PINE RIDGE FOREST NURSERY DEVELOPMENT & DESIGN

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Provincial legislation places the responsibility on the wood producing industries within the province to reforest crown lands cutover by themselves either by obtaining seedlings from the provinces existing nurseries or by paying a regeneration levy, in which case the province will take up the responsibility of reforesting cutovers on crown lands. Forest Management Agreement Holders do not have this option. The province is also responsible for regenerating areas burned over by fires on crown lands. Government legislation also makes provision that the seedlings required for this purpose be supplied to the wood producing industries by the Department of Energy and Natural Resources as required. Industry must supply the required amount of seed bearing cones to grow the requested number of seedlings. In order to meet this steadily increasing demand for seedlings the Alberta Department of Energy and Natural Resources are in the process of planning, designing and developing a new large forest nursery complex near Smoky Lake, approximately 90 miles north east of Edmonton; the project is entitled Pine Ridge Forest Nursery. The proposal is to grow 10 million bareroot and 10 million container seedlings annually at this facility.

The parameters that were considered in locating a nursery site were:

(a) Soil Texture: The soil type is loamy sand which is well suited to good drainage and the soil can be worked when weather conditions would forestall operations on heavier soils. Also light soils do not usually present the same chronic weed problems as heavier agricultural soils.

(b) Soil pH and organic matter content: For satisfactory growth of conifers, soils should be about a pH of 5.5 to 6.0. Our soil is a pH of 6.0 to 6.5 and this may he taken care of by the addition of sulphur to the soil. Organic matter content should be 5 to 8 per cent. Our soil is deficient (.5 – 1.0%) but this will be amended by the addition of peat which will be done prior to seeding.

(c) Soil Depth: A soil depth of 4 feet free of hardpan, claypan or calcarious substrata is required and our soil is continous sandy loam to a depth of in excess of 80 feet. The water table is at a depth of approximately 100 feet. Hence there is no impeded drainage.

(d) Water Supply: An adequate water supply is a necessity. We will be pumping water from the North Saskatchewan River which is about a mile and a quarter south of the nursery site. The water will be pumped up an elevation of 180 feet across the mile and quarter of terrain and into an on site reservoir in the proximity of the main buildings. Then water will

be drawn from here for irrigation of the fields, greenhouses and remainder of the facility. This water is slightly alkaline and requires acidification. There is an injection system at the reservoir pumphouse that will monitor and make pH adjustments to the water. Fertilizer and herbicides may also be injected.

(e) Topography: The topography where the nursery fields will be located is slightly undulating with slopes not exceding 3 per cent; this will greatly facilitate machinery operation. Fields are rectangular in layout and shelterbelts are oriented to oppose the prevailing storm winds. The topography is much more variable both to the east and west of the field area, being interrupted by depressions and glacial sink holes.

(f) Climate: The climate in this area is suitable in that it is relatively free of early and late frosts. There is good air drainage on all sides except the north. The area is relatively free of damaging hail storms.

(g) Cover: The area supported a stand of uneven aged jack pine. The stand was utilized where at all possible to provide temporary shelterbelts between fields and because the area is subject to mistletoe infection a program will be started to replace the natural shelterbelts with a non-susceptible species.

Various sites were studied throughout the province considering the above parameters and the site was chosen near Smoky Lake as being most suitable.

