PROSPERITY
A Gold-Copper Project of Taseko Mines Limited

# Taseko Prosperity Gold-Copper Project

## Appendix 6-5-A

Taseko Mines Limited

# TASEKO PROSPERITY GOLD-COPPER PROJECT

## FOREST RESOURCES AND LAND USE

**March 2007**

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# Abbreviations

EIA ..... Environmental Impact Assessment
GIS ..... Geographic Information System
TSS ..... total suspended solids

# 13 Forest Resources and Land Use

## 13.1 Introduction

This section describes the existing forest resources of the mine site area at Fish Lake and within the 125 kilometer (km) transmission corridor from Dog Creek to Fish Lake. In accordance with the Project Report Specifications (PRS), it provides an assessment of the potential effects of project construction, operation and closure on forest land and timber production. Methods to avoid and minimize adverse impacts are also presented.

The potential effects of mine and transmission line development on forestry are assessed for the following:

- harvesting of merchantable timber
- loss of forest land base
- destruction of immature growing stock
- disruption of forestry planning and operations

For the purpose of this report, the phrases 'forest resources' and 'forest land use' refer to timber-related resources and land use; other forest values and uses referred to in the Forestry section of the PRS (i.e. recreation and range) are discussed in separate sections of the project report.

The forestry resource assessment describes the potential effects of project development, operation and closure within the context of the three forest districts encompassing the mine site and transmission corridor. Relevant background information on the resources and activities of the administrative forest units is provided, followed by detailed statistics for the specific areas within the footprint of the proposed mine facilities. The resource data and assessment of potential effects provides the basis for the development of sound mitigation and reclamation plans to minimize potential adverse impacts on forestry resources and their use.

The footprint of the proposed mine site facilities is shown within the context of important forestry resources and features on the appended Mine Site Forestry map (Map 13-1). A three kilometer wide corridor (1.5 km on either side of the centerline) defines the study area for the 230 kV transmission line. The attached Transmission Corridor Forestry map (Map 13-2) presents important forestry resources and features within the corridor.

In accordance with the PRS, the forestry assessment follows current methodologies and standards established by the documents referenced throughout this section.

Forest Health Context

Current Status

Future Projections at end of Mine Life (2017)

Future Projections for the Post-closure Period (2037)

Influence on Project

Land Use Planning Context and Influence on Forest Management

CCLUP

LUPs

RMZs

OGMAs

WHRs

Changes to Land Use Plan Implementation to address Beetle Impacts

## 13.2 Mine Site

### 13.2.1 Approach and Methodology

The forestry assessment is based on the following:

- A review of existing information sources, including:
    - British Columbia Forest Service (BCFS) digital forest inventory data, Forest Cover Maps (FC1) and Forest Inventory Program (FIP) data files which present information on species composition, volumes, and growth;
    - Canada Land Inventory (CLI) Forest Capability Maps;
    - BCFS biogeoclimatic ecosystem classification maps;
    - BCFS Small Business Forest Enterprise Program (SBFEP) information; and
    - Riverside Forest Products Limited Forest Development Plan Maps.
- Stereoscopic examination of 1:10,000 (1987) and 1:15,000 (1993) scale color air photos, and
- Field work to verify and update forest inventory information.

A helicopter reconnaissance survey of the mine site study area was carried out in June 1997, with a limited number of ground checks. More detailed investigations to verify forest cover types were conducted by helicopter and ground surveys from July to August 1997. Twenty ground plots were inspected and forest cover, vegetation, soils, and landforms were recorded. The location of ground survey sites are identified on map 13-1 and the site forms are presented in Appendix ?

Additional information was collected through a series of interviews with BCFS and local forest industry personnel during July and August 1997. The following individuals provided assistance over the course of the assessment:

- Mark Tamas, Kelly Hutchinson, Rob Anderson, Phil Theriault (Forest Planner) and Bob Flinton of Riverside Forest Products, Williams Lake;
- Troy Hromadnik, RPF, Planning Forester of West Fraser Mills, Williams Lake;
- Sean Donahue (Small Business Forester, Williams Lake Timber Supply Area (TSA) of the BC Forest Service (BCFS) in Williams Lake; and
- Gerry Grant (District Manger) of the BCFS, Chilcotin Forest District.

Forest Capability

Forestry features within the mine site area, including high quality sites, cutblocks, major haul roads, and administrative boundaries, were identified from stereoscopic aerial photo interpretation, Forest Cover Maps, Ministry of Forests maps, CLI forest capability maps, field investigations, and forest company plans. High quality sites are sites designated as "good" in the BCFS Forest Cover classification. Sites were also assessed based on CLI forest capability classes. CLI forest capability classes are based on estimates of gross, mean annual increment (MAI) as follows:

| Class | MAI ($m^3$/ha/year) |
|---|---|
| 1. | > 7.8 |
| 2. | 6.3-7.8 |
| 3. | 5.0-6.2 |
| 4. | 3.6-4.9 |
| 5. | 2.2-3.5 |
| 6. | 0.8-2.1 |
| 7. | < 0.7 |

Methods for determining MAI differ between CLI and the BCMoF forest cover system, however, both methods give similar results. In most cases, the BCMoF system has been used in this report because it generally provides more site-specific information.

Many of the above-mentioned features are presented on the accompanying 1:20,000 scale Mine Site Forestry map (Map 13-1) that also shows the proposed mine layout and watershed boundaries.

The areas occupied by individual forest cover types within the proposed mine site facilities footprint were obtained by overlaying the Forest Cover Map polygons (FC1 files) with the mine development layout using Geographic Information System (GIS) techniques (ARC/INFO software). Timber volumes and other forestry data were accessed from the FIP data files for each map polygon on the Forest Cover Maps.

