat levels and patterns dependent upon their suitability for representation of habitat value. Mitigation during the modeling process occurs through:

    - Use of the best available data in developing predictions of habitat value for application in the model. Use was made of established model parameters as developed under the direction of the Manitoba Forestry Wildlife Management Project (MFWMP).

    - The habitat models applied for incorporation with the Mc base case wood supply modeling provide representation for a variety of other wildlife species utilizing similar habitat conditions.

    - The habitat supply models have been utilized in similar applications for analysis in Manitoba . The sustainability modeling undertaken for FML 01 builds upon previous experience gained in previous modeling work elsewhere in Manitoba.

    - FSP management objective for wildlife habitat (Section 5.2.1.1.1) and the FML 01 forecast modeling process (FSP Section 4.3.1) incorporated modeling constraints in order to maintain determined HIS levels at a minimum of 90 5 of the current values over the 200 year modeling process.

    - Re-curing analysis of the sustainable harvest level, incorporating HSI modeling, is undertaken every 20 years in association with the preparation of the FSP. Intermediate analysis will also be undertaken should major fire events result in a substantial change to the forest composition and age class structure from that which had been forecasted from the previous FSP modeling work. This adaptive management approach to determination of the sustainable harvest level allows for incorporation of improved forest succession and growth and yield data as time moves forward and future FSPs and associated modeling work is undertaken.

    - Sustainability modeling provides positive impacts to planning processes in forest management. This enables planning staff to undertake analysis to include a number of wildlife habitat values and other non-timber factors that would be difficult to incorporate in more traditional approaches and to run a series of analysis inputting a variety of different constraints and objectives to achieve a suitable alternative. For the FSP modeling work inputs and resulting outputs for consideration, in addition to HSI models and values, included:

  - Netting down of the available landbase to incorporate consideration of buffers providing reflection of non-timber values (FSP Section 4.1)
  - Establishment of old forest targets and large contiguous core areas (FSP 5.2.1.1.1) and retention targets for harvest areas (FSP 5.2.1.1.2)

- In addition to the positive impact of the habitat modeling process, in terms of incorporation of these habitat factors into the determination of the sustainable timber harvest supply, the modeling also introduces potential insignificant to significant and mitigable impacts for management of these species in conjunction with forest management. As described earlier, these models do include limitations in terms of a lack of consideration of the spatial arrangement of the habitat accounted for in each species model. In addition, the HSI models do not have a capacity to account for the influence of roads, in terms of public use and hunting pressure, on the species themselves. In terms of spatial arrangement, this factor may be more significant for woodland caribou than for the other modeled species, due to this animal's relatively wider range of movement and corresponding habitat needs (Johnson, 1993). In addition to the use of these habitat models mitigation is provided in terms of spatial arrangement in the application of planning location and design of roads and cutblocks to accommodate wildlife requirements in conjunction with other non-timber needs. Direction in this regard is provided in WDS – 010, WDS – WI - 003 and the MC *Forest Management Guidelines for Wildlife in Manitoba* (MNR 1984). The influence of roads is more an issue of population management in terms of public use and related hunting pressure than of habitat and is mitigated through the application of access management planning and implementation, as described later.

  - The modeling results, incorporating HSI models and outputs, developed by MC as described in Section 4.1 of the FSP, indicate the sustainable harvest levels available for FML 01 for the upcoming 200 year period. Tembec's spatial analysis and incorporation of management objectives, described in Section 4.3 of the FSP, resulted in a sustainable harvest level below that determined by MC. The Tembec results were then utilized as the maximum harvest level in the preparation of the harvest plan for the FSP.

  - The Tembec modeling process (FSP Section 4.3) addressed the non spatial assessment of HSI values, specifically for woodland caribou, by forecasting harvest areas over a 60 year period to ensure the maintenance of large contiguous areas of high habitat values.

  - On-going use of these HSI models by Tembec will provide a monitoring function and the capacity for adaptive management of sustainable harvest levels as required to maintain species diversity in terms of wildlife habitat levels for FML 01. This work is incorporated within the LLI framework (Indicator 1.2.2.1) of Tembec for the wildlife species utilized in the sustainability analysis to represent various wildlife species habitat requirements. In addition, the habitat units for winter range for the Owl Lake Woodland Caribou herd will be specifically monitored as part of the LLI (Indicator 1.1.3.1) in conjunction with the follow-up work on this project.

Information collection and application activities can impact species diversity to varying degrees as indicated in Table 2 related to the influence of forest management activities on their habitat. Information collected through various forest inventory, population inventories, PHA assessment and monitoring processes provides the basis for decision making from the stand level (e.g. mitigation for cutblock design) to the landscape level (e.g. sustainable harvest levels). Processes must be in place to collect relevant information and to process and apply it to decisions.

- Information collection and application is noted as an insignificant mitigable impact for those species whose habitats are most directly influenced by forest management activities including moose, deer, bats and raptors. A more significant mitigable impact of this process is noted for the woodland caribou due to its rating as threatened by MESA and SARA.

- The Manitoba Forest Inventory provides full coverage of FML 01 with basic timber related data necessary for strategic level planning, including sustainability analysis for determination of sustainable harvest levels. Certain aspects of this information has been built into the HSI models as input parameters in order to capitalize upon a readily available database that covers the forested area of Manitoba. Available to Tembec, this database was utilized in the determination of sustainability for the FSP, including wildlife habitat parameters. As described earlier, the FLITAC has recommended improvements to the inventory that have been implemented by MC, which along with updated woodland caribou habitat use patterns, allowed the EMWCAC to update the woodland caribou HIS model (Schindler 2006). Such improvements are important in the context of adaptive management and will provide improvements for application to sustainability modeling overall.

- Population inventories, providing some direct measurement of the successful implementation of wildlife habitat management, in addition to measures such as hunting success, are the responsibility of MC in their role as the managers of the wildlife resource.

- Tembec has implemented a PHA program as outlined in WDS – 002 to provide operational level information at the operating block and cutblock level. This program provides important information for application to non-timber and timber values, supplementing the information available from the Manitoba Forest Inventory, other provincial information sources, the Manitoba FEC and joint planning and other public participation processes. In terms of wildlife species diversity the PHA program assists in identification of such components as critical wildlife habitat features (e.g. raptors nests, heron rookeries, mineral licks) and other sensitive sites. Identification of such components provides a positive impact enabling the planning staff to incorporate such values into the design of cutblocks and follow-up renewal strategies.

Access management of the public use of forest access roads is generally considered to be one of the most significant potential impacts of forest management activities upon terrestrial wildlife. Impacts in terms of roads as they affect wildlife are related strongly to the improved

public access made available to newly accessed portions of FML 01. This road infrastructure generally eases the level of effort required for access by hunters. Access management programs are important to establish at the planning stage of access development. Public use and access management relates most particularly to those wildlife species having importance for hunting and trapping activities.

- For big game ungulates, significant impacts can occur due to public use and ease of effort for hunting leading to positive benefits of access management programs for mitigation. Unregulated hunting of woodland caribou and increased hunting of moose and white-tailed deer can have a significant impact when roads are constructed into new areas. Moose hunting occurs to a large extent from road networks (Boer 1990). Development of new roads into areas currently populated by moose, elk and deer or with the potential to support viable populations of these species in response to the disturbance caused by logging, can be expected to have a detrimental effect without mitigation through access management. As pointed out in *Manitoba's Forest Plan* (MFP) (KPMG 1996), access restrictions should be implemented where harvesting takes place in areas important to woodland caribou. Mitigation tools to deal with these concerns in the form of road access control integrated with the access development plan for each road has been identified in the MC *Forestry Road Management* guidebook (MC 2005B) and WDS – 009. Road retirement of many dry-weather roads has been successfully undertaken by Tembec over the past fifteen years.

- For furbearers significant impacts can occur due to public use and ease of access for trappers to new operating areas. It must be noted that it is not generally a case of entirely new access being created to these areas, as most would previously be accessed using snowmobiles, all-terrain vehicles and boats, but rather a case of improved access. This ease of effort can allow for more efficient trapping operations, with related impacts upon furbearer populations. Marten and fisher inhabit mature, conifer-dominated forest and are both highly susceptible to pressure from trapping (Racey and Hessey, 1989). Mitigation of this impact will be provided through MC regulation of trapping seasons and, where applicable, quotas on the number of animals that can be taken. Access control options exercised in cooperation with MC through the implementation of a Road Development and Access Management Plan (RDAMP) as described in the MC *Forestry Road Management* guidebook (MC 2005B) and WDS - 009 can also be utilized as a mitigation tool to assist in this regard.

- For game birds and water birds insignificant impacts can occur due to public access and ease of access for hunters to new operating areas. Taken in the context of the overall landscape this impact is insignificant. Hunting regulations and quotas enforced by MC provide mitigation to manage the impact of increased access upon these bird populations.

- For access management programs and the related tools available to implement them (e.g. gates and other access control, road closures and road decommissioning), to work most effectively, it is important that the access management program for a new access road network be a part of the planning for the road prior to construction. It is a more difficult process to put access management programs into place after the road has been built and a

pattern of use by the public has become established. Processes established by Tembec to accomplish this include joint planning and other public participation forums with resource user stakeholders, and discussions with MC through the IRMT, with the intent of developing access management programs for each road prior to construction and use. These processes, incorporated within the MC *Forestry Road Management* guidebook (MC 2005B) and WDS – 009, provide important mitigation in contributing, along with MC regulation of hunting and trapping activities, to the management of wildlife populations potentially impacted by public use of road development.