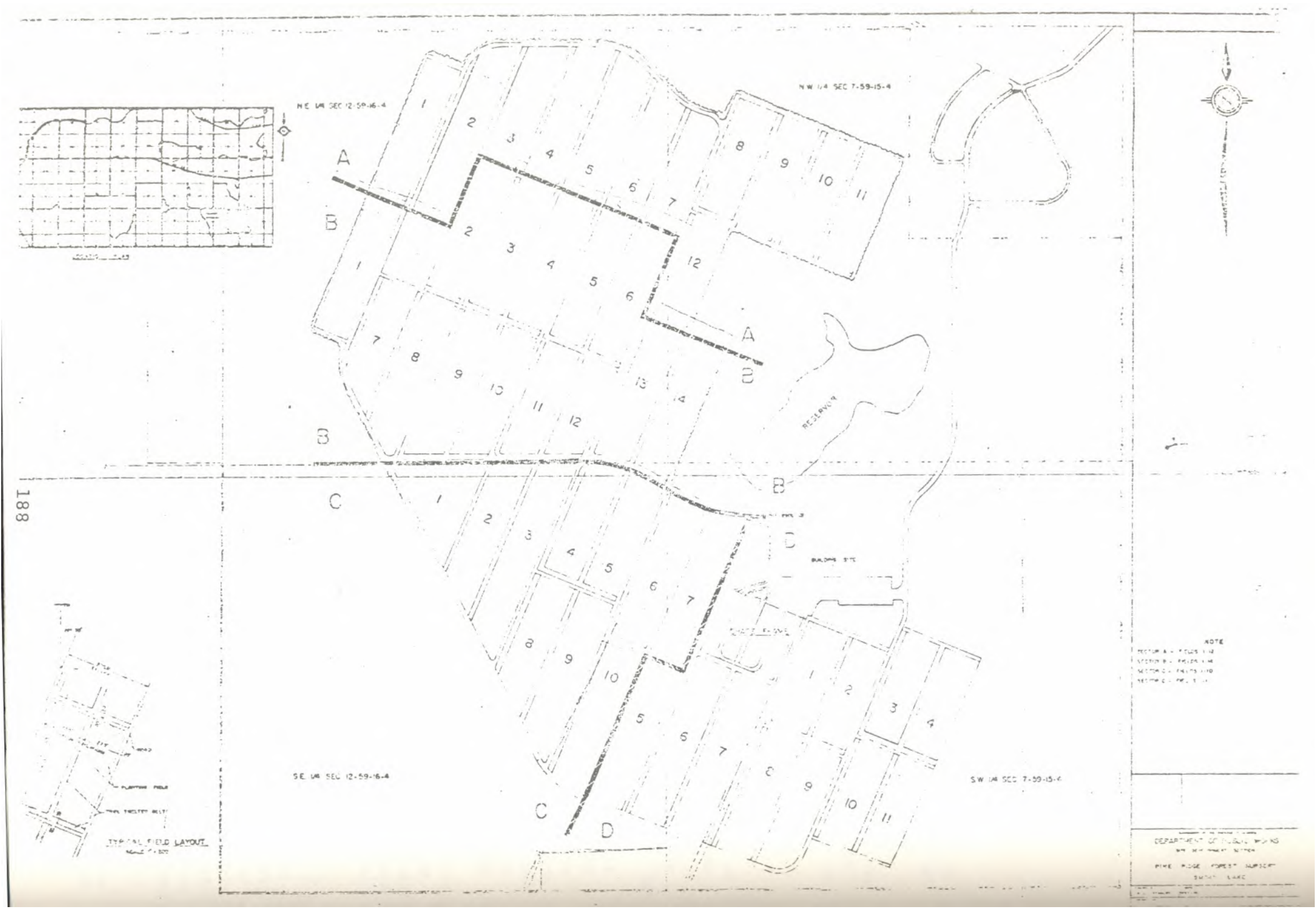
Site Development

The Pine Ridge Forest Nursery site plan (Fig. 1) showing the bareroot field layout plan, reservoir, and building site is attached. There are 43 fields varying in size from 3 to 4 acres, the total area available for field production is approximately 170 acres. Long term weather records provided the information on prevailing storm winds, which was used in the site plan surveying and orientation of the shelterbelts which are at right angles to the prevailing storm winds. Shelterbelts are leave strips from the original jack pine stand.

Initial development of the site began in the winter of 1975 with a control survey and the development of a one foot interval contour map of the proposed production area. This map provided the basis for the development of our field layout plan.

In the spring of 1975, after establishment of the site plan on the ground by control survey, a cutting program was initiated to salvage all post and log material from the fields and road right-of-ways. This also involved the location and establishment of the main building site and the reservoir area. The salvage cut proceeded on into the spring of 1976 and was completed in May. Also during the summer of 1975 a 6 foot high chain link fence was erected on a cut right-of-way, which encompasses approximately 44 quarter sections. (680 Ac.) This will constitute the main production and service area. The purpose of the fence is to deter game and rodents from entering the property that may constitute a potential hazard to a crop.

