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Planning for an Integrated Wood Processing Complex in Maine

Maine Department of Commerce and Industry

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MACDONALD ASSOCIATES INCORPORATED

PROJECT WOODCHIP

PREPARED FOR THE MAINE DEPARTMENT
OF
COMMERCE & INDUSTRY

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JULY 1973

MACDONALD ASSOCIATES INCORPORATED

ACKNOWLEDGEMENT

Grateful acknowledgement by the staff of Macdonald Associates Incorporated is extended to the several individuals and organizations who have contributed to the extensive data and information contained in this report. While it is impossible to name each person who has participated in study efforts, special appreciation is extended to Mr. James K. Keefe, Commissioner, and Mr. Leo K. Lowry, Project Woodchip Director, Maine Department of Commerce and Industry; Mr. Edward D. Sprague, Northeast Area State and Private Forestry, Forest Service, U.S. Department of Agriculture, and Mr. Philip Bartrum, Economic Development Administration, U.S. Department of Commerce, who served as members of the Woodchip Monitoring Committee; and the several members of the Project Woodchip In-State Advisory Committee representing industry and the public interest. Valuable assistance by organizations has been received from the Northeastern Forest Experiment Station, Upper Darby, Pa.; Seven Islands Land Company, Bangor, Maine; and the Great Northern Paper Company, Millinocket, Maine.

The conclusions and recommendations contained herein are the responsibility of Macdonald Associates Incorporated in its capacity as consultant to the Maine Department of Commerce and Industry, Augusta, Maine 04330.

MACDONALD ASSOCIATES INCORPORATED

CONSULTANTS AND ENGINEERS TO FOREST PRODUCTS INDUSTRY

Aspen, Colorado - Menlo Park, California

FOREWORD

PROJECT WOODCHIP, conceived and placed in motion by the Maine Department of Commerce and Industry, bears a name that on first impression belies the title of this report. Contrary to that nomenclature, findings and recommendations in the four report sections that follow are exclusively concerned with sawtimber utilization, which, in a sense, involves transgression against the historical pattern of usage of the State's timber resource as a raw material for paper manufacture. Time has seen a progression from pulpwood as the principal form of raw material for paper manufacture to present emphasis on pulp chips. It can be expected that from now on the progression will be toward more sawtimber processing, with pulp chips derived increasingly as a by-product. This report patterns means of complying with needs of the established and critically important pulp and paper industry in Maine, while still meeting intensifying pressures for better economic (and ecological) utilization of the timber resource.

The condition of the 35 billion board feet of sawtimber inventoried on Maine's almost 18 million acres of forest land is a result of harvest practices directed to provide cordwood and (increasingly) tree-length pulpwood to meet the enormous appetite of Maine's pulp and paper industry for wood fiber -- 3.22 million cords of pulpwood (equivalent to 1.61 billion board feet log scale measure) were harvested in 1970. In comparison, only .64 billion board feet of sawlogs (77 percent softwood) were harvested in 1970. Sawtimber accounted for only 40 percent of the total timber harvested. Previous to 1970 the ratio between pulpwood and sawtimber harvest was considerably more unbalanced in favor of pulpwood. Past predominance of a 'pulp chip' influence is made self-evident by these data. That influence has been guiding to forest management, to harvesting practices, and to formulation of policies and control of the timber resource.

Control is the single-most important aspect of the timber resource that impinges on the concept of a Fully Integrated Wood Products Manufacturing Facility in Maine. Considerate of 'common and undivided interest' ownership of Maine's commercial forest land, with 45 percent of the land owned by pulp and paper companies, control is availability; conversely, availability is control. It is virtually imperative to process sawtimber into lumber; today, softwood (sawtimber) has more value processed into lumber than in chip form; evidenced by the current trend toward crossover, with sawtimber harvest exceeding pulpwood harvest (a fifty-fifty cut ratio was recorded in 1972; softwood cut at .86 billion board feet, and the proportion of softwood increased to 76 percent). This is motivating pulp and

paper ownerships to sell their good sawtimber, but (consistent with the 'pulp chip' influence) with willingness contingent upon 100 percent sale-back of chips from sawmill slab and trim; amounting to 1,400 pounds of chips per thousand board feet of sawlogs. In effect, the tonnage of wood fiber in each sawlog cut from paper company timberlands is pre-allocated in an approximate fifty-fifty ratio into chips for pulping and lumber for best value-added realization.

