RECLAMATION TO NATIVE FOREST ECOSYSTEMS IN THE OIL SANDS REGION[1]

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INTRODUCTION

Suncor's reclamation goal is to achieve maintenance-free, self-sustaining ecosystems with capability equivalent to their pre-disturbed condition. This does not imply a changeless state, as landforms will experience the normal processes typical of the region leading to gradual reshaping of the landscape. Ecosystems are expected to evolve in revegetated terrain, from new plantings toward mature systems typical of those in the region.

Objectives of the Suncor reclamation program are:

- Disturbed lands shall be reclaimed with gentle slopes to primarily a forest use compatible with pre-disturbed terrain, providing a range of end uses including wildlife, traditional use and recreation; and
- Dyke slopes shall be revegetated primarily for erosion control providing natural end-use possibilities.

RECLAMATION PROCESSES

Development of a design to achieve Suncor's reclamation goals and objectives requires consideration of the principal processes influencing ecosystem development. The types of vegetation and soil that will develop on Suncor leases are dependent on climate, topography, parent material, drainage and time. In addition knowledge and experience gained from years of active reclamation work in the oil sands region provide specific design guidelines.

Suncor's vision for reclamation includes the construction of stable landforms and re-establishment of productive, self-sustaining ecosystems which will provide land use capabilities equivalent to those of the pre-mining environment. The greatest portion of the reclaimed landforms on the current and proposed oil sands mines will be returned to upland forest; the remaining will consist of shallow wetlands with some open-water areas.

As a result of constructed features, there will be a transfer of some of the land areas into alternate land forms. Some of the low lying land will be transformed into well drained slopes with a ratio of three vertical to one horizontal (3:1). These will be better drained than the pre-existing landforms and allow for the development of a more productive forest complex.

ECOSYSTEM RE-ESTABLISHMENT

Suncor has developed and successfully demonstrated its reclamation techniques for overburden and tailings sand deposits over the last twenty-five years. Soil reconstruction of disturbed lands provides the basis for establishing self-sustaining ecosystems capable of supporting a number of end uses. Prepared reclamation areas then undergo a single seeding of barley which serves as a nurse crop for out-planting nursery seedlings

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and other natural vegetation. Area fertilization is also undertaken for two to four years to establish adequate nutrient levels. Woody-stemmed species are planted in reclamation areas with species mix and planting densities defined by the specific ecosystem-type goals for the reclamation area and the variable terrain features of the area.

Soil Reconstruction

Suncor's current soil reconstruction technique has been used on an operational scale since 1984. Reconstruction of soil for reclamation areas is one of the critical components of Suncor's reclamation plan with ultimate capability of the reclaimed area determined largely by the quality of reconstructed soil. Reclamation sites are enhanced with quality soil-building material, using a technique which involves stripping muskeg to include 25% to 50% (by volume) of mineral overburden. The peat/till mixture (wherever possible containing live native vegetation) is hauled, placed on prepared overburden, tailings sand sites and spread to an average depth of 15 cm to 25 cm over the underlying materials. Stockpiling of muskeg soil is employed where surface disturbance has begun but where no areas are yet available for reclamation.

Revegetation Process

Typically, the revegetation process begins with excavation and hauling of undisturbed muskeg soils to the reclamation area. This method (which is completed in the winter whenever possible) enhances site revegetation because dormant, insitu native seed and root fragments are transferred with the soil. Spreading of the muskeg soil on the reclamation site is completed in early spring with the usual result an emergence of a variety of native, woody-stemmed species, forbs, wildflowers and grasses.

Revegetation objectives are achieved through implementation of a program which involves: seeding of reclamation areas with ground covers designed to control erosion; area fertilization; and establishment of appropriate, woody plant species. Suncor currently uses barley as a ground-covering nurse crop on all reclaimed sites. Barley (an annual variety) provides erosion control without hindering development of native vegetation emerging from the muskeg soil by leaving stubble which traps snow, thus protecting out-planted shrub and tree seedlings during the winter.

Fertilizer is applied during initial years of revegetation; applications are made from four to five years, depending on results obtained from annual monitoring programs. Yearly fertilizer application is then discontinued so that developing herbaceous cover does not compete too vigorously with planted woody seedlings.

Establishment of woody plants on reclamation areas is integral to the reclamation process. Selection of species and the proportion of each species in the planting mix are based on the woody-stemmed species common to the eco-sites within the Suncor region; existing field conditions; the vegetation type expected to develop on the site (based on landscape terrain features); and the expected growth of woody-stemmed species from seeds and root fragments in the soil amendment layer. Suncor's woody-plant establishment methodology is designed to accelerate the process of natural succession towards desired vegetation types. As woody cover develops on a reclamation area the micro-environment modifies, providing favourable conditions for later successional and mature species. The planting program ensures these species are present, established and capable of taking advantage of condition changes.