The assessment of potential impacts, including avoidance and mitigation measures, addresses the most significant factors with respect to the production and harvesting of merchantable timber, the forest land base, growing stock, and forestry operations. The following provides a brief description of the why these factors were selected.

- harvesting of merchantable timber:

  Merchantable timber has stumpage value to the Crown and a market value to logging or forestry firms. If these values are not recovered through logging prior to land clearing, compensation is required under the *Forest Act*.

- loss of forest land base:

  Loss of productive land base, and the commensurate amount of timber that the land is able to contribute to the allowable cut, can be a significant effect associated with forest land development. The severity of this loss depends on its magnitude relative to the annual allowable cut for the forest management unit (in this case, the Williams Lake Timber Supply Area).

- destruction of immature growing stock:

In addition to the loss of productive land base, there is also a value attached to immature trees even though they are too small to be merchantable. The value can be thought of as a replacement cost which represents the cost of initial establishment of the stand, compounded over its age. The value is also sometimes called "liquidation damage" or "liquidation cost".

- disruption of forestry planning and operations:

  Disruption of existing forest plans and operations is also an important concern. Typically, planning must take place 1 to 5 years or more in advance of logging (depending on the specific type of plan) and must take into consideration timber supply, forest company objectives, various environmental concerns, and other resource values. Planning demands have grown substantially since the implementation of the Forest Practices Code. For the study area in general, special zones, established under the Cariboo-Chilcotin Land-Use Plan, create further planning demands.

Other potential effects of project development on forests are covered in Project Report sections dealing with fish, wildlife, and recreation values.

## 13.2.2 Baseline Conditions

### 13.2.2.1 Overview of Forest Resources and Land Use

Forests, interspersed with grassy or shrubby meadows and wetlands, dominate the landscape in the mine site area and transmission corridor. Along the transmission corridor, Douglas-fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) are the main tree species in forests along the eastern part and lodgepole pine is the main species in the western part. In the mine site study area, lodgepole pine is the main tree species. Hybrid white – Engelmann spruce (*Picea glauca X Engelmannii*) and black cottonwood (*Populus balsamifera ssp. trichocarpa*) are common in many riparian areas. Spruce also occurs in some wetter sites and in older forests. Trembling aspen (*Populus tremuloides*) occurs as a pioneer species in a few disturbed upland areas. Yields of merchantable timber stands average around 100 $m^3$/ha. Average, net mean annual increment (MAI) is about 1 $m^3$/ha/year.

Riverside Forest Products Ltd. is the major industrial forest operator with interests in the mine site area and transmission corridor. West Fraser Mills also has a few operations adjacent to sections of the transmission corridor. Various operations conducted under the B.C. Ministry of Forests Small Business Forestry Enterprise Program (SBFEP) are also planned or active in the general vicinity of the mine site and transmission corridor.

### 13.2.2.2 Forest Resources

Five biogeoclimatic zones occur in the general area of the proposed mine site: Alpine Tundra (AT), Engelmann Spruce - Subalpine Fir (ESSF), Montane Spruce (MS), Sub-Boreal Pine - Spruce (SBPS), and Interior Douglas-fir (IDF). However, the area potentially affected by mine development coincides with only two zones: the SBPS and the MS.

The SBPS, represented in the mine site area by the SBPS Very Dry, Cold subzone (SBPSxc), is a forest subzone occupying valleys and lower slopes. Lodgepole pine is the dominant, and often the only, tree species. Poorly drained areas that are dominated by

scrub birch (*Betula glandulosa*) and willow (*Salix* spp.) or by sedge-grass vegetation are also common. White spruce occurs to a very limited extent, usually on imperfectly drained soils along the margins of wetland shrub or sedge-grass meadows.

The Very Dry, Very Cold subzone of the MS (MSxv) occupies higher elevations. Lodgepole pine is the dominant species in most stands within this subzone in the project area, but hybrid (white-Engelmann) spruce is often a component of older stands. Spruce is also common in wetter than zonal sites and in some areas is the dominant species.

Net yields of timber range from approximately 50 $m^3$/ha to 250 $m^3$/ha with an average of approximately 100 $m^3$/ha. The greatest yields are in mixed, lodgepole pine-dominated stands on moderately well to imperfectly drained soils in the MSxv subzone.

Lodgepole pine is the dominant tree in most of the upland forests and often contributes 80% or more to the stand volume. Spruce represents about 10 to 20% of the volume of many mixed stands.

Spruce is the dominant species of some old stands and in imperfectly drained soil units. Spruce often comprises 80% or more of the volume of these stands. Trembling aspen contributes a very small portion of the volume of a few mixed stands. Pure stands of trembling aspen occur sporadically in a few areas and Douglas-fir is rare.

The average MAI for forests in the mine site area is approximately 1.6 $m^3$/ha/y and ranges from 0.3 $m^3$/ha/y to 2.3 $m^3$/ha/y. MAI is an average of the annual growth of trees within a stand, averaged over their rotation age. MAI's for BCFS forest inventory data are based on net volume (including allowances for losses from decay, waste, breakage, and utilization level) and are presented as $m^3$/ha/y whereas MAI limits set for CLI forest capability classes use gross volumes. Most of the forestlands in the project area are in CLI forest capability Classes 5 and 6. The age of stands ranges from approximately 20 years to more than 200 years.

#### 13.2.2.3 Forest Land Use

Forests of the mine site area are within the Williams Lake TSA and are administered by the Chilcotin Forest District of the BC Ministry of Forests, headquartered in Alexis Creek. In addition, matters related to the Small Business Forest Enterprise Program are administered through the Small Business Forester, located in Williams Lake. The Williams Lake TSA covers about 4.87 million hectares (ha), of which about 1.66 million ha are available for timber harvesting under the current level of forest management practices, and has an annual allowable cut (AAC) of 3.81 million $m^3$/y, based on the Chief Foresters latest AAC determination of April 1, 1997.