Given the approaches relative to LLI indicators and targets for road densities (Indicator 1.1.3.3) and planning to operate within the natural range of variability of disturbances and renewal, the impacts associated with planning activities are mitigable, and in general, provide positive mitigation for operations at the landscape level. Modeling approaches to incorporate HSI assessment within the determination of sustainable harvest levels and to follow-up and monitor habitat levels in the long term provides positive SFM direction in this regard. The role of access management is of particular importance as a planning tool to mitigate potential impacts upon wildlife species resulting from ease of public access.

Infrastructure Development

Infrastructure development includes the alteration of forested cover, and thus related wildlife habitat, through temporary or permanent removal of vegetation at the site level to provide a location for placement/construction of roads and landings, watercourse crossings, camps, timber storage sites and fuel storage sites. The magnitude, extent and duration of impacts upon wildlife habitat and related species diversity are related to the extent to which infrastructure developments may infringe upon critical habitats, and to a lessor extent, through the fragmentation of forest cover.

All-weather and dry-weather road construction will lead to insignificant mitigable impacts upon wildlife habitats, generally at the site level due to the requirement to remove the overlying vegetation from route corridors to be developed as roads; however, impacts to woodland caribou are considered significant mitigable.

- For moose and white-tailed deer construction of all-weather and dry-weather roads can have some site-specific impacts related to such sites as mineral licks occurring within the road route. Identification during PHA (WDS – 002) and incorporation of such values into the route selection provides mitigation.

- For woodland caribou, there is conflicting evidence that the construction of all-weather and dry-weather roads may or may not act as barriers to movement for animals. Godwin (1990) indicates that woodland caribou may avoid crossing roads to avoid wolves using the roads for access. Other evidence, more local to Manitoba, Benoit (1996) and Johnson (1993) suggest that animals will cross these roads and are seen to travel along the road corridors at times. Schindler (2006B) determined that woodland caribou indicated avoidance of Happy Lake Road at approximately two kilometers and resumed maximum use of habitat at nine kilometers from the road. Given the most recent assessment

conducted on the FML, the impact of construction of all-weather roads is considered to be significant mitigable. The use of access management controls, as directed by MC and as described in the *Road Development and Access Management for Happy Lake* plan and the eventual decommissioning of all-weather and dry-weather roads, once operating areas have been completed, provides mitigation.

- Construction of all-weather and dry-weather roads will have a small impact at the site level on furbearers and rodents in terms of the loss of habitat that will occur where new roads are built. As described in WDS – 009 and 010, route planning will generally avoid riparian areas to the extent possible, other than for the purpose of crossing watercourses. This will assist in mitigating potential impacts upon furbearer species such as beaver and otter that utilize these areas for habitat. The wolverine is a furbearer species that appears to prefer remote habitats and, as such, the development of roads may detract from the use of otherwise suitable habitat by this species. In a spatial context this impact, and those to other furbearers, is mitigable in that these roads will occupy only a very small percentage of habitat available to these animals. As described in WDS – 006, 009 and WDS – WI – 023, road right-of-ways are kept to the minimum required for safe use of the road and drying of the roadbed and a management objective in the FSP (Section 5.2.1.3.2.) restricting road development by watershed area, and monitored in LLI Indicator 1.1.3.3, provides mitigation.

- For bats, the construction of all-weather and dry-weather roads can have an impact in the vicinity of cave hibernacula. Mitigation occurs through the application of PHAs for assessment of such areas prior to planning and development (WDS – 002), and in the landscape context, the low percentage of roads relative to available habitat locations.

- For raptors, the impacts of road construction are limited to those occurrences where roads are constructed in close proximity to nests of species such as the bald eagle, which are sensitive to disturbance. These birds generally nest close to water which places them within areas that are usually buffered as per the MC guidelines for riparian areas (MC 2008) and WDS - 010. In addition, PHA conducted prior to road development allows for alignment of the road route to avoid active raptor nests (WDS – 002). These actions in addition to the site-specific nature of the potential impacts make these impacts insignificant and mitigable.

- For NTMBs, road ROW clearing for all-weather roads resulting in fragmentation of forest habitats relate to the potential for reducing the biodiversity of species which require large uninterrupted tracts of forest such as the broad-winged hawk or for the potential by cowbirds which parasitize many NTMBs nests (Brittingham and Temple, 1983 *in* Wildlife Resource Consulting Services, 1996). Except for the southern edge of FML 01, most of the region is not in close proximity to agricultural areas where cowbirds are common and such forest fragmentation poses a greater concern. The FSP addresses the recommendations made by Wildlife Resource Consulting Services (MBMF 1997B) in Section 5.7.2.2.

- For water birds, impacts due to construction of roads relate to the potential impacts upon water levels in wetland areas thus affecting birds nesting in these areas. Construction of roads has the potential to impede drainage if proper measures are not taken. Implementation of practices as outlined in WDS – WI – 025 and 036 will effectively mitigate these concerns.

Camp development results in the occupation of the site by workers and equipment, with resultant activity in the vicinity on a localized basis.

- These effects, which relate in particular to species such as woodland caribou and furbearers such as wolverine, are considered to be insignificant given the limited spatial extent of these activities have on the landscape and the relative short duration during which any given area is impacted.

- PHA, joint planning and discussion with the IRMTs at the planning stage assist in mitigation through location of camps away from critical wildlife habitat areas for woodland caribou and other species.

- Follow-up mitigation includes the decommissioning of each camp site (WDS-013), ending of such activity in the area, and natural revegetation with application of forest renewal measures for such areas contained within or directly adjacent to cutblocks

For the most part, impacts of infrastructure development as they relate to wildlife habitat, occur at the site level. This localized extent, in conjunction with mitigation measures for planning and development of infrastructure, are such that these activities are not expected to significantly impact the wildlife species diversity of FML 01. The temporary duration, with follow-up decommissioning (WDS – WI – 035, 036, 037 and 039), of designated all-weather roads, which are utilized to the minimum level required (WDS – 006), further mitigate effects upon habitat, particularly when viewed in a landscape context. Planning activities, including joint planning and discussion with IRMTs, provide up-front direction in these regards by ensuring that infrastructure is minimized in extent and duration to the standard required to undertake forest management activities for the area being developed and that critical habitat is incorporated.

Harvesting

Harvesting operations will result in altering of the vegetation, and thus wildlife habitat conditions of areas harvested by this anthropogenic disturbance. The manner in which these activities take place, relative to the natural stand level disturbance mechanisms and landscape level patterns, have implications for wildlife habitat at the site and landscape levels. The nature and degree of impacts are determined relative to those arising from natural disturbance mechanisms including fire, insects and disease.

Logging, in the context of VRL practices, necessarily results in the removal of all merchantable trees, other than those intended for retention as corridors, buffers and wildlife

trees, from the defined cutblock area. In extracting the timber resource, logging activities can result in impacts upon the various components of wildlife habitat at the stand level.

- For moose, and white-tailed deer in southern areas, harvesting of timber will generally have a positive effect in terms of habitat impact. Improved browse opportunity created in response to the disturbance caused by logging can continue for 20 years in an area (Allen *et al*. 1987; Palidwor *et al.* 1995). White-tailed deer are not typically a species of the boreal forest, but the development of roads and harvested cutblocks provides new habitats and when there are relatively mild winters as has been experienced recently, their numbers and distribution are expected to continue to expand, particularly in the south. In addition to the development of browse, the spatial arrangement of areas of food and cover are important. In this regard the approach of developing harvest areas to approximate natural disturbance patterns, including cutblock boundaries following natural stand boundaries to the extent possible, assists in providing mitigation. As described earlier under planning, woodland caribou habitat includes requirements for mature forest in conjunction with other habitats. On-going research work undertaken on the Owl Lake herd by the EMWCAC of the Manitoba Model Forest, of which Tembec is a member, in terms of harvest designs and animal use following logging, provides a basis for continued application by Tembec in other areas of FML 01 for which woodland caribou habitat requirements are highlighted as critical. The Owl Lake management strategy (MBMF 2005), developed by the EMWCAC, recommended among other considerations, that harvesting be permitted within documented winter range provided that 66% of the high quality winter habitat be maintained at all times. The Atiko and Bloodvein caribou herds, located in the northern portion of the FML, are the subject of a management strategy currently under development by the EMWCAC. Adherence to the caribou management strategies completed and under development (FSP Section 5.2.1.1.3), the incorporation of the woodland caribou HSI model to reflect landscape habitat values in determining sustainable harvest levels (FSP Section 4.1)**,** the spatial modeling of large, contiguous high habitat areas (FSP Section 4.3), and the establishment of protected areas and areas closed to commercial timber harvesting in Nopiming Provincial Park, which contains important calving areas, the impacts of logging upon the woodland caribou are mitigable.