Woody plant seedlings are propagated either from seed or cuttings collected in the Fort McMurray area. Seedlings are planted in early spring and late summer, the choice depending on logistics and availability of reclaimed areas. Tree and shrub seedlings are planted at an average density of 2500 stems per hectare. This planting density is chosen to ensure sufficient seedlings are planted to permit establishment of volunteer plants and to provide adequate stocking of each species after initial mortality. Variation in woody-stemmed species planting ratios will allow a return of the original forest ecosystem in as short a time as possible. This revegetation mix will undergo natural succession processes and become a mature biological community providing habitat for wildlife as well as areas for traditional land use and recreation. Specific areas on the reclaimed site will have possibilities for timber production.

Primary Vegetation Communities

Four primary vegetation types found in the region are expected to develop as a result of Suncor's revegetation program:

- Closed Mixed-Wood Forest - Coniferous Dominant (Pine Forest) - This vegetation type will be established on the edges of tailings sand plateaus and slopes.
- Closed Mixed-Wood Forest - Deciduous Dominant (Poplar-White Spruce/Shrub) - This vegetation type will be established on the moister areas of tailings sand plateaus and consolidated tailings deposits. It will also be established on overburden dykes used to re-establish Steepbank Mine escarpment areas within the Athabasca River valley.
- Closed Mixed-Wood Forest - Coniferous Dominant (White Spruce-Poplar/Shrub) - This vegetation type will be established on the overburden dumps, the lower portions of the tailings dyke slopes with northerly aspects and on reclaimed consolidated tailings deposits.
- Wetlands Closed Shrub Complex - This vegetation type will be established on poorly- drained areas of tailings sand plateaus and consolidated tailings deposits.

MONITORING

Monitoring programs are instrumental in demonstrating that clear progress toward environmentally-sound and fully-mature ecosystems is being achieved as a result of the reclamation program implementeed at Suncor. Assessment of the sustainability of re-established ecosystems requires consideration of soil reconstruction, evaluation of revegetated areas, with forecasts of evolution of revegetated areas to mature systems. To determine this development, vegetation and soil characteristics in reclaimed areas are monitored each year. The monitoring program consists of annual vegetation cover assessment and soil sampling from areas reclaimed within the past three to four years, followed by detailed assessment and sampling of all reclaimed areas every fifth year.

Soils

Performance of topsoils and subsoils is a key parameter for ecosystem sustainability, and erosion control. Suncor has monitored and assessed its reclaimed soils by comparing trends of key parameters to reference soils. Results form the soil monitoring program indicate that the reclamation soils have sufficient nutrients to support an initial vegetative cover and improve in capability as they develop toward representative soils in the region.

Vegetation

The reclamation monitoring program assesses achievement of the reclamation objective of "returning the disturbed lands to a forested use compatible with pre-disturbed terrain, providing habitat for wildlife and with possibilities for recreation". Since 1976 Suncor has conducted programs to monitor ecological development on its reclaimed sites. Results of the reclamation monitoring program were recently summarized in the February 1995 Application for Renewal of Environmental Operating Approval (Suncor 1995a). Specific studies were initiated in 1995 to assess vegetation and soil characteristics of both reclaimed sand structures and natural forested areas on Suncor and Syncrude mining leases. The objective of these studies was to continue assessment of methods used to establish vegetation species suitable for erosion control and which develop into self-sustaining communities compatible with surrounding ecosystems.

CONCLUSION

Suncor's current method of reclamation and tree planting results in a diverse herbaceous cover developing within a year of soil amendment application providing erosion protection along with a source of cover and food for wildlife.

Ecosystems re-established on reclaimed sites will be self-sustaining and will function in a similar manner to ecosystems on undisturbed areas adjacent to the Suncor development. Individual components of re-established ecosystems have been evaluated as follows:

- Reconstructed soils have been shown to be equivalent to or better than original soils.

- Results of field monitoring indicate that Suncor's reclamation sites are developing into sustainable ecological units comparable to nearby natural forest areas. These results together with those from terrain modelling show that Suncor's reclamation strategy will achieve long-term, mature communities sustainable under current topographic and climatic trends.
- Successful development of a viable reclamation area vegetative cover together with establishment of reclamation drainage systems means that reclamation ecosystems will become viable wildlife habitats.

The characteristics and ecological diversity of reclamation areas will provide the flexibility to accommodate a number of end uses. Suncor believes that the reclamation plan and methods presented will meet the goal of achieving maintenance-free, self-sustaining ecosystems in the oil sands region with capability and plant community diversity equivalent to the pre-disturbed condition.

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