More specifically, the proposed mine site is within the interest areas of Riverside Forest Products Limited and the Forest Service's SBFEP. Riverside has a few active cutblocks - cutblocks are considered "active" until regeneration has reached "free to grow" status - on the southerly lower slopes of Cone Hill north of the mine site, as shown on Map 13-1. No active cutblocks are currently located within the proposed mine development footprint.

Forest development plans specify that more logging will occur in the project area between 1998 and 2002 (Map 13-1). Riverside's current five year cutting plans call for 274 ha of logging within the mine development footprint, consisting of about 230 ha of lodgepole pine and 44 ha of spruce and other species.

The coordination of logging schedules and mine development is currently being discussed by Taseko Mines Limited, the BCFS, and Riverside Forest Products Limited.

The land area in the mine development footprint is within the Taseko Lake Special Resource Development Zone (SRDZ) of the Cariboo-Chilcotin Land-Use Plan (CCLUP). The SRDZ covers an area of 173,481 ha, of which 87,137 ha are forest (CCLUP 1995, p. 88). There are some special constraints on logging and forest management within the SRDZ. For example, 17% of the productive forest land base is to be reserved from logging and 33% of the productive forest area is to be logged using "modified harvest" methods (CCLUP 1995, p. 89). Within the SRDZ, planning requirements are stringent and both the forest and environment ministries must jointly sign off forest development plans.

## 13.2.3 Construction and Operation

### 13.2.3.1 Potential Effects Assessment

The nature of potential effects on timber resources has been discussed above. The main concerns are potential loss of merchantable timber, losses of the productive forest land base, destruction of immature timber, and the disruption of forestry plans and operations.

The land area within the mine development footprint is 3215 ha, comprising about 2457 ha of merchantable timber, 119 ha of non-merchantable timber (dominantly immature lodgepole pine), and 639 ha of non-forested areas. The total net volume of merchantable timber within this area (based on estimates from BCMoF forest inventory data as of December 10, 1997) is 292,731 $m^3$. The annual volume in tree growth (MAI) potentially affected by mine development within this area is 3873 $m^3/y$. The non-merchantable timber areas mainly comprise non-productive brush, open range, meadows, swamps, and some forests of low BCFS site quality class, along with some immature stands of non-merchantable lodgepole pine. About 89% (259,926 $m^3$) of the total merchantable timber consists of lodgepole pine. The remaining 11% (32,434 $m^3$) consists of hybrid white-Engelmann spruce. The volume of merchantable timber by BCFS age class is presented in Table 13-1.

The value of non-merchantable, immature lodgepole pine that might be payable to the Crown as liquidation damages, was calculated following the methods and assumptions used by Jones (1996, Appendix V), namely, a starting value of $900/ha and a compound interest rate of 1.5%. An average stand age of 30 years was used. These calculations are extremely sensitive to estimated log selling prices and logging costs. Assumed interest rates and time periods (rotation length or number of years for an investment) are even more influential.

Based on this approach to evaluation, it is calculated that the liquidation costs for 119 ha of immature lodgepole pine growing stock in the mine development footprint are $167,790. This value is a rough estimate but is comparable to the estimates made by Jones (1996; 1998) for the transmission line corridor.

As discussed above, about 274 ha of mature lodgepole pine and spruce forest within the mine development footprint are slated for logging by the year 2002. This amounts to approximately 11% of the total area of merchantable timber within the proposed footprint of the mine development. As a best but rough estimate, based on past rates of logging and the current forest development plans for the mine site area, it is estimated that about half of the merchantable timber area within the mine development footprint would be logged

over the next decade or two, in the absence of the project. The potential effects of the project on merchantable timber harvesting are therefore an accelerated rate of logging over about half of the area that will be developed, and harvesting of as much as about 1200 ha of the disturbed area that would likely be left standing for the forseeable future in the absence of the project.

Roughly 2,500 ha of productive forest land are within the mine site footprint; this represents about 3% of the total forest area within the Taseko Lake SRDZ of the CCLUP. Figures on how much of the 87,131 ha of forest area with the SRDZ are productive forest land are not available, however, the mine footprint area is relatively small and should be well within the guidelines set for SRDZ's. For example, the forest industry's access to timber supply within SRDZ's is limited to 70% of the timber from the productive forest land base, averaged over the SRDZ (CCLUP 1995, p. 177).

The greatest potential impact on forestry resources resulting from project development is the loss of about 2500 ha of productive forest land base that will not be available for replanting and natural regeneration, until the implementation of the comprehensive reclamation plan following mine closure, as discussed in the following.

#### 13.2.3.2 Mitigation and Enhancement

Mitigation for the partial replacement of the forest land base that will be within the developed area of the mine site will be achieved through implementation of the comprehensive reclamation plan following mine closure. The reclamation plan calls for replacement of native topsoil over portions of the mine site following closure, and planting of native vegetative cover, including lodgepole pine and spruce. The ultimate extent of reclamation and reforestation is discussed in the following residual effects assessment, as well as in the reclamation plan presented in Section ?

#### 13.2.3.3 Residual Effects Assessment

The total volume of timber potentially affected by mine development is a relatively small portion (less than 8%) of the annual allowable cut for the Williams Lake TSA. The residual effect is the harvesting of this timber at an accelerated rate, which is not deemed to be a significant factor from a timber supply perspective.