All the material salvaged from the cutting operation has been disposed of by public auction sale and most of the material was bought by local farmers for posts.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RESERVOIR
BALDWIN SITE
TYPICAL FIELD LAYOUT
NOTE
DEPARTMENT OF PUBLIC WORKS
PINE RIDGE FOREST NURSERY
SWIFT LAKE

In the spring of 1J76 a clearing contract was awarded for the stumping and clearing of the 170 acres of field area. The contract stipulated that all roots, stumps, and debris had to be removed from the soil and transported to a disposal area. That is, no disposal by burning took place on the field areas because of the possiblity of altering the soil reaction. Also care was to be taken to prevent the removal of top soil from the fields during the clearing. This resulted in a novel way of land clearing in that the contractor used backhoes to remove stumps, and a loader and trucks to transport the material to the burning site. This method resulted in a relatively clean soil with minimum soil disturbance. The clearing was completed in the period from June 1976 to October 1976.

In the spring of 1977 the final cleaning operation was carried to completion in the field area, the objective of which was to remove the smaller root material that was left after the stump clearing operation. The procedure that worked most effectively involved a series of root raking operations separated by a series of chisel ploughing and discing operations. The first root raking operation was with a large rotary drum type "Dika" rake, which windrowed the largest material, which in turn was picked up by a basket type rock picker with a hydraulically operated dump. The roots and debris were dumped into trucks and transported to the disposal area.

This operation was followed by side delivery root raking operation, This implement is very similar to a hay rake but constructed of much heavier metal. This rake picked up the intermediate size root material and debris. The final stage of raking employed an actual side delivery hay rake which picked up only the finest root material. The material gathered in this final operation was unable to be lifted by the rock picker and thus hand labour was used for loading onto wagons for transportation off the field areas. This procedure was followed for each field and the number of cultivation and root raking operations varied depending on the volume of roots to be removed from the soil.

Nursery Buildings - Design and Development

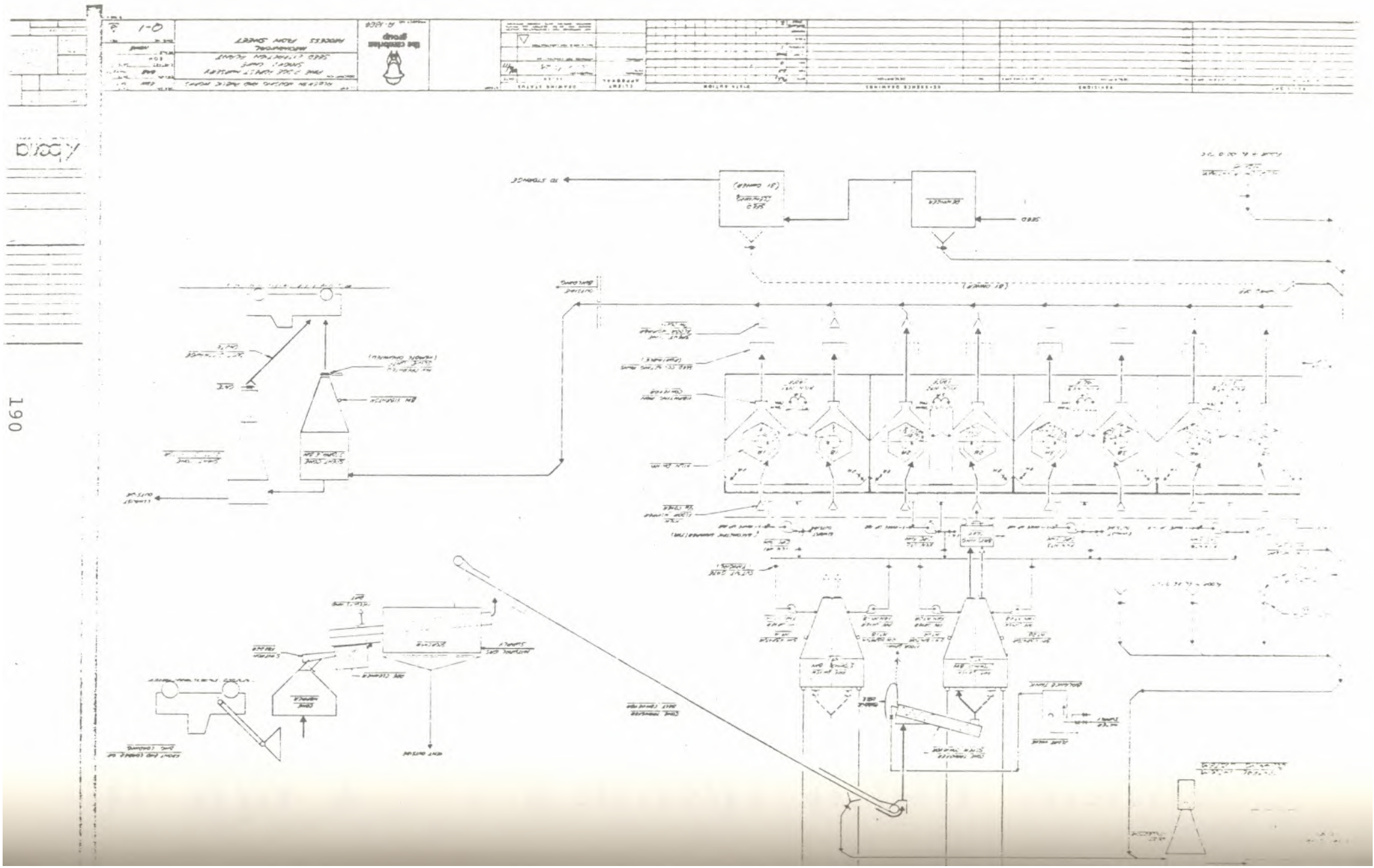
The physical plant and buildings were designed and constructed to support four major functions, which are:

(a) Seed Extraction
(b) Bareroot Seedling production
(c) Container Seedling production
(d) A tree improvement and seedling production investigations program

Seed Extraction

The design objective was to provide a seed extraction facility that was capable of processing 50,000 bushels of spruce and pine cones per year. In order to attain this objective there is required a 30,000 bushel cone storage facility. These are steel frame sheds with heavy gauge wire screening on the outside. All spruce cones will be stored in self stacking pallets, and the pine will be stored in stacking tote bins.

The process is to move stacks of pallets from the cone storage buildings into the seed extractory building by fork-lift. Once inside, the cones are dumped into a hopper and then go through a pre-cleaner that will separate debris and foreign material. (see attached flow chart) The next step is the



scorching unit which will be used to break the resin bond on the pine cones. The spruce cones will bypass this process. The cones then proceed up into the preheater bins by means of a conveyor belt.

The preheat bins utilize the exhaust heat from the kilns to pre-condition the cones before going into the kiln. This is an energy saving and time saving device. Batch carts are loaded from the preheat bins and then positioned over the appropriate kiln and fed into the drum in the kiln by means of a chute. The batch cart holds approximately 30 bushels the capacity fo each kiln drum.

Each of the kiln drums are hexagonal in shape for maximum tumbling effect when the drums are rotating. Both the inside temperature of the kiln and the drum rotation speed are variable; the temperature to 160 degrees F and the rotation to 15 RPM. Each will be adjusted to suit the species and seedlot being extracted.

Once seed is separated from the cones they fall through the drum, through the floor of the kiln, and are then conveyed into a catch bin. This step provides continous visable evidence of the progress of the extraction process, as well, as the effects of varying the temperature and rate of rotation. There is also the facility for raising the humidity in the kiln by steam injection.

Dumping of the cones in the kiln once the extraction cycle is complete merely requires reversing the direction of rotation of the drum and the spent cones will fall out, which also falls through the bottom of the kiln and are conducted outside of the building into the spend cone hopper by means of a vacuum system.

The seed cleaning system consists of scalpers, wet dewinger, liquid separator, seed dryer, air separators, seed sizer, and gravity separators.

The seed cold storage building is a separate facility and is constructed 6 feet below the ground level in the side of a small hill. This type of structure was decided upon for energy conservation reasons, as well as facilitating a more closely controlled environment. The seed cold storage facility will have a capacity of 100,000 lbs. The temperature will be able to be controlled down to 0 degrees F and less than 10 per cent humidity. The seed testing laboratory is on the second floor of the seed extraction plant.

This facility was designed with maximum flexability in mind such that adjustments could be made to accommodate inherent differences in species and differences between seedlots in order to attain maximum yield and still maintain a high quality standard in terms of seed viability. An effort was also made to minimize the operational energy requirements. The system offers the advantage of a relatively continous flow system while at the same time enables us to keep separate relatively small seedlots.

Bareroot Seedling Production

There is sufficient field area developed to enable an annual production of 12 to 15 million seedlings on a three year crop rotation, including one year summer fallow. There is also additional area available for expansion of the field production if and when required.