- For other mammals, the impacts of logging will vary from insignificant to significant and in some cases are positive, dependent upon the habitats utilized by the various species. Harvesting of mature forest, resulting in regeneration to a younger seral stage, can benefit those species orientated to these areas for food requirements as well as those oriented to forest edges. Species orientated to forest interiors will generally be negatively impacted at a site level with the removal of the tree cover. The size of range utilized by each species is also a factor in determining potential impacts of harvesting upon small mammals. Species that range across a watershed, such as wolf and wolverine, utilize areas far beyond those impacted by individual cutblocks. Species such as marten, with a smaller sub-watershed level range, are expected to be affected, as their ranges intersect areas impacted by one or more cutblocks. Site level furbearers such as beaver and red squirrels, as well as rodents, occupy ranges that are small enough to be contained within the extent of individual cutblocks and the impact of harvesting is immediate. The impacts of harvesting upon small mammals and rodents are mitigable through the application of forest management

practices as outlined in WDS – WI – 003, 004, 005, 006, 007, 008 and 048. Cut and leave design to include leave areas that provide sufficient mature habitat (e.g. winter habitat for marten), retention of wildlife trees and residual vegetation to maintain a level of stand structure and the implementation of riparian buffers will assist in mitigation of harvesting activities. MC regulation of trapping seasons and quotas is also an important component of mitigation for overall management of these populations.

- For raptors, logging activities have potential for insignificant to significant impacts, dependent upon the species, as a result of the harvest of existing and potential nesting trees. The practices described in WDS – 002 and WDS – WI - 004 provide for mitigation to deal with these concerns. Planning and PHA will allow for buffering of identified nests. The Consolidated Buffer Guidelines (MNR 2006) prescribes a 200 meter buffer for eagle and osprey nests during nesting season and a Terrestrial buffer guideline under development by the FPC prescribes a buffers of 100 meters to maintain nest integrity and 200 meters where operations are occurring during the nesting season**.** Establishment of wildlife trees as single trees and clumps will provide future nesting trees as the surrounding forest re-grows. As described by Kimmins (1992), the essential concept behind the implementation of wildlife trees is to provide as many of the, "old-growth structures", as possible in the newly established forests. For some species such as the red-tailed hawk and kestrel, hunting opportunity is increased after logging, resulting in a positive impact due to harvesting activities.

- For NTMBs, logging will have a significant impact upon the habitat at the site-specific level. Harvesting with subsequent forest renewal changes the affected area to an early stage of succession, which can have positive or negative implications depending upon the species. The combination of the different species of NTMBs utilize all forest age classes with importance of any given age class varying by species (Thompson and Welsh *et al.* 1993). Mature undisturbed habitats are thought to provide more specialized habitat requirements of many rare species (Noon *et al.* 1979; Webb *et al.* 1977). Recognizing the change to stand structure that occurs once harvesting takes place, it is also reasonable to note the similar impact forest fire disturbance has on these habitats. A principal difference that can occur without appropriate management is that, in general, more dead trees will be left standing following a fire than after harvesting. This impact upon stand structure can be mitigated within cutblocks, as prescribed in WDS – WI – 004, 005, 006, 007 and 048, through the application of VRL for maintenance of wildlife trees and other residual vegetation throughout the cutovers. Tembec has developed the FSP management objective (Section 5.2.1.1.2) to further advance progress in implementation of VRL techniques including implementation of Target 1.1.3.4 of the LLI framework to achieve retention of 5% merchantable standing alive and dead representative trees post-harvest. As further described in the FSP management objectives (Section 5.2.1) , strategies for the maintenance of old forests, core forest targets, wildlife habitat targets, and road construction targets are utilized in FML 01 to meet various wildlife and other management objectives. This variation in size and shape of cutblocks across the landscape will assist in matching the mosaic created by natural disturbances. At the landscape level, suppression of forest fire disturbance will assist in balancing the rate of turnover of mature stands to younger stages of succession as described earlier in the discussion of ecological diversity.

Recommendations made by Wildlife Resource Consulting Services (MBMF 1997B) for the conservation of boreal bird species have been addressed in Section 5.7.2.2 of the FSP to address site and landscape level impacts to NTMB's. While there is potential for significant impact upon NTMBs at the site level, the mitigation steps described, in combination with landscape considerations, can mitigate this impact. The use of sustainability analysis and regulation of harvest levels within these sustainable levels results in a relatively small proportion of the forest being impacted by harvesting at any time. Provided that sufficient habitat is available through time, the landscape impact upon population levels can be mitigated.

- For game birds, logging will have impacts that are both negative and positive. Modifications to habitat for spruce grouse will have site specific impacts in harvesting of softwood, however, there will also be positive effects caused by creation of edge effect surrounding the created openings. Species such as ruffed grouse and sharp-tailed grouse will benefit from improvements to their habitat caused by harvesting and subsequent renewal of the forest to younger stages of succession. Maintaining understory vegetation as outlined in WDS – WI – 006 will assist mitigation for these species. Logging debris, particularly fallen logs, will be beneficial, providing drumming logs for ruffed grouse. Given the positive effects and site specific mitigation available, the impacts of logging activities upon game birds is considered to be insignificant in a landscape context.

- For resident and water birds, the impacts of logging activities will vary dependent upon the habitat requirements of each species. Those such as the pileated woodpecker that requires large trees associated with mature stands for nesting will be most affected. At the site-specific level, mitigation can be achieved through leaving of wildlife trees in clumps and as single trees, both green and snags, of sufficient size for nesting. This can be complemented through harvest design which incorporates cut and leave blocks of varying size across the landscape, VRL practices, retention of hardwood species, maintenance of riparian buffers and use of corridors to link habitats in the area. The implementation of these practices as outlined in WDS – 010 and WDS-WI-004, 005, 006, 007 and 048 and the FSP (Sections 5.7.2.2) in addressing the recommendations for the conservation of boreal birds resulting from the MBMF bird monitoring study (MBMF 1997B). Considering the availability of habitat across the landscape the impacts are significant but mitigable. For the great blue heron the potential impact is of a very site specific nature related to the location of nesting rookeries. PHA for identification of these features is followed with the establishment of buffers and restriction of operations in the vicinity during the nesting season, as outlined in the MC C*onsolidated Buffer Management Guidelines* (MNR 1996). For water birds the general protection afforded to riparian areas as outlined in the MC *Forest Management Guidelines for Riparian Areas* (MC 2008) will provide protection for these species.

Woody debris management actions can have an insignificant impact upon forest stand structure in terms of the elements of woody debris retained across harvested areas relative to those left by natural disturbances. Standing snags, fallen logs and pieces of woody material form a component of stand structure, particularly as it relates to use by some wildlife species,

including small vertebrates, in particular, rodents, small carnivores likes weasels and a number of bird species which nest low to the ground.

- VRL practices to incorporate retention of snags and other wildlife trees (WDS – WI – 004, 005 and 048) provide mitigation to retain these elements following logging operations.

- Retention of limbing and topping woody debris at the stump area provides processes to ensure distribution of logging debris across cutover areas (WDS – WI – 012).

- There is also an added positive impact from maintaining this debris on the site, in the slow nutrient release from its decay and the provision of organic matter for fungi to grow upon. Fungi are an important food source for many species of wildlife.

Use of VRL practices by Tembec in harvesting operations in combination with harvest planning designs utilizing natural boundaries, maintenance of large contiguous core areas and road decommissioning following the completion of operating areas will assist the Company in mitigating effects of harvesting on wildlife habitat and thus wildlife species diversity. These practices, including retention of wildlife trees and understory vegetation, protection of ephemeral streams and riparian zones and design of cutblocks to incorporate critical identified wildlife habitats will provide necessary elements for wildlife species.

As noted in the examination of ecosystem diversity, the extent of harvesting activities across FML 01 as compared to the disturbance that occurs as a result of forest fire is relatively insignificant. The on-going effect of fire and its role in the ecosystem of the forests of FML 01 provides further mitigation of the impacts of harvesting through the continuing natural disturbance and renewal processes that occur on these areas and the continued effect that these processes have on wildlife habitat cycle.

Forest Renewal

Forest renewal operations for harvested forest stands are undertaken to complement natural renewal processes in regenerating forest covertypes harvested for timber. The manner in which these activities impact negatively or positively upon wildlife habitat values have implications for wildlife species diversity. The nature and degree of impacts are determined relative to those arising from natural renewal mechanisms, particularly fire.

Site preparation and scarification activities, while positive in terms of assistance to regeneration of trees, can have some insignificant implications for understory vegetation that has been retained through the logging operations on the cutblock.

- For areas prescribed by MC for woodland caribou management, the rapid reforestation of harvest areas to softwood species, as prescribed by the EMWCAC, in combination with vegetation control to discourage the establishment of browse species favoured by moose and white tailed deer, will provide for the establishment of young successional forests that will produce suitable woodland caribou habitat in the future. By discouraging the regeneration of ungulate browse species, the use of the regenerating areas by moose and

deer will be reduced which in turn will reduce the movement of wolves into the area, as increased wolf densities would increase their preying on woodland caribou. This requirement matches well with the forest renewal objective of Tembec, which is to reforest each harvested site to a forest similar to that, which existed prior to harvest. This objective is articulated in the silvicultural prescriptions, contained in Section 5.14.3 of the FSP, along with the techniques to be implemented to achieve it (WDS-014, WDS – WI – 027, 28, 029, 031, 033 and 039).

- Site preparation and scarification activities will have an insignificant impact at the site level on small furbearers and rodents including red squirrel and weasels that utilize fallen logs and other debris in searching for food and providing shelter. Minimizing disturbance to understory vegetation and maintaining wildlife trees during site preparation activities as outlined in the work instructions (WDS – WI – 004 and 007) will mitigate these effects at a site level. On a landscape level the impacts are insignificant. Forest renewal activities result in a diversity of trees, shrubs and other vegetation becoming established on the site that assists in providing cover and food.