Reductions in MAI reflect the impact of mine development resulting from the loss of productive forest land base. The lost MAI is potentially the greatest impact on timber resources that would result from development of the proposed mine. The lost MAI is equivalent to the loss of about 2500 ha of productive forestland, which represents only 0.1% of the Williams Lake TSA, AAC. Even with respect to just the SBFEP, which comprises a small part of the total cut for the TSA, the total merchantable timber volumes affected represent only about one-half of the annual area or volume that is cut under this program. The overall, net effects on the timber resources in the mine development area are expected to be small but none-the-less will be partially offset, in the long term, by reclamation of the disturbed areas to productive forest at mine closure. The reclamation plan calls for the placement of salvaged topsoil and planting of lodgepole pine and spruce forest over ? ha of the mine site. This would result in the residual loss of ? ha of productive forest land, or about ? MAI.

The following presents a summary of residual, forestry-related effects of mine construction, operation and closure, with implementation of the comprehensive reclamation plan:

- Merchantable timber will be logged prior to land clearing for mine development, thus, there will be no net negative effect associated with loss of merchantable timber.
- The estimated replacement value or "liquidation cost" of lost immature growing stock within the mine development site is about $167,790 (covering an area of 119 ha). The loss of immature growing stock is small in the context of timber supply for the Williams Lake TSA. However, as stated in the PRS, the BC Ministry of Forests may require compensation for the replacement value of immature growing stock within the mine site. This will be discussed as project planning and permitting proceeds. A more detailed appraisal of replacement cost may be required.
- About ? ha of productive forest land, or roughly ? MAI will be permanently lost to mine development, following closure and implementation of the reclamation plan.

#### 13.2.3.4 Monitoring and Management

In accordance with the PRS and existing provincial legislation, logging operations will meet or exceed the requirements of the Forest Practices Code. Operations are also subject to audits by the Forest Practices Board. Timely monitoring will ensure that all merchantable timber is recovered prior to land clearing and that planning is well coordinated between Taseko and logging companies (Riverside Forest Products and the SBFEP). Special attention will be given to road building and logging in and near riparian areas and other environmentally sensitive areas. Continued liaison with the BCFS, Chilcotin Forest District, and with Riverside Forest Products Limited, will ensure that timber removal as proposed in forest development plans for the area and development of the mine are not in conflict.

Timber harvesting plans, including access road design, maintenance and reclamation, will be developed as part of detailed project planning, following issuance of the Project Certificate. Plans and operations must follow practices outlined in the Forest Practices Code guidebooks. All forest-related planning activities will be carried out by Registered Professional Foresters and Professional Engineers, and all construction and logging activities will be administered and monitored by accredited professionals, following the detailed environmental monitoring plan guidelines.

### 13.2.4 Closure

Portions of the mine site will be reclaimed to productive forestland at mine closure through the creation of forested wildlife habitat, as presented in the reclamation plan. Reclamation of these areas to natural capability levels will require soil salvage during mine construction in sufficient volumes to cover disturbed areas with a depth of topsoil approaching the natural rooting zone (approximately 70 cm) of forest lands within the mine site (refer to Conceptual Reclamation Plan, Section ?).

## 13.3 Transmission Line

### 13.3.1 Approach and Methodology

The transmission corridor forestry assessment is based on the same information sources and approach used for the mine site described in section 13.2.1. This existing information was augmented by interpretation of 1:20,000 color air photos (1996). A helicopter reconnaissance survey of the route was carried out in June 1997, with a limited

number of ground checks. More detailed investigations were conducted by helicopter and ground surveys during August 1997. The ground survey sites are located on Map 13-2.

Additional information was collected through a series of interviews with BCFS and local forest industry personnel during July and August 1997, as noted in section 13.2.1.

Information on timber volumes and valuation was obtained from estimates presented in forest cover clearing reports prepared for Taseko as part of the transmission corridor feasibility studies (Jones 1996; Jones 1998). The level of detail presented in these reports meets the requirements of the PRS (which call for more detailed timber cruising to BC Ministry of Forests standards, following submission of the Project Report).

The forest capability along the transmission line corridor was estimated using 124 randomly selected samples points along transects established on 1:50,000 CLI Forest Capability Maps. Timber volumes and other forest cover data were summarized based on BCFS timber inventory data in FIP files for 315 randomly selected sample points on 1:20,000 scale Forest Cover Maps along the corridor.

The forestry features along the transmission corridor were identified and mapped following the methods described in section 13.2.1. The accompanying 1:20,000 scale Transmission Corridor Forestry map (Map 13-2) shows the centerline, distance along the centerline, and major forest resource features within the three kilometer wide corridor.

## 13.3.2 Baseline Conditions

### 13.3.2.1 Forest Resources

The following describes the forest resources within the transmission line corridor in sufficient detail to meet the requirements of the PRS. The baseline information provided the data necessary to assess the potential effects of transmission line construction on forest resouces and use, and to develop the prescribed impact avoidance and mitigation measures.

The significant forestry features along the transmission route are summarized in Table 13-2 and are shown on the Transmission Corridor Forestry map (Map 13-2). Areas logged in the twenty years prior to 1996, areas logged or planned to be logged in 1997, and areas planned to be logged between 1998 and 2002 are shown, as well as areas that may impose constraints on logging and clearing operations because of riparian values or sensitive soils. Several groups of major forest cover types are also shown, including:

- Non-Productive Forest;
- Stands that are more than 141 years old dominated by Douglas-fir, lodgepole pine, or spruce; and
- Stands of any age dominated by black cottonwood or trembling aspen.

The transmission line route crosses five biogeoclimatic zones (Meidinger and Pojar 1991). The extent (percent) of each biogeoclimatic zone within the transmission corridor is as follows:

- Interior Douglas-Fir (IDF) 23%,
- Bunch Grass (BG) 4%,

- Sub-Boreal Pine-Spruce (SBPS) 17%,
- Montane Spruce (MS) 53%, and
- Engelmann Spruce-Subalpine Fir (ESSF) 3%.