There will be situations in northern Maine enabline procurement of sawtimber for a complex without preassigned sale of chips. However, ASSURED AVAILABILITY is (and will remain) heavily contingent upon the exercise of prerogatives by pulp oriented timberland ownerships. Awareness of priorities of sawtimber allocation, and planning to accomodate means of assuring availability of sawtimber is prerequisite to establishing an integrated wood products manufacturing facility. This was found to be applicable in all areas of northern Maine studied by this project -- Aroostook County, Lincoln-Howland area of Penobscot County, Brownville Junction and Dover-Foxcroft in Piscataquis County, and Central Somerset County. The pattern of action by ownerships is in no sense demeaning to the pulp and paper industry, or individual firms that are part of that industry. As a matter of fact, the (imposed) trend to better economic utilization of the sawtimber portion of the resource can be commended. In addition to benefiting the competitive stance of the Maine pulp and paper industry, spin-off advantages include improved 'ecological utilization' of the timber resource, opportunity for realization of improved forest management, and considerable advancement toward better use and improvement of the overall forest resource in Maine. Without the fresh actions being taken by some timberland owners it is doubtful that the concept delineated by this report could have become reality -- as it has through implementation of an integrated wood processing facility in the Ashland area.

A part of the equation of fresh actions is the developing conclusion that 100 percent of the wood fiber in a tree has value-added potential; thus it is wiser, and in increasing practice to value standing timber by weight; departing from volumetric (log scale and cord) measure. Using the current (average) delivered value of $75 per thousand board feet for (hardwood and softwood) sawtimber, adjusting for species density, and adjusting for the ratio of hardwood and softwood to be processed (by the Ashland area complex), the cost per ton of wood raw material (dry weight) in sawtimber form will be $36.40. A fully integrated wood processing complex converting that sawtimber and resulting processing residues into the array of products and usages recommended by this report, will (under Spring 1973 economics) add $82 per ton to the value of each ton of processed sawtimber. Processing the same tonnage of pulp timber into paper products, at an average pulpwood/chip raw material cost of $37.35 per ton. will result in $74.75 value-added -- using an average net revenue of $112 per ton of paper. There data show a per ton margin $7.25 in favor of integrated processing compared to performance of a (typical) pulp and paper mill.

In contrast, a non-integrated sawmill of comparable scale will add about $15 less to the value of processed sawtimber ($97 per ton of sawn lumber); $8 per ton below the average capability of pulp and paper processing. The difference in value-added potential between an integrated and non-integrated sawmill may be indentified as 'INTEGRATION EFFECTIVENESS' -- amounting (based on the $15 per tone differential) to $15 per ton [$32 per thousand board feet] of harvested sawtimber manufactured into wood products.

The extensive date, information, and recommendations in this report must be interpreted and applied as a concept of industrial activity that will take time to mature into the fully integrated posture envisioned by many. The amount of time will vary with product line, and effectiveness of operating and sales management. The first facilities and first actions will pattern heavily to conventional operations, but with modest differences such as utilization of a lower (for Maine) average grade of hardwood sawlogs than customarily programmed. Another important initial departure will be to utilize virtually all processing residues, either converting them into value-added products or using them as fuel for generation of energy. These facilities -- identified as the Mode-1 configuration of the complex -- will manufacture basic products, which will become the materials of construction for attraction satellite (or Mode-2) manufacturing units. Economic feasibility of the satellite units will be made more certain through partial relief of fixed and variable overhead costs made possible by efficiencies and the economics of scale of the integrated complex.

A charter of the Mode-1 complex will be to intensify utilization of low grade and off-species sawtimber. As this materializes, the expected result will assist forest managers to upgrade the timber resource. Each satellite unit added, advancing further into the Mode-2 configuration, will strengthen potential for (real) timber improvement by providing a captive market more receptive to the defects of low-grade (knots, mineral streak, etc.) which are in general unacceptable to 'open market' trade. The economics of this are self-evident, serving to assure that the purposes of the integration are real, not theoretical. Premised on this realism, the Mode-2 configuration of the complex will truly be a vehicle to provide durable new employment and contribute wholesomely to the economy and the ecology of the State of Maine.

In outline, and in concept, the nucleus of the Mode-1 complex that has been implemented as a result of this study in the Aroostook working circle is a large softwood sawmill (sawing 200,000 board feet of sawlogs per day) that will provide economic and operational strength enabling symbolic operation of a more modestly sized hardwood sawmill (sawing 40,000 board feet of sawlogs per day), with residues consigned as fuel to extract Btu energy. The thesis comes as close as practicable under present day technologies and as allowed by market potential to utilizing the 'total tree'. Conservatively estimated, 200 new jobs will be created in production and management activities by the Mode-1 configuration, with another 100 to 150

directly related jobs in timber procurement and supporting activities. Cash flow, measured by net sales revenue, will exceed $21 million per year when these facilities have attained their optimum levels of product output; flowing into the local, regional, and State economies.