Tree establishment activities generally provide positive benefits at both the stand and landscape level in following up on site preparation activities to renew each site. Accelerated establishment and early growth of trees will generally provide a positive benefit in terms of wildlife habitat; particularly for species requiring softwood forests for cover and associated habitat needs.

- For woodland caribou and for furbearer species such as martin, tree establishment follows up on site preparation and scarification forest renewal activities in providing a positive impact upon the habitat in that these activities promote a quicker recovery of each site to the various stages of forest succession including the softwood component of the forest.

Mechanical and chemical stand tending activities undertaken to influence stand development and growth can be considered relative to natural stand dynamics, and related wildlife habitat conditions, that take place in boreal forest stands following fire and other disturbances.

- Chemical stand tending activities assists in the renewal of each site back to a similar forest, with a positive impact on the provision of ungulate habitat. This is particularly the case for woodland caribou for which the recovery of harvested areas back to softwood dominated forest types is important. For moose, there is a localized short-term reduction of available browse on sites treated with chemicals for control of deciduous shrubs and hardwood tree species; however, the herbicide application procedures (WDS-014) prescribed have reduced efficacy on some shrub species such as red osier dogwood and willow which are preferred by moose and deer over species such as trembling aspen so browse species are not eliminated. Where a variety of such regenerating sites at various stages of succession are combined with adjacent leave areas providing escape and thermal cover, a more rapid total utilization of the entire area by moose can be achieved. Site specific design of the chemical application area to incorporate buffers and leave areas exempt from application and the preference for the use of chemical ground site

preparation techniques (FSP Section 5.14.3, 5.14.4 and 5.15), which maintain browse species on treated sites will favour use of the harvest areas by moose. Therefore, the effects of chemical stand tending are insignificant and mitigable.

- Chemical stand tending will have an insignificant impact on small mammal habitat in terms of the short-term affect on herbaceous vegetation, which will occur on a site-specific level. This impact is of relatively short duration, is insignificant in a landscape context, and is further mitigated through practices related to spray area design (leave areas, etc.) and application procedures (WDS – 014 and FSP Section 5.14.3, 5.14.4 and 5.15).

- For NTMBs, stand tending activities may have a site-specific impact in terms of the short-term effect these activities have upon the vegetation composition particularly in terms of the shrub component of the regenerating site. As indicated earlier, the *Forest Management Guidelines for Riparian Areas* (MC 2008) outline mitigation practices to incorporate buffers and VRL practices combined with the retention of other values within harvest areas and the maintenance of undisturbed areas adjacent to harvest areas maintains a variety of habitat conditions for wildlife where stand tending occurs (WDS-010, WDS-WI-004, 005, 006, 007 and 048). These mitigation practices and the limitation of tending activities to only specific regenerating areas, result in impacts that are insignificant at the landscape level. For some bird species that prefer softwood forest habitat, these tending activities have a positive impact in the long-term as they result in the more rapid development of mature softwood forests.

- For game birds, chemical stand tending activities may have a short-term impact caused by the removal of some food species. Given mitigation practices as described above and the limited area of application of this treatment across FML 01, this impact is insignificant at the landscape level.

As with harvesting, the forest renewal methods employed by Tembec are typical of those used throughout the boreal forest in Canada and have been adapted to capitalize upon the adaptations to major disturbance (principally fire), utilized by boreal forest species in regeneration. Processes designed to approximate natural disturbance translate as well to the effects upon wildlife habitat conditions produced by the regenerating forest. As is the case for the forest vegetation, the wildlife species present in FML 01 are adapted to the changes and cycles of habitat conditions that occur in the boreal forest. As the approaches to forest renewal and the targets are within the natural range of conditions presented by natural disturbance, the impacts of forest renewal are mitigable and generally positive.

Forest Protection

Responsibility for forest protection lies with MC. Tembec cooperates in planning and modifying harvest operations as practical to minimize losses due to insect and disease infestations. The Company provides a Fire Protection Plan each year to assist MC by providing relevant information for the suppression of forest fires on FML 01. Additionally, the Company assists in suppression activities through initial attack activities in fighting fires that

break out in active operating areas. The degree to which Tembec has control over forest protection is thus limited to its co-operative role with MC.

- At the landscape level, suppression of forest fires will assist in balancing the rate of turnover of mature stands to younger stages of succession as described earlier in the description of impacts upon ecological diversity. Such measures, in combination with harvesting conducted at sustainable levels, can be expected to result in a generally stable level of forest composition and age class structure, and thereby, landscape habitat conditions and species diversity. In terms of wildlife habitat these activities do not result in any specific impacts. As described earlier, the wildlife species present in FML 01 are adapted to the changing and cycling of habitat conditions that occurs as a result of disturbance, including fire, insect and disease. The forest protection activities that are undertaken on FML 01 are directed towards protection of specific values, including human, communities, timber, recreation and other non-timber values. Beyond the results of protection activities, the role of insects, disease and particularly fire continue to dominate overall as agents of disturbance and change in the forest of FML 01. Given this factor, the effects of these forest protection activities do not result in any particular impacts upon wildlife habitat.

Equipment Use

Equipment use and associated activities can impact upon species diversity through the noise from operation of heavy equipment on the site resulting in disturbance to some species of wildlife.

In-block operations of equipment will result in generation of noise and general activity during operating hours on cutblocks.

- These impacts, which are very localized in magnitude and extent, and limited in duration and hours of operation for a given cutblock, can cause some disturbance to woodland caribou, should the locations be in proximity to areas that the animals traditionally move through. Such disturbance is considered to be insignificant and mitigable given the limited magnitude, extent and duration for any given area and the strategies in place and described earlier for undertaking planning and operations in areas inhabited by woodland caribou.

Equipment use will result in some level of noise and disturbance to animals, particularly woodland caribou in terms of traditional patterns of movement, in the immediate vicinity of operations. Such disturbance is mitigated through the overall incorporation of woodland caribou strategies in developing harvest locations and designs. In terms of general effects of these disturbances the limited magnitude, extent and duration of impact at any given location provides additional mitigation.

Special Concern, Threatened and Endangered Wildlife Species

Planning

Planning of forest management activities, including public participation, location and design of operating blocks and associated cutblocks and roads, collection and application of information for decision making and access management has implications for species diversity of wildlife in terms of STE wildlife species. Procedures for the identification of such values with subsequent incorporation in planning processes determine the nature and degree of impacts.

Special concern, threatened and endangered wildlife species present on FML 01 are described in Section 5.7 of the FSP. Species, which are listed by MESA and/or SARA, include woodland caribou, piping plover, monarch butterfly, red headed woodpecker and the rusty blackbird. Impacts of forest management activities as they relate to wildlife species have been described as applicable in the description of impacts for the various components of terrestrial species.

Impacts of forest operations as they relate to particular species included as STE in FML 01 have been described earlier within the general assessment of terrestrial wildlife. The description provided here will focus upon considerations for these species in terms of their STE status as it relates to planning processes.

Public participation processes such as joint planning and discussions with other resource users, in addition to on-going planning processes with MC, has a significant mitigable impact upon the planning and operating approaches utilized for STE species. It is particularly important that the status of these species, related factors and the interactions with forest management activities that could affect their status, be brought forward and discussed in these forums. An educational role by MC and the Company, with potential on-going input from the Manitoba CDC, will assist in providing other resource users and interested parties to understand potential interactions with these species and mitigation requirements.

Road and watercourse crossing and harvest and renewal planning for operations can result in significant impacts to STE species due to the potential alterations to habitats for the species that can result from implementation. These impacts and mitigative approaches have been described earlier in review of each wildlife species group.

In addition, the FSP identifies management strategies for STE species designated by MESA or SARA in Section 5.7.1 along with management objectives for woodland caribou and the carmine shiner in Section 5.2.1.1.3. Management strategies for other species of conservation concern that have been identified by sources other than MESA or SARA are contained in Section 5.7.2 of the FSP. This provides mitigation in planning for STE and other species of conservation concern, on the FML.

Sustainability modeling can have significant and positive impacts upon STE wildlife species for which models, suitable for application to FML 01, have been developed. In the case of the woodland caribou, sustainability modeling in Section 4.1 and 4.3 of the FSP has incorporated the use of HSI models, maintenance of habitat values and spatial modeling of habitat patches over time. Discussion of the impacts and mitigation associated with the use of this model has

been provided earlier in the review of forest management activities upon the woodland caribou.

Information collection and application processes and implementation can result in significant impacts with regard to future potential identification of STE wildlife species for FML 01 and the evolving status of those currently recognized. Tembec is committed to on-going follow-up of the STE status of wildlife species present in FML 01 as described in WDS - 007. Through on-going research initiatives such as the Owl Lake, Atiko and Bloodvein woodland caribou herds, the MBMF Eastern Manitoba Woodland Caribou Advisory Committee, research results can be reviewed for application to other woodland caribou herds across FML 01 and elsewhere in Manitoba.

Access management can have significant implications for the management of STE species due to the potential effect upon the population from improved public access. These impacts and mitigative approaches have been described earlier in review of each wildlife species group, in particular the woodland caribou.