Approximately one half of the forestlands intersected by the transmission corridor are within the MS zone. The IDF zone covers approximately a quarter of the length with the other three zones contributing to the remaining distance. The biogeoclimatic subzones that occur along the transmission line corridor are summarized in Table 13-3.

The MS is the most extensive and, in the western parts of the route, the most common biogeoclimatic zone. It is a forest zone characterized by climax forests of hybrid white spruce and subalpine fir (*Abies lasiocarpa*). However, successional stands of lodgepole pine dominate most of the landscape as a result of intense forest fires that have occurred throughout much of the area. Only one subzone, the Very Dry Very Cold (MSxv) subzone, occurs along the route. The MSxv is distinguished from other subzones of the MS zone by the common occurrence of black crowberry (*Empetrum nigrum*), reindeer lichens (*Cladina* spp.) and common juniper (*Juniperus communis*), as well as the absence of certain species on zonal sites (Meidinger and Pojar 1991).

The IDF is an important zone for timber production and grazing that covers a large part of the transmission corridor. This zone is particularly common in the eastern sections from about km 0 to 21 and from km 26 to 34. The Dry Cool subzone (IDFdk) and Very Dry Mild subzone (IDFxm) occur along the corridor. Douglas-fir and lodgepole pine are the most abundant commercial tree species in the IDF. Hybrid white spruce occurs in riparian areas and in some sites that receive seepage water.

The SBPS zone along the corridor is almost as extensive as the IDF zone. It occurs along and near the corridor from about km 78 to 100 and to the north of the corridor centerline between about km 35 and 41. The SBPS is a forest zone that occurs at elevations below the MS zone. Lodgepole pine is the dominant species. The main subzone that occurs along the route is the Very Dry Cold (SBPSxc) subzone. The SBPSxc covers about six kilometers between km 35 and 41 along the centerline.

The BG is a grassland zone occurring adjacent to the Fraser River. Two subzones of the BG zone are located along the corridor; the BCxh (Very Dry Hot subzone) occurs at the lowest elevations with the BGxw (Very Dry Warm subzone) just above the BCxh. The ESSF is a subalpine forest zone and occurs in a small area near the western end of the corridor. The ESSFxv (Very Dry Very Cold) is the subzone in this area.

Approximately 90% of the corridor is forest land. This estimate includes some recently logged or not satisfactorily restocked areas that comprise about 12% of the corridor. The non-forest lands include grasslands of the Bunch Grass biogeoclimatic zone along the Fraser River as well as open range, native (grass/sedge) hay meadows, and shrubby willow-birch wetlands.

Lodgepole pine is the dominant tree species in 34% of the forest stands and is co-dominant with either hybrid white spruce or Douglas-fir in 38% of the stands. Douglas-fir is the dominant tree species in 28% of the stands in the IDF, particularly in the eastern part of the corridor, but also in some non-zonal SBPS and MS stands.

Most of the forests along the corridor are mature forests. Almost 90% of the forest stands in the corridor are older than 80 years. Forty-six percent are between 140 and 251 years of age. Less than 10% of the stands are younger than 60 years.

Although the forests are predominantly mature, the stands have modest productivity. About 14% of the forest stands within the corridor are of high quality (BCFS good or medium site classes). Seventy-six percent of forest stands have a BCFS site class of poor and 10% have a low site class. The 'low' site class is the least productive.

The timber yield for stands along the corridor varies depending on the dominant tree species. The average yield for stands ranges from about 50 $m^3$/ha for certain selectively logged stands to 150 $m^3$/ha for mature Douglas-fir stands and 180 $m^3$/ha for mature hybrid white spruce. A yield of 50 $m^3$/ha represents a marginally merchantable yield.

Forest capability along the corridor is, in general, low. The gross MAI, as a weighted average, for the entire transmission corridor is about 1.4 $m^3$/ha/y, based on the predominant CLI forest capability ratings of Class 5, 6, and 7. A summary of the CLI Forest Capability Classes for the transmission corridor is provided in Table 13-4.

#### 13.3.2.2 Forest Land Use

The transmission line intersects the 100 Mile House, Williams Lake, and Chilcotin administrative districts of the B.C. Forest Service. Only the first few kilometers at the eastern end of the corridor are in the 100 Mile House District. The next approximately 100 km to the west lie in the Williams Lake Forest District and the last (approximately) 24 km at the western end of the corridor fall in the Chilcotin Forest District.

Logging activity has occurred in this area for many decades. Most of the larger-scale, commercial logging operations along the transmission corridor, particularly clearcutting in western areas of the SBPS and MS biogeoclimatic zones, have occurred in the last 15 years. Extensive logging has occurred over the past 25 years or more in other areas, such as the Douglas-fir stands along the eastern part of the route.

The transmission line corridor lies within the Williams Lake TSA. Approximately 1% of the land within the corridor (less than 10 ha) is private. The B.C. Forest Service administers the remaining Crown land of the corridor and Riverside Forest Products Limited is the main licensee operating in the area. In the past, Timber West was the main company operating in the area but their operations in the Cariboo were absorbed by Riverside Forest Products Limited in 1997. West Fraser Mills Ltd. operates north of the corridor near Willan Lake. Other important operations in the Williams Lake TSA are those of the SBFEP which is managed by the B.C. Forest Service through the Williams Lake district office.

Roughly 25% of the length of the corridor is within the Grasslands Integrated Resource Development Zone (IRDZ) of the CCLUP. The remainder is in the Gaspard Enhanced Resource Development Zone (ERDZ). Forestry is a recognized use in the IRDZ and the ERDZ. The total area to be cleared for the transmission line corridor represents a small fraction of a percent of the total forest area in the IRDZ (about 0.08%) and the ERDZ (about 0.16%).

### 13.3.3 Construction and Operation

#### 13.3.3.1 Potential Effects Assessment

As discussed for the mine development, transmission line construction also has the potential to affect timber resources through losses of merchantable timber, losses to the

productive forest land base, the destruction of immature growing stock and disruption of forestry operations and plans.