Fall sowing will predominate with some spring sowing to take care of late orders, winter losses, and contingency orders.

The soil is a light loamy sand with a low organic matter content. In order to improve the soil standard, there is approximately 200 cu. yds. per acre of peat moss incorporated into each field prior to seeding. The nursery has rights to, and operates, a peat bog about 18 miles from the nursery site. Peat extraction is carried out in the winter months.

The field irrigation system consists of a river intkae at the North Saskatchewan River, 1.25 miles south of the nursery site, which pumps water into the on-site reservoir. The reservoir also supplies the water requirements for the balance of the nursery.

All irrigations mains and submains are under ground with stand pipes at the head of each field. Above ground in the field area is a solid set lateral system with impact sprinklers. The irrigation system is also fitted with a fertilizer injection system as well as an acid injection system for making pH adjustments in the water quality; the water from the river is slightly alkaline.

Crops will be maintained using conventional methods, techniques, equipment and culturaling practices.

Once ready for shipping the crop will be lifted using a mechanical harvester. When lifted, the seedlings are transported into the grading and sorting area for assortment and packaging. Lifting will take place both in the fall and spring. All stock will go into cold storage to await shipping.

The bareroot cold storage was designed in such a way that there are no cross over of traffic flow paths. Once stock goes into the cooler it will leave via the shipping doors at the opposite end. This facilitates the idea of first stock lifted will be the first shipped. The cooler is divided into four separate rooms to facilitate start up and shut down as required. Again this is a measure to conserve energy.

Container Seedling Production

The container production facility consists of 160,000 feet of greenhouse area that will enable the production of 10 million seedlings per crop. At present the greenhouse facility need produce only one crop per year to provide for current requirements. The operational period will be from April 1st to Sept. 1st. Once demand for seedlings increase, the greenhouses are capable of being expanded to two crops per year.

There are 20 greenhouses, 10 on each side of a common central corridor. Each of the greenhouses are separate from each other to facilitate snow sheading in the winter. The quonset roof design will also facilitate snow sheading by providing a high pitch angle. The glazing material is fiberglass. The distance between greenhouses was established by calculating the sun angle in order to minimize the shadow effect of one greenhouse on another. The long axis of the greenhouses are oriented in an east west direction.

The production area in the main building will be used for filling and

seeding containers as well as grading and sorting for bareroot seedlings. Once filled and seeded the containers will be put into self stacking pallets. The pallet stacks will then be moved to the head of each greenhouse by fork-lift along the central corridor, where they will be transferred from the stack onto the benching system.

The benching system is equipped with rollers such that the pallets are readily moved along the benching system to the other end of the greenhouse. The pallets are readily separated to allow workers in between to facilitate crop maintenance.

The pallets will be taken out of the greenhouse through the opposite end, stacked and moved by fork-lift into the shade frame area. Container seedlings will be ready for shipping when they leave the greenhouse but the majority will be over-wintered in the shade frames and shipped to the planting site in the following spring.

All the greenhouse lighting, heating, and watering, as well as fertilizer injecting, will be controlled from a separate control panel for each greenhouse. The irrigation system is on the bench, which consists of supply lines, risers, and distribution sprinklers. The lighting provided is minimal in that the requirement is only to control photo period rather than to promote growth. Each greenhouse is equipped with a CO_2 generator which is also tied into the central control panel. It is only activated when the vents are closed and the lights are on.

Tree Improvement and Seedling Production Investigations

There is a small greenhouse provided to house the operational aspects of the Alberta Forest Service's tree improvement program, and also to provide space for investigations into seedling production problems, methods and new techniques.

This facility will also be equipped with small seedlot processing equipment for tree improvement proposes.

This will be double glazed to facilitate year around environment control as well as for energy conservations.

Summary

The design and development of the Pine Ridge Forest Nursery was carried out by the Department of Energy & Natural Resources, Alberta Forest Service in cooperation with the Alberta Department of Public Works, for the sole purpose of producing reforestation and reclamation seedling stock for use on public owned lands. The Alberta Forest Service was awarded the funds for development from the Alberta Heritage Trust Fund. The Alberta Heritage Fund is funds surplus to current requirements derived in the form of royalities and taxes primarily from the oil and gas industry operating within the province.