3.3.3.3 Aquatic and Amphibian Wildlife Species Diversity

Aquatic Species, Amphibians and Reptiles

Planning

Planning of forest management activities, including public participation processes, planning of operations, information collection and application and most particularly, access management, has implications for species diversity of aquatic and amphibian wildlife as represented by the components described in Table 3. Effects of forest management activities upon aquatic habitats as compared to changes incurred through natural disturbance and renewal processes, and implications for aquatic species populations arising from public use of forest access roads and access management activities determine the nature and degree of impacts.

Public participation forums, including joint planning and forums with the general public and sportsman provide information and feedback to Tembec regarding approaches to the integration of aquatic species habitat considerations into planning for operations and application of access management options to specified road access routes and associated watercourse crossings throughout FML 01. Potential impacts of the public participation processes relate to the general interest in, and resource use of, the aquatic species, as well as the relative impact of forestry activities upon each group of aquatic species.

- In the case of aquatic species, particularly fish species utilized commercially and for sport, there is a vested interest by First Nations, commercial fishermen, sportsman, local residents and other interested parties in the sustainable management of populations.

- Public participation processes involving both Tembec and MC in discussions with public interests, is important for successful mitigation to occur. Tembec is in a good position to

work with First Nations through joint planning and other interested parties relevant to the role of forest management activities in affecting habitat conditions for aquatic species. In terms of management of populations, the role of MC as regulators and the organization with primary responsibility for wildlife management is important for population management. Access management is an area of mutual interest for all parties to jointly develop and promote for the benefit of aquatic species.

The involvement of First Nations, stakeholders and interested parties in forest management planning activities is determined to be insignificant and mitigable and will provide positive benefits through the education of those involved participants.

Road and watercourse crossing planning can have impacts related to site-specific location of routes adjacent to watercourses and other respective habitats and, in particular, the location and design of watercourse crossings. General route and road classification issues related to the permanence of road routes and seasons of use are also factors.

- The planning of road routes can have an impact on a site-specific basis should routes be chosen which come in close proximity to watercourses that contain fish and other aquatic species. These potential impacts, which are very localized in extent, are considered to be insignificant on a landscape scale and are mitigable through design of road routes to avoid such areas, incorporating information obtained from PHA of routes, as described in *Wildlife Guidelines for Forest Management in Manitoba* (MNR 1984) and WDS – 002.

- More direct in potential impact is the location and design of watercourse crossings to be utilized in road construction. The planning process itself contributes to the mitigation of potential impacts through the provision of information to MC and Manitoba Water Stewardship at an early stage in the form of Watercourse Crossing Data Forms, provided with each AORP. Information provided is described in WDS - 003, and allows for early discussion and mitigation planning to occur between MC and Tembec and input from the Department of Fisheries and Oceans Canada (DFO) as described in WDS-012. This information is followed up with final crossing design and development of any further required mitigation steps. The impact is considered significant mitigable based on the process and organizations involved.

- Location of roads in the vicinity of snake hibernacula will create a situation whereby snakes, moving onto the roads to warm themselves, can be killed by traffic. This impact is non-mitigable but very localized in extent and considered to be insignificant in a landscape context.

- Location of watercourse crossings can have a direct effect on water quality, flow levels and habitat for STE species such as the carmine shiner. Adherence to the *Recovery Strategy for the Carmine Shiner (Notorpis percobromis) in Canada* (Fisheries and Oceans Canada 2008) and the management objective in Section 5.2.1.1.3, in the FSP in consultation with Manitoba Water Stewardship and DFO, will mitigate the potentially significant impacts of planning watercourse crossings on STE species.

Harvest and renewal planning can have impacts related to site-specific concerns arising from harvesting in areas adjacent to aquatic habitats. The implications for aquatic species habitat resulting from the harvest and renewal process as compared to habitat changes that occur under natural disturbance regimes are important to consider.

- The planning of operating blocks and cutblocks, including their location and design in the vicinity of riparian areas is an essential consideration in incorporation of aquatic species values at the site and watershed scales. As described in the description of impacts related to ecological diversity, measures undertaken in application of VRL by Tembec (WDS – WI –006, 007 and 048 and *Forest Management Guidelines for Riparian Areas* (MC 2008), provide mitigation in terms of protection of aquatic habitats:

    - Understory vegetation retention, particularly adjacent to wetland areas and the protection of ephemeral streams assisting in stabilizing soils and reducing potential for erosion and sedimentation into watercourses in these areas.

    - Variable buffers for riparian areas assisting in stabilizing of soils and reducing potential for erosion and sedimentation into watercourses. These buffers can also assist in direct screening and water temperature control for relatively small watercourses.

- Management of disturbance levels, including harvesting, at the watershed scale (WDS – 010) will assist in maintaining levels of forest cover with associated effects upon watercourses contained within these watersheds in terms of erosion and siltation. As part of the LLI framework, Indicator 3.1.4.2 provides on-going measurement of harvest levels at the watershed level with a target of no greater than 30% of each watershed to be in a disturbed state at any time.

Information collection and application activities can impact species diversity to varying degrees as indicated in Table 3 related to the influence of forest management activities on their habitat. Information collected through various population inventories, PHA watercourse and riparian habitat features assessment and monitoring processes provides the basis for decision making from the site level (e.g. mitigation for watercourse design) to the landscape level (e.g. watershed harvest levels). Processes must be in place to collect relevant information and to process and apply it to decisions.

- Information collection and application is noted as a significant mitigable impact for fish whose habitat is most directly influenced by watercourse crossing location and design. An insignificant mitigable impact is noted for snakes related to the identification of hibernacula locations related to planned road locations.

- The Manitoba forest inventory and additional GIS coverages, maintained by Tembec, provides full coverage of FML 01 with related data necessary for evaluation of the level of disturbance at a watershed scale. Updating of this information by Tembec for harvest and renewal activities (WDS – 001) and by MC for natural depletion events will provide the basis for measuring and tracking this indicator in the LLI framework (Indicator 1.1.1.1.).

- Fish population inventories, providing some direct measurement of the successful implementation of aquatic habitat management, in addition to measures such as fishing success, are the responsibility of MC in their role as the managers of the fisheries and wildlife resources.

- Tembec has implemented a pre-crossing assessment of proposed watercourse crossings (WDS – 003) to provide operational level information at the site level in terms of evaluating potential crossing locations and developing mitigation for crossing design. This program provides important information for application to water quality and aquatic species values, supplementing the information available from the MC and other provincial information sources and joint planning and other public participation processes. In terms of aquatic species diversity the pre-crossing assessment assists in identification of such components as critical aquatic habitat features (e.g. spawning beds) other sensitive sites and other potential aquatic habitat mitigation values, such as streambank slope and soil conditions, water depth and velocity and adjacent riparian vegetation. Identification of such components provides a positive impact enabling the planning staff to incorporate such values into the design of crossings and follow-up construction and decommissioning strategies where applicable.

Access management of the public use of forest access roads is generally considered to be one of the most significant potential impacts of forest management activities upon aquatic species wildlife. Impacts in terms of roads as they affect aquatic species are related strongly to the improved public access made available to the lakes and streams in newly accessed portions of FML 01. This road infrastructure generally eases the level of effort required for access by fishermen. Access management programs are important to establish at the planning stage of access development to provide positive mitigation of these effects.

- Public use of access development can impact upon fish populations as a result of the increased ease of access provided by the road network. This impact can be significant, particularly in site-specific situations where permanent stream crossing access is created (Schultz 1973). Long term planning, such as that afforded through this FSP process, is important as a mitigative tool as this allows Tembec and MC to review access development plans jointly to consider potential impacts and mitigation where new access will be created to lakes and streams containing fish stocks. As described in WDS – 009, WDS – WI - 034 and *Forestry Road Management* guideline (MC 2005B), access control may be an option in some cases, particularly where no prior use of the access has occurred. Identifying the desire to decommission roads following harvest and forest renewal activities in road management plans (MC 2005B) also assists in limiting the duration of time lakes and rivers are exposed to fishing activities resulting form new access development. Further mitigation is available through MC establishment of fishing limits and management activities. Based on long-term planning of access development, and MC knowledge of fish populations, establishment of fishing limits on waterbodies to be newly accessed could be a very useful tool in mitigation of this impact. These mitigation activities in conjunction with on-going public awareness and education can mitigate increased fishing pressure anticipated due to access development.

Given the approaches relative to planning to locate and design operations and crossings utilizing information describing the non-timber resource values present, the impacts associated with planning activities are mitigable, and in general, provide positive impacts for operations at the site and landscape levels. The role of access management is of particular importance as a planning tool to mitigate potential impacts upon aquatic species resulting from ease of effort through public use of roads.

Infrastructure Development

Infrastructure development includes the removal/altering of vegetation cover and ground conditions, and thus potential altering of related aquatic habitat, through placement/construction of roads and landings, watercourse crossings, camps, timber storage sites and fuel storage sites. The magnitude, extent and duration of impacts upon aquatic habitat and related species diversity are related to the extent to which infrastructure developments may infringe upon inhabited watercourses particularly critical habitats, such as spawning beds.

All-weather and dry-weather road construction will lead to varying impacts upon benthic communities, fish, anurans and snakes in locations where road is constructed in close proximity to these habitats.

- An insignificant mitigable impact to benthic communities can occur where road locations occur in close proximity to aquatic systems. Exposed soil from the road construction can lead to erosion and siltation into these areas. Erosion control measures described in WDS – WI – 023, 025 and 026 are applied by Tembec in the vicinity of watercourses providing mitigation.