### *Timber Harvesting*

The following assessment of the volume and value of merchantable timber that will be harvested within the transmission line right-of-way as a result of project construction is based on Jones (1996; 1998). The estimates were calculated using B.C. Hydro clearing width standards for wooden 'H'-frame power poles.

A total of about 45,000 $m^3$ of merchantable timber will be cleared from 438 ha of transmission line right-of-way. This timber (based on recent volume estimates and log selling prices) represents more than two and a half million dollars in potential stumpage revenue and profit. The timber can be recovered by existing licensees such as Riverside Forest Products Limited or through the SBFEP. Interested parties will require adequate notice to accommodate the removal of the timber. This volume and value of timber will be diminished by any future logging activity that occurs post-1998, prior to right-of-way clearing. As this timber will be recovered, there will be no significant residual effects due to timber loss.

Riverside Forest Products Limited, the major forest operator in the area of the transmission line corridor, West Fraser Mills Ltd., and the SBFEP, have expressed interest in working with the proponent to clear the right-of-way within their interest areas.

There are about 15 ha of mature, non-merchantable timber that will be removed within the right-of-way. These include areas disturbed by logging or fire that are not yet adequately stocked with commercial tree species and some open, parkland-like stands that occur mainly in the IDF zone. There may be as much as 800 $m^3$ of unsalvageable merchantable trees in these areas. To put this in perspective, 800 $m^3$ is similar to the anticipated yield from 5 to 10 ha of well-stocked, productive forestland in the region. The stumpage value of the non-merchantable timber is predicted to be very low or perhaps to have no value, or even negative value.

It is estimated that 60% of the timber volume is composed of lodgepole pine. About 30% is Douglas-fir and 10% is hybrid white spruce. Douglas-fir is the species that contributes the most to the timber volume in forest stands to the east of the Fraser River. Lodgepole pine and Douglas-fir contribute similar volumes in the section of the corridor just east of the Fraser River to just west of Vedan Creek. Lodgepole pine is the major merchantable species that grows in most of the remaining corridor to the west. However, hybrid white spruce is also important in stands between Kloakut Lake and the mine site.

The estimated stumpage value of timber within the transmission line right-of-way, based on the volume estimate of 45,000 $m^3$ and a stumpage of \$17/$m^3$ (Jones 1998), is \$765,000. Table 13-5 provides an up-dated summary of forest cover along the transmission line right-of-way.

### *Destruction of Immature Growing Stock*

There are about 54 ha of immature forest within the transmission corridor. The replacement value of the immature growing stock that would be lost as a result of installation of the wooden 'H'-Frame transmission line was estimated by Jones (1998) to be \$153,000. Jones (1996 in Appendix V) shows the assumptions and procedure for arriving at this estimate.

### *Loss of Productive Forest Land Base*

The estimated maximum area to be cleared within the right-of-way is 607 ha which comprises only 0.04% of the total area (1.66 million ha) available for timber harvesting in the Williams Lake TSA.

Jones (1996) reported an average MAI for the western blocks of the Williams Lake TSA of 1 $m^3$/ha/y. As a check for the purpose of this assessment, another estimate of MAI was generated based on sampling from CLI mapping which resulted in a weighted average MAI of 1.4 $m^3$/ha/y. The latter figure is a gross MAI, which must be reduced to account for decay, waste, breakage and merchantability factors. After taking into account these factors and adjusting the gross MAI, a net MAI of about 1.12 $m^3$/ha/y is more realistic. This figure is slightly higher but very close to the average rule-of-thumb MAI for the TSA of 1 $m^3$/ha/y. This likely reflects the inexact nature of MAI estimates rather than actually higher MAI's for the transmission line.

The greatest total loss of MAI for the lifetime of the transmission line can be predicted using the highest estimate of MAI and the area to be cleared of 607 ha. At most, about 700 $m^3$/y of MAI will be lost for the duration of the project by clearing the right-of-way.

### *Disruption of Forest Planning and Operations*

The existing tenure holders have several Forest Development Plans in effect along the transmission corridor. The plans for cutblocks and roads within or immediately adjacent to the right-of-way may require alteration to accommodate construction of the transmission line.

The forest companies (Riverside and West Fraser Mills) operating in the vicinity of the transmission corridor, as well as the SBFEP, have indicated an interest in working with the proponent to develop harvesting plans for the merchantable timber within the transmission line right-of-way. This will entail revisions to the existing Forest Development Plans that will require considerable lead-time, especially in terms of accommodating the SBFEP, which could take up to two years or longer.

Where sufficient lead-time is not possible, the Forest Service may grant cutting rights through a license to cut under the authority of Section 47(2) of the Forest Act. BCFS officials have indicated that they would issue a license to cut only under the following general terms:

- The license to cut would be issued in the name of the proponent (not in the name of logging contractors or others); and
- The license would require that merchantable timber be decked for sale, probably to the highest bidder under the SBFEP.

Regardless of the approach to cutting the timber, the mine owner would not receive revenue from the sale of the timber.

### *Other Issues*

A significant portion of the transmission line corridor is within the Grassland IRDZ and the Gaspard ERDZ of the CCLUP. However, the amount of land to be cleared is only a negligible fraction of the total forest land and it should not negatively impact strategic planning goals.

Other forestry issues related to transmission line construction include:

- Potential disruption of access roads currently used by the forest companies due to transmission line right-of-way clearing and construction activities; and
- Increased risk of fire related to construction activities.

#### 13.3.3.2 Mitigation and Enhancement

The following measures will be implemented to mitigate potentially negative impacts of transmission line construction and maintenance:

- The proponent will work closely with the forest companies and the BCFS to ensure that current Forest Development Plans are modified to accommodate right-of-way clearing requirements.
- The proponent will work closely with the forest companies and the BCFS to ensure that existing access roads are maintained and that forestry operations are not disrupted during construction of the transmission line.
- Contractors will abide by the fire protection requirements of the Forest Practices Code, to minimize increased fire risk.

Logging and clearing operations in the vicinity of streams, especially on difficult terrain, will closely follow procedures in the Forest Practices Code and may require special permits from BC Environment and the Federal Department of Fisheries and Oceans. In several cases, trees will need to be removed adjacent to the streambanks in order to meet transmission line clearance standards. In these cases, special plans and procedures, such as directional falling and the use of light flotation or cable yarding equipment, will be applied. Potentially sensitive areas have been identified on Maps 13-2 and ?, and a summary description of these sites is provided in Table 13-2.

#### 13.3.3.3 Residual Effects Assessment

The following provides a summary of the residual effects of transmission line construction, operation and closure:

- No residual effects will occur with respect to merchantable timber;
- Potential disruption of current forestry plans and operations will be mitigated to the extent possible through close liaison with forest companies and the BCFS;
- There will be a loss of 60 ha of immature growing stock within the transmission corridor, with an estimated replacement cost (or “liquidation cost”) of $153,000;
- The loss of about 600 ha of productive forestland within the right-of-way will be in effect for the life of the mine and transmission line, estimated to be 15 to 20 years. This will result in the loss of approximately one quarter of the rotation required for merchantable lodgepole pine. At mine closure, the transmission line will be removed and the right-of-way will be planted to suitable growing stock, which will ultimately return the land to its current productive capacity.

#### 13.3.3.4 Monitoring and Management

All logging operations and access road construction will meet the requirements of the Forest Practices Code.

Close liaison will be maintained with the Ministry of Forests, Riverside Forest Products, and West Fraser Mills, to ensure orderly development with minimum disruption of transportation routes and forestry plans.

All forestry planning and logging operations will be carried out under the guidance and monitoring of a qualified Registered Professional Forester.

In accordance with the PRS, a number of detailed forestry studies and plans will be developed under the guidance of a Registered Professional Forester following Project Certification, including:

- A detailed clearing plan, including access requirements and logging methods and procedures;
- A detailed topsoil salvage and handling plan related to the construction of new access roads that will be reclaimed either following construction or mine closure;
- Terrain stability assessment related to logging access road requirements; and
- Detailed inventory of timber within the right-of-way to Ministry of Forests standards.

### 13.3.4 Closure

The transmission line will be reclaimed at closure. All productive forestland that was cleared for the line, as well as any access roads that were constructed for the line, will be reclaimed according to Forest Practices Code standards in effect at the time. The key components of access road closure and returning the roads to productive forest land will be the salvage and stockpiling of topsoil material required to replace the rooting zone and the provision of adequate drainage controls to prevent soil erosion following closure.

## 13.4 13.4 Cumulative Effects Assessment

to be discussed with John Boyle

## 13.5 13.5 Summary and Key Conclusions

to be written after decisions on end land use objectives are made (discuss with John Boyle)

# 14 REFERENCES

Jones, J. R. 1996. Forest clearing required by a proposed 230 kV transmission line from Dog Creek to Prosperity mine project Williams Lake, B.C. A report submitted to Ian Hayward International Ltd. Simons Reid Collins, Vancouver, B.C. 12 pp. plus appendices.

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Meidinger, D. and J. Pojar (eds). 1991. Ecosystems of British Columbia. Province of British Columbia. B.C. Ministry of Forests, Research Branch, Victoria. 330 pp.

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**Map 13-1 Mine Site Forestry**

**Map 13-2 Transmission Corridor Forestry**

## Table 13-1 The volume ($m^3$) of merchantable timber and percent of total volume by age class for the mine development footprint

| Age Class | Age (years) | Volume ($m^3$) | |
|---|---|---|---|
| 1 | 0-20 | 0 | (0%) |
| 2 | 21-40 | 116,832 | (40%) |
| 3 | 41-60 | 1.5 | (nil) |
| 4 | 61-80 | 1,797 | (0.6%) |
| 5 | 81-100 | 4,238 | (1.4%) |
| 6 | 101-120 | 38,535 | (13%) |
| 7 | 121-140 | 47,176 | (16%) |
| 8 | 141-250 | 83,878 | (29%) |
| Total | | 292,371 | (100%) |

## Table 13-2 A summary of the forestry-related features along the transmission line

| Kilometer | Forest Cover Map Sheet | Features and Values | Comments |
|---|---|---|---|
| 0 to 9 | 92O.070 | Logging (1972-1982) | License #s A20019 & A02017 |
| 3 | 92O.070 | Gullied terrain along Bingham Creek | May require cable or other special yarding methods when logging RoW |
| 22 to 27 | 92O.069 | Primarily private land. Few trees in many areas | Primarily rangeland. Poor forest growth. Some steep terrain |
| 26 | 92O.069 | Forest occurs at higher elevations near km 26.5 | Crosses Fraser River |
| 34 | 92O.069 | Selectively logged areas | Fir-dominated stands logged about 20 to 30 years ago |
| 36 to 37 | 92O.069 | High quality F, F(Pl) (and some high quality logged) sites | Could avoid most of these sites by staying to the north side of corridor |
| 35 to 40 | 92O.068 | Many logged areas | Mostly Fir and Fir-Pl stands. Logged about 20 to 30 years ago |
| 35 to 42 | 92O.068 | High quality Fir and Fir-Pl sites | Mainly along the south side of centerline from km 36 to 40 and along the north side from km 40 to 42 |
| 42 to 56 | 92O.078 and 92O.077 | Many selectively and clearcut logged Fir, Fir-Pl and Pl stands. Also, some high quality sites | Most logging is from 1974-76. Most high quality sites could be avoided by moving alignment north or south of centerline |
| 47.5 | 92O.078 | Gully side slopes of Farwell Creek | Slopes are stable but special care in falling and yarding may be needed |
| 48 to 55 | 92O.077 | Considerable logging from 1970's and 1980's | Mostly clearcutting of Pl-dominated stands. Some selectively logged, Fir-dominated stands. License #s A05451, A20019, A01920 & A20025 |
| 55 | 92O.077 | Vedan Creek-wetlands and meadows | Riparian zone protection required. Mostly non-forest or forested with small, poor quality Pl |
| 55 to 59 | 92O.077 | Some high quality Fir, Fir-Pl and logged sites, especially on north side of centerline | |