- Similar to benthic communities, siltation from adjacent roads can impact upon fish spawning beds located in adjacent sections of watercourses. Erosion control measures described in WDS – WI – 023, 025 and 026 are applied by Tembec in the vicinity of watercourses providing mitigation.

- Potential impacts to wetland habitats, as described earlier, can result from road construction as related to the interruption of natural drainage patterns. This in turn could impact upon amphibian and reptile communities using these habitats. The instructions provided in WDS – WI – 025 describe practices including planning and construction of drainage structures that will mitigate potential impacts upon habitats for amphibians and reptiles.

Permanent and temporary watercourse crossings can result in impacts to benthic communities and fish as a result of disturbance to streambank slopes and in-stream activity during construction.

- Construction of watercourse crossings, both temporary and permanent, have potential to impact benthic communities and fish. Bridge and culvert construction practices and stream bank restoration, if not done correctly can result in increased siltation and turbidity

downstream. Increased turbidity from suspended silt and clay particles, decreases light penetration and can limit photosynthesis by algae and aquatic plants in turn limiting food for aquatic species (Lloyd et al. 1987 *in* Ward 1992). Impacts related to these factors are generally short-term; being related to the construction activities themselves. In judging the impacts it is important to relate these occurrences to the levels and fluctuations which occur in most natural waters on a normal basis. Such sedimentation arises as a result of erosion processes acting upon the surrounding land surfaces and can fluctuate considerably daily and throughout the year. Soil types, geology, vegetation cover and slope are important contributing factors as well as surface water flows arising from major rainfall events and spring runoff. Bedload sediment impacts benthic invertebrates by infilling crevice spaces which are used as shelter and a storehouse for organic silt on which some of these organisms feed (Ward 1992). Benthic organisms however, are adapted to survival and recovery in waters containing suspended solids and are able to withstand variations in stream conditions as they occur naturally on an annual basis (Hirsch *et al.*, 1978). Impacts upon these communities are anticipated to be insignificant. Impacts upon fish may be more significant in terms of potential effects upon feeding, and in particular, upon spawning beds. Short-term effects of siltation upon spawning beds can be cleaned during major rainfall events and spring runoff (Saunders and Smith 1965; Shapely and Bishop 1965). It is also important that culvert sizing and bridge abutment placement be designed to provide for adequate fish passage where applicable. The procedures and instructions in WDS – 003 and 012 and WDS – WI – 026 outline mitigation measures for construction and on-going monitoring and maintenance of watercourse crossings complementing those procedures described in *The Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat* (DFO/MNR 1995). These measures, including assessment of fisheries values, road alignment approach planning, crossing site selection and design, construction scheduling and practices, embankment slope treatment, and post construction monitoring and maintenance, provide site mitigation for each crossing.

Decommissioning can result in impacts to benthic communities and fish as a result of disturbance of road and/or to streambank slopes and in-stream activity during decommissioning work as well as the positive benefits provided by streambank restoration following removal of temporary crossing structures.

- During decommissioning work, similar impacts due to erosion and siltation can occur as a result of disturbance to the site during excavation and removal of any structures and placement of erosion control and/or access control structures. The duration of such activity is very short and any impacts will be very localized in extent. Work should also be undertaken during periods of low flow and when fish are absent and during spawning and incubation periods (Ward, 1992). These impacts will be insignificant and mitigable.

- Once decommissioning is undertaken positive benefits can be realized in the restoration of streambanks including shaping re-contouring and establishment of vegetation to prevent future erosion and sedimentation. This also removes structures that may otherwise become plugged over time causing potential flooding and overflowing/erosion of the associated road structure.

Impacts of infrastructure development as they relate to aquatic habitat, occur at the site level. This localized extent, in conjunction with mitigation measures for planning and development of infrastructure, particularly crossings, are such that these activities are not expected to significantly impact the aquatic species diversity of FML 01. The temporary duration, with follow-up decommissioning, of all infrastructure developments (WDS-WI-035, 036 and 037), further mitigate effects upon aquatic habitat, particularly when viewed in a landscape context. Planning activities, including joint planning and discussion with IRMTs, provide up-front direction in these regards by ensuring that infrastructure is minimized in extent and duration to the standard required to undertake forest management activities for the area being developed and that critical habitat is incorporated.

Harvesting

Harvesting operations can result in altering of the vegetation on areas adjacent to aquatic communities, and thus can affect aquatic habitat conditions in such locations. The manner in which these activities take place relative to the effects of natural stand level disturbance mechanisms have implications for aquatic habitat. The nature and degree of impacts are determined relative to those arising from the effects of natural disturbance mechanisms including fire, insects and disease, on adjacent lands.

Logging, in the context of VRL practices, necessarily results in the removal of all merchantable trees, other than those intended for retention as corridors, buffers and wildlife trees, from the defined cutblock area. In extracting the timber resource, logging activities can lead to impacts upon adjacent aquatic habitats.

- For benthic organisms and fish the impacts of logging activities are related to the anticipated increase in runoff resulting from the removal of trees from adjacent areas and the potential for deposition of logging debris into the water. Changes in runoff will be related to topography, slope and soil types and the extent of harvesting and proportion of retained vegetation within a given watershed. The duration of the impacts will also be affected by the rate of reforestation. Increased streamflow as a result of increased runoff may result in a reduction of benthic invertebrates due to “catastrophic” drift. Recovery from this situation is generally rapid, ranging from 14 days to one year (Rosenberg 1980; Griffiths and Walton 1978). Increased suspended sedimentation and turbidity in the water can result from increased runoff from the surrounding land areas. Application of harvest design to incorporate variable buffers, protect in-block drainage areas, retention of understory vegetation, and the prompt forest renewal of harvested sites (WDS – WI – 006, 007, FSP Section 5.14 and the MC *Guidelines for Riparian Areas* (2008), provide mitigation for these impacts which are considered insignificant, particularly in considering the similar impacts to aquatic systems, within watersheds, resulting from natural disturbance mechanisms as assessed by the Manitoba Model Forest (Kotak et.al. 2005 and Kotak and Selinger 2006). Indicator 3.1.4.2 of the LLI framework tracks the total area in a disturbed state at any given time on a watershed basis for FML 01, with a corresponding target of no more than 30% at any time for each watershed. This target for

harvest planning and follow-up monitoring process provides further mitigation at a landscape level.

- Effects upon fish would be similar to those described previously regarding water crossings, though the impacts would not be to the same extent. North South Consultants (MBMF 1997C) found that total suspended solids in the study area were low and that no change in total suspended solids could be attributed to forest harvesting activities. Given the relatively flat topography of FML 01, insignificant impacts related to runoff from cutover areas will be minor and localized in extent. Mitigation is achieved through the practices described in the MC *Guidelines for Riparian Areas* (2008). These include establishment of buffers and retention of understory vegetation in most areas, which will provide a filtering effect for sediments from the cutover areas, consideration of topography in design of spur road layout and rapid establishment of forest renewal on all cutover areas. As a result of the topographic conditions and these mitigating practices the impacts of logging upon fish are insignificant and mitigable.

Timber storage has the potential to result in seepage of unwanted material, leached from the cut timber, into adjacent watercourses.

- Timber storage occurring in the vicinity of watercourses has the potential to result in seepage of unwanted material into watercourses thereby affecting benthic communities and fish. Leachate from cut hardwood timber is considered to be more of a concern than that from softwood. However in a study on the storage of softwood logs for the MMF, Farmer et al. (1998) found that black spruce and jack pine logs stored in laboratory and field conditions produced a leachate with varying toxicity to three trophic levels; rainbow trout, water fleas and a luminescent bacteria. This study found that toxicity of leachate increased with decreasing rain events i.e. higher concentration of leachate. This study also investigated effects of softwood log storage on carbon and nitrogen mineralization and the functional diversity of forest soils and found no detectable impacts on these components. Mitigation is achieved through consideration of topography and soils in site selection for the storage of timber and the establishment of minimum set backs for storage areas from drainage and watercourse areas (WDS – WI – 014). Relative to the overall timber harvest from FML 01, harvest and subsequent storage of hardwood timber is small (hardwood volume from lows of less than 1 % up to 10 % of FML harvest). Timber storage is of relatively short duration with hauling usually completed by the end of the winter, which makes up the predominate portion of the harvest activities on the FML. Stock pile sites, established for chip production, are located away from watercourses to reduce the potential for run off .

Use of VRL practices by Tembec in harvesting operations in combination with integration of LLI Indicator 3.1.4.2 in the planning process to limit the total amount of gross productive forest land in a recently disturbed state will assist the Company in mitigating effects of harvesting on aquatic habitat and thus aquatic and amphibian/reptile species diversity. These practices, including retention of wildlife trees and understory vegetation, protection of ephemeral streams and establishment of buffers for riparian zones will assist in slowing water flow allowing sediment to fall out of suspension and eventual infiltration of this surface water.

This will minimize sediment and water flow into adjacent watercourses. Use of such measures compares favorably in mitigating effects of disturbances on the land in light of anticipated effects in other areas resulting from fire and other natural disturbances. The terrestrial and aquatic ecosystems are adapted to such disturbances and the resulting run-off and other effects on adjacent aquatic systems.

Forest Renewal

Forest renewal operations for harvested forest stands are undertaken to complement natural renewal processes in promptly regenerating forest covertypes harvested for timber. The manner in which these activities impact negatively or positively upon aquatic habitat values have implications for aquatic species diversity. The nature and degree of impacts are determined relative to those arising from natural renewal mechanisms, particularly fire.

Site preparation and scarification activities, while positive in terms of assistance to regeneration of trees, can have some insignificant to significant implications for aquatic systems arising from disturbance to soils and understory vegetation that has been retained through the logging operations on the cutblock.

- Soil disturbance, undertaken to provide suitable microsites for tree establishment, can lead to soil erosion and resulting sedimentation into adjacent watercourses. This is particularly the case for techniques utilizing continuous furrows to provide mineral soil exposure. North South Consultants (MBMF 1997C) assessed the potential for erosion from continuous trench site preparation and determined that erosion was restricted solely to sites prepared parallel to the slope where the slope was greater than 7 % on coarse soiled sites. Such sedimentation can have insignificant effects upon the benthic community and significant effects upon fish, particularly related to spawning beds. Mitigation is achieved through measures including orientation of equipment travel against the slope to minimize erosion downslope and into watercourses, retention of understory vegetation and use of buffers to stabilize soils and filter any resulting run-off, and prompt tree establishment following site preparation operations (WDS – WI – 027, 028 and 029 and FSP Section 5.14.3).

Tree establishment on lands adjacent to watercourses will have positive impacts through accelerated establishment and growth of forest vegetation on these sites.

- In comparison to regeneration following natural disturbance this prompt renewal of trees assists in stabilizing soils and uptake of water to reduce potential effects of run-off and siltation into watercourses.

Chemical stand tending can result in significant impacts upon benthic communities and fish as a result of inadvertent introduction of the chemical into the watercourse.

- Chemical stand tending has potential to impact upon the watercourses adjacent to treatment areas as a result of drift from aerial application and through introduction via ephemeral streambeds within the treatment area during ensuing heavy rainfall (Norris *et*

al. 1991). Glyphosate exhibits high absorption combined with rapid degradation minimizing risk beyond the target plant species (Westworth 1992). Ghassemi *et al.* (1981) indicates that glyphosate as low potential for accumulation in aquatic organisms despite its solubility in water and acute toxicity was found to be relatively low (CCREM 1989). In a study conducted by Manitoba Environment on FML 01, old, vegetated highway borrow pits were purposely aerially treated with glyphosate and monitored over a nine year period. In that assessment, Jones et. al. (1996) found that the data provided no evidence that glyphosate applications affected the water chemistry of the study ponds and comparison of results between control and treatment ponds indicated that the herbicide applications may have been partially responsible for short term declines in *Typha* spp. production, however long term adverse effects were not discernible (1997). Mitigation measures for application of herbicides, as described earlier, include buffer zones along watercourses, consideration of wind conditions to minimize spray drift, a preference for ground versus aerial application which greatly reduces spray drift and an application target not exceeding 25 % of harvested areas. Mobilization of the chemical through rainfall will also be minimal given the desire to time application of the herbicide in dry conditions (Kimmins 1992). It is also worth noting that use of chemical stand tending is generally limited to at most a few treatments, usually only a single treatment, on a given area during the course of a forest life cycle. This factor, and others, separates forest management applications of herbicides from those of agriculture (Kimmins 1992). The use of these practices as described in WDS – 014 and the FSP Section 5.15, the selective nature of herbicide application and the inherent characteristics of the chemical itself result in any potential impacts to aquatic habitats being mitigable.

Forest renewal activities, undertaken to complement natural renewal processes and accelerate establishment and growth where required, are positive in returning adjacent forest lands to a productive state, increasing vegetative cover to take up run-off water, stabilize soils and filter run-off prior to entering watercourses. Measures provided for to retain vegetation, particularly buffers around most watercourses, and controls in place for application of herbicides in chemical stand tending mitigate potential impacts.

Equipment Use

Equipment use and associated activities can impact upon aquatic wildlife species diversity through the effects of heavy equipment movement on adjacent sites, leaks and spills resulting from fuel storage and handling and waste disposal practices in the vicinity of watercourses.

In-block operations of equipment can result in site disturbance as a result of movement on the cutblock.

- Heavy equipment use during all phases of forest management activities, particularly logging and site preparation and scarification activities, can result in rutting, displacement and compaction of soils. These impacts on the site can lead to erosion of soils with resulting sedimentation into adjacent watercourses. As described for logging activities, such run-off can result in insignificant impacts to benthic communities and more significant impacts to fish and their spawning beds. PHA to identify soil and slope

conditions at the planning stage (WDS – 002) is utilized in scheduling cutblocks for logging and site preparation and scarification activities in terms of season (year-round versus winter to achieve frozen conditions) as described in WDS-WI-007 and 008. Further planning steps to mitigate these impacts are provided through the inclusion of contingency cutblocks in each AORP to be available should weather or other operating conditions necessitate changing from a scheduled cutblock (WDS – 010). Operating practices such as delimbing and topping in the harvest block to assist in providing a corduroy effect are described further in Criteria 3: Soil and Water. In the vicinity of watercourses, heavy equipment travel is limited to maintain buffer distances to the watercourse as prescribed in the MC *Guidelines for Riparian Areas* (2008). Such practices provide mitigation for in-block operations of equipment.

- In-block operations of equipment can have very limited and site specific insignificant impacts upon the forest litter and ground surface utilized by amphibians and reptiles. This disturbance is mitigated through retention of understory vegetation and particular attention to such areas associated with ephemeral streams and riparian areas, which are important habitat for these species (WDS – WI – 006 and 007).

Fuel storage and handling can lead to seepage of fuel into aquatic and amphibian habitats resulting from leaks or spills in the course of transportation, storage and fueling of equipment.

- At the planning stage mitigation is achieved through set backs from watercourses for the location of fuel storage sites, the use of spill containment material and equipment servicing requirements (WDS – WI – 019 and 020. Regular inspections of equipment and storage tanks and emergency response procedures as provided for in WDS013 to deal with any spills of fuel that may occur provide mitigation during operations. Monitoring of spills reportable to Manitoba Environment are tracked in LLI Indicator 3.1.5.1. Incidents of this nature are anticipated to be rare and have short-term duration, with procedures in place to mitigate any potential occurrence. Given the selective location of these sites, mitigating procedures in terms of site planning and spill response, any impacts related to these activities are insignificant and mitigable.

Non-hazardous and hazardous waste disposal in the vicinity of watercourses can result in insignificant impacts to aquatic habitats and species through generation and disposal of materials used during equipment maintenance.

- Maintenance activity and waste disposal procedures described in WDS – WI –018, 019 and 020 provide measures to prevent seepage of unwanted material into watercourses, ephemeral streams and adjacent riparian areas which may otherwise impact benthic communities, fish, amphibians and reptiles. Mitigation includes consideration of topography and soils in site selection for the servicing of equipment and disposal of waste products.

Equipment use will result in some level of impact to lands adjacent to watercourses as described in detail in Criteria 3: Soil and Water. Maintaining buffers in riparian areas, proper scheduling of equipment use to match site conditions, locating equipment service and fueling

sites away from watercourses and follow-up inspection and emergency response provides mitigation of these impacts. In terms of the potential effects of these activities to any given watercourse and its aquatic species diversity, the limited magnitude, extent and duration of impact at any given location provides additional mitigation.

Special Concern, Threatened and Endangered Aquatic Species

Planning

Planning of forest management activities, including public participation, location and design of operating blocks and associated cutblocks and roads, collection and application of information for decision making and access management has implications for species diversity of wildlife in terms of STE aquatic wildlife species. Processes for the identification of such values with subsequent incorporation in planning processes determine the nature and degree of impacts.

Special concern, threatened and endangered aquatic wildlife species present on FML 01 are described in Section 5.7.1 of the FSP. Species that are listed by SARA include the Carmine Shiner and the Northern Leopard Frog. Impacts of forest management activities as they relate to these aquatic wildlife species have been described as applicable in the description of impacts for the various components of aquatic species.

Impacts of forest operations as they relate to particular species included as STE in FML 01 have been described earlier within the general assessment of aquatic wildlife. The description provided here will focus upon considerations for these species in terms of their STE status as it relates to planning processes.

Public participation processes such as joint planning and discussions with other resource users, in addition to on-going planning processes with MC, has a significant mitigable impact upon the planning and operating approaches utilized for STE species. It is particularly important that the status of these species, factors contributing to this status and the interactions with forest management activities that could affect their status be brought forward and discussed in these forums. An educational role by MC and the Company, with potential on-going input from the Manitoba CDC, will assist in providing other resource users and interested parties to understand potential interactions with these species and mitigation requirements.

Road and watercourse crossing and harvest and renewal planning for operations can result in significant impacts to STE aquatic species due to the potential effects upon habitats for the species that can result from implementation. These impacts and mitigative approaches have been described earlier in review of each aquatic wildlife species group.

In addition, it is noted that the Tembec framework for LLI includes Indicator 1.2.1.3 which measures progress made in developing management strategies for all STE species present on FML 01 and the monitoring of sites identified in AORP's for protection. This provides a monitoring mechanism for following up on STE approaches for FML 01.