| Kilometer | Forest Cover Map Sheet | Features and Values | Comments |
|---|---|---|---|
| 60 to 74 | 92O.076 | Much private land | From about km 60 to 63 and 69 to 73, private lots cover much of the corridor. Between km's 63 and 69, private lands are mainly on north side of centerline |
| 67 to 73 | 92O.076 | Big creek floodplain and riparian areas | |
| 70.5 | 92O.076 | Steep, failing cutbank above Big Creek | Top of bank is about 35 m above floodplain level |
| 71 and 72 | 92O.076 | Some large clearcuts | License # A20019. |
| 73 | 92O.075 | Scattered large Fir vets, especially around the Mons Lake area | Most forests here are dominated by Pl. Other species are Fir, S & At |
| 73 to 76 | 92O.075 | Some 1985 logging | |
| 73 to 76 | 92O.075 | Big Creek riparian areas and lakeshore areas of Mons Lake and several small lakes. Also much private land | |
| 76 to 80 | 92O.065 | Many private lots across corridor. Wetlands, riparian areas and meadows near the west end of Mons Lake, south side of the centerline | |
| 78 to 80 | 92O.065 | Cross and follow Big Creek | |
| 76.5 to 79.5 | 92O.065 | 1989 clearcut logging, south side of centerline | |
| 77 to 78 | 92O.065 | High quality sites with stands of S, P., and Fir-Pl | |
| 80 to 84 | 92O.065 | Recent clearcut logging | |
| 82.5 | 92O.065 | Stable creek gully. | |
| 86 to 92 | 92O.065 | N-S flowing tributaries of Bambrick Creek | Gully slopes appear stable |
| 90 | 92O.064 | Logging | License #A020019 |
| 87 to 92 | 92O.064 | Potentially sensitive riparian areas along Willan and Bambrick creeks, just south of centerline | |
| 91 (approx.) | 92O.064 | Willan Lake Private lot south of centerline | Lot 2313 |
| 92 (approx.) | 92O.064 | Private lot south of centerline | Lot 8451 |
| 92 to 97 | 92O.064 | Mostly Pl stands of poor and low site class, Spruce in wetter areas. A number of young (40 to 80 year old), Pl stands | |
| 98.5 | 92O.064 | Willan Creek gully | Gully appears to be stable |
| 97 to 99 | 92O.064 | Clearcut logging, logged in 1986 & 1987 | License # A26974 |
| 98 to 100 | 92O.064 | Willan Creek drainage, wetlands and meadows to south of centerline. | |
| 103 | 92O.064 | Kloakut Lake – wetlands, meadows and lakeshore | |

| Kilometer | Forest Cover Map Sheet | Features and Values | Comments |
|---|---|---|---|
| 106 and 108 | 92O.053 | High quality sites | Mature (141-250 year old) stands of Pl and S in high site areas. Also some NSR |
| 109.5,111.5, 112,113,114, 115,116.5 &118 | 92O.053 | Tete Angela Creek and tributaries | Ensure riparian areas are protected during logging |
| 122.5 to end | 92O.043 | Cross (un-named) creeks | Observe standard precautions for riparian areas |

## Table 13-3 The biogeoclimatic subzones along the transmission line

| Biogeoclimatic Subzone | Distance from Eastern End (km) | Length (km) | % of Total Length |
|---|---|---|---|
| IDFdk | 0 – 14.4 | 14.4 | 11.5 |
| IDFxm | 14.4 – 21.8 | 7.4 | 6 |
| BGxw | 21.8 – 23.1 | 1.3 | 1 |
| BGxh | 23.1 – 25.8 | 2.7 | 2.2 |
| BGxw | 25.8 – 26.7 | 0.9 | 0.8 |
| IDFxm | 26.7 – 34.1 | 7.4 | 5.9 |
| ESSFxv | 107.6-111.6 | 4 | 3.2 |
| MSxv | 34.1 – 79.6<br>99.6 - 107.6<br>111.6 - ~124 | 65.5 | 53.3 |
| SBPS | 79.6 – 99.6 | 20 | 16.1 |

## Table 13-4 The percent area of CLI Forest Capability Classes along the Transmission Line

| Canada Land Inventory | Forest Capability ($m^3$/ha/y) | Percent of Area |
|---|---|---|
| Class 4 | 3.6-4.9 | 0.2% |
| Class 5 | 2.2-3.5 | 13.6% |
| Class 6 | 0.8-2.1 | 63.2% |
| Class 7 | <0.7 | 23% |

## Table 13-5 The area of each forest cover type to be cleared along the transmission line (Jones 1998)

| Forest Cover | Wooden 'H'-Frame Area (ha) |
|---|---|
| Merchantable Timber | 438 |
| Marginal Timber | 62 |

| | |
|---|---|
| Mature non-merchantable | 15 |
| Immature non-merchantable | 54 |
| Aspen (non-merchantable) | 5 |
| Regeneration | 22 |
| Logged - not satisfactorily restocked | 11 |
| Total | 607 |