Information collection and application processes and implementation can result in significant impacts with regard to future potential identification of STE aquatic wildlife species for FML 01 and the evolving status of those currently recognized. Tembec is committed to on-going management of the STE wildlife species present in FML 01 as described in WDS – 007 and FSP Section 5.2.1.1.3 and 5.7.1.

Access management can have significant implications for the management of STE aquatic wildlife species due to the potential effect upon the population that improved access may have. These impacts and mitigative approaches have been described earlier in review of impacts upon fish.

3.4 Genetic Diversity

3.4.1 Introduction

Genetic diversity is reflected in the variation that exists within the forest vegetation that composes forest ecosystems. This variation is represented by the component described as maintenance of the gene pool in Table 1. Maintaining the diversity of the gene pool is an important factor in sustaining the productivity and resilience of forest ecosystems (CCFM 1997b).

The focus of the review will be related to the potential impacts upon genetic diversity of forest vegetation that the implementation of the FSP and associated forest management activities are expected to have.

3.4.2 Data Adequacy and Gaps

FSP sources of information include:

- Description of Tembec's cooperative work with MC on Tree Improvement Projects for FML 01 (Section 5.14.4.4)

- Description of forest renewal practices regarding tree establishment from natural seed and tree planting (Section 5.14.4.3 and 5.14.4.5)

Other sources of information include:

- MC Tree Improvement Strategy (MNR 1991)

- Assessment of Arthropod diversity in forest fire and harvested sites (Capar and Westwood 2004)

- Indicators of sustainable forest management inspired by natural disturbance (Kneeshaw et.al.2000)

- Compendium of biodiversity research projects in Canada (Bland 1999)

On-going Operational Data Sources include:

- Regeneration surveys
- MC permanent sample plot data
- MC volume sampling temporary sample plot data

These sources of information represent the best information currently available regarding genetic diversity of the forest vegetation on FML 01.

The SFM Criteria and Indicators (C & I) framework developed by Tembec during the preparation of the FSP provides the framework to be utilized for monitoring of indicators for measurement of progress towards targets established in the FSP. Indicators developed to represent genetic diversity will provide improved data regarding the components referenced in Table 1 as the monitoring program for adaptive management is implemented during the FSP 20 year period. Indicators 1.3.1.1, 1.3.1.2, 1.3.1.3 from the LLI will provide enhanced data as time moves forward relative to components indicated in Table 1. This specifically relates to the sources of seed utilized in tree establishment, use of material associated with the tree improvement program and the distribution of tree establishment from on-site local seed, natural seed collection within the relative Provincial seed zone and trees from Provincial Tree Improvement sources.

3.4.3 Forest Management Activities Assessment

Planning

Planning of forest management activities, particularly as it relates to design of operating blocks and associated cutblocks and renewal planning has implications for genetic diversity. The manner in which mechanisms are put into place for the subsequent renewal of trees on sites following harvesting relative to the natural mechanisms that would otherwise occur in the forest determine the nature and degree of impacts.

Harvest and renewal planning can lead to significant impacts upon the gene pool as a result of the decisions made for tree renewal mechanisms following harvesting. It is at this point that potential exists for constraints to be introduced upon the natural genetic diversity of the tree vegetation of FML 01. Mitigation requires that mechanisms be established in the design of cutblocks and implementation of logging operations to take advantage of natural renewal processes and to consider natural genetic diversity in planning forest renewal operations.

- As per the FML Agreement, Tembec is committed to renewal of all areas harvested to supply the mill. The strategies and treatments utilized to accomplish this objective are described in WDS – 008. As described in this procedure, the first priority in forest renewal planning is to maximize use of natural regeneration sources. Positive steps are in place to utilize mechanisms to capitalize on natural regeneration sources including:

- Application of harvest design to retain tree seed sources and advanced softwood regeneration present on the site to maintain a component of natural site genetic material.

- MC guideline (2005A) requiring limbing and topping to be conducted within the harvest area which maintain seed bearing cones on site to natural regeneration.

- Forest renewal processes to assist and capitalize upon natural on-site seed sources both as the primary renewal strategy for sites where resulting regeneration can be expected to meet renewal standards and targets and for planted sites where such sources will provide in-growth from natural sources to supplement planted material

- The LLI framework includes Indicator 1.3.1.1 which tracks sources of seed and/or seedlings utilized in the establishment of forest renewal for FML 01. This indicator provides measurement of Tembec progress in utilizing seed suited to the climatic and geographic area.

- Tembec is a partner with MC in a cooperative Tree Improvement program which is targeted at the tree species harvested and renewed by the Company and the Provincial Seed Zones in which these activities occur. This program is in place to establish a long-term source of seed for the growth of trees that will be more resistant to insects/disease and exhibit superior growth and form characteristics. The genetic material for this program comes from "plus trees" selected from natural stands across the entire seed zone (MNR 1991), which has the potential to increase the genetic diversity when compared to mass seed collection from harvest areas. Given the strategy of utilizing natural local sources of this genetic material as well as that utilized for the current tree planting program combined with the relatively large area of remaining stands originating from natural sources, the potential significant impact upon the gene pool from the tree improvement program is mitigable.

- The LLI framework includes Indicator 1.3.1.2 which tracks the utilization of genetic material in tree propagation for FML 01. This indicator provides measurement of Tembec progress made in remaining within established targets.

Planning activities related to the development of harvest designs to maximize natural regeneration opportunities, including continuing in-growth on planted sites, combined with use of Provincial seed zones for establishing stock to be planted on planted sites provide mitigation of the potential impacts to the gene pool from planning activities.

Harvesting

Harvesting of cutblocks, in terms of the implementation of design considerations described for planning of operating blocks and associated cutblocks has implications for genetic diversity. The manner in which mechanisms are put into place for the subsequent renewal of trees on sites following harvesting relative to the natural mechanisms that would otherwise occur in the forest determine the nature and degree of impacts.

Logging can lead to insignificant impacts upon the gene pool as a result of harvesting of trees and the implementation of mechanisms for the renewal of the forest following harvesting. Mitigation requires that mechanisms be established in the design of cutblocks and implementation of logging operations to maximize the advantage of natural renewal processes.

- During logging operations mitigation will include incorporation of designs developed at the planning stage to maximize use of natural regeneration sources for forest renewal of harvested cutblocks. Positive steps are in place to utilize mechanisms to capitalize on natural regeneration sources (WDS – 008, WDS – WI – 004, 006, 012) including:

    - Wildlife tree retention to provide natural on-site seed source for areas to be naturally regenerated and to supplement planted stock on areas for which this treatment is applied

    - Adjacent trees from uncut areas, corridors and buffers provide additional on-site seed

    - Protection of advanced softwood growth to provide on-site originating seedling to young trees

    - Limbing and topping of trees at the stump area to retain original on-site cone source across cutover areas

    - VRL practices retain 5 % of harvest area as single and clumps of trees which is monitored in LLI Indicator 1.1.3.4.

Harvesting activities related to the retention of on-site seed and regeneration sources to maximize natural regeneration opportunities, including continuing in-growth on planted sites, provide mitigation of the potential impacts to the gene pool from logging activities.

Forest Renewal

Forest renewal activities, particularly as they relate to use of on-site natural seed and regeneration sources and the introduction of planting stock have implications for genetic diversity. The manner in which mechanisms are put into place for the subsequent renewal of trees following harvesting relative to the natural mechanisms that would otherwise occur in the forest determine the nature and degree of impacts.

Tree establishment can lead to significant and positive impacts upon the gene pool as a result of the use made of on-site source seed and regeneration and the source of planted stock. Mitigation requires that maximum use be made of mechanisms established in the design of cutblocks and implementation of logging operations to take advantage of natural renewal processes and that natural genetic diversity be considered in selection of planting stock.

- To follow-up upon seed sources provided through logging operations the following practices, as described in WDS – 008, WDS – WI – 004, 006, 027, 028 and 029 and the FSP Section 5.14.4 provide mitigation by taking advantage of on-site seed and regeneration sources:

    - Site preparation and scarification equipment use will be undertaken to continue to retain natural on-site regeneration sources that have been retained through logging including:

        - Wildlife trees for seed source

        - Advanced softwood regeneration among other understory

    - Scarification treatments (and site preparation treatments for planting) will assist in distribution of on-site natural seed sources, left behind through delimbing and topping within the harvest area, through scattering of the logging slash and cones while providing suitable micro-site growing conditions for germination of this seed.

- These mechanisms ensure that the new forest includes genetic material from the present and surrounding forest.

- In some areas planning for site preparation followed by planting of tree seedlings is developed in order to obtain successful regeneration of the site and to meet MC forest renewal standards.

    - Kimmins (1992) describes the importance of using the local provenance or genotype to provide seedlings for forest renewal. In Manitoba this is applied through use of tree seedlings grown from seed that originates from the same provincial seed zone area as the new stand to be established.

    - For stands established through tree planting programs there is also considerable in-growth of trees from seed originating on the site, as described in the mechanisms for natural regeneration, as time moves on.

- The LLI framework includes Indicator 1.3.1.3 which measures the distribution of tree establishment from Provincial tree improvement sources, natural seed collection within seed zones and regeneration from local site seed sources for FML 01. This provides a monitoring mechanism for assessment of progress made in remaining within established targets.

Forest renewal activities related to the retention of regeneration sources retained on-site during logging combined with use of Provincial seed zones for establishing stock to be planted on planted sites provide mitigation of the potential impacts to the gene pool from tree establishment activities.