This report informedly suggests, rather than to detail the Mode-2 configuration of the complex; to detail would be an exercise in imagineering. It is practical to project jobs for another 300 production, support, and management employees to man the several feasible satellite manufacturing operations which could and (some) should be implemented. It is also practical to project that cash flow from satellite unit activities would approach doubling the $21 million projected for the Mode-1 configuration. This increase will be highly consequential, for it represents value added by manufacture without further consumption of sawtimber. It is the value that under prevailing circumstances today is largely lost by out-shipment of basic products from Maine to market centers in other New England and Northeastern states. It in effect identifies opportunity to double the value of at least a portion of the forest resource in Maine.

The economy of Maine has been essentially characterized by export of raw materials and import of finished goods, in forest products and other industrial fields, notably excepting shoe manufacture and more recently, processed potato products. The integrated wood products manufacturing facility conceptualized by this report has every potential to set precedent for reversing this trade flow within the forest products segment of the economy. Marketing investigations incident to Woodchip study have evidenced a highly receptive attitude toward possible availability of various types of furniture, panel products, cabinets, architectural plywood, and other consumer and construction products manufactured by sources indigenous to Maine. Potential industrial customers in southern New England and New York state, chiefly furniture and fixtures manufacturers, are anxious for sources (in Maine) of semi-manufactured and component parts.

A conclusion of Woodchip study is that implementation of one or more fully integrated wood processing complexes in Maine is feasible, and there is room for more than one complex from competitive viewpoints of the sawtimber resource and market opportunities. Undoubtedly, project objectives can be fulfilled if venture is properly financed and managed. A major difficulty, because of the scale of enterprise and large order of magnitude of capital investment, will be to attract investor interest leading to implementation. This can be substantially alleviated, but with some sacrifices in the rapidity and thoroughness of desired results, by planning for phased growth of first the Mode-1 complex, to materialize as rapidly and as extensively as success allows into an 'ultimate' Mode-2 configuration.

All of the potential and good that might result from implementation of a complex will be contingent upon the skills of managers and workmen; therefore, it will be expedient upon the community that may support investment

to itself plan constructively for the greater responsibilities that new industrial activity of scale will require. It will be imperative that leaders evolve plans for housing and family well being that will be attractive to and holding on the people of talent that a Woodchip complex must have. It has been evident to the consultant throughout the conduct of study activity that qualified communities have the proper attitudes, but organization and guidance are needed.

It is recommended that the Maine Department of Commerce and Industry continue to take a leading role, in implementation, correlating with recommendations in this report, cooperating with industry, and providing assistance and encouragement to potential investors and those who would act to promote community support.

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SECTION 1

1. Timber resource data in this report are extrapolated from Timber Resources of Maine. U.S.D.A. Forest Service Resource Bulletin NE-26, 1972. These data do not necessarily compare across-the-board with Maine Forestry Department data. For example, data issued by the State of Maine do not identify red oak as a consequential species. Such differences are not considered important to application of this report; however, it is adviseable for the interested reader to obtain comparative data from the Maine Forestry Department.

2. Sawtimber Export Data (pp. 11-12) have been made available for this report by the Bureau of Internal Revenue. These data do not necessarily compare across-the-board with Maine Forestry Department Data. The differences are attributed to methods of information collection; Bureau information being based on border station revenue reports, whereas Maine Forestry Department Data are direct reports from principals involved in timber buy/sell transactions. It is adviseable for the interested reader to obtain comparative data from the Maine Forestry Department.

3. Log diameter data presented under discussion of each of the four preselected working circles evidence weighted averages, derived from Company data in Bulletin NE-26, 1972 (adjusted arithmatically to evidence the portion of each county within the prescribed 50-mile areas.

4. Growth/removal data presented under discussion of each of the four preselected working circles are derived from county data in Bulletin NE-26, 1972 (adjusted arithmatically to evidence the portion of each county within the prescribed 50-mile areas). The method of data extrapolation imparts some distortion to the values; however, this is not considered consequential to the purposes of this study by the Consultant.

ANNOTATIONS

[CONT.]

5. Reference to 'woods-run' sawlogs in this report is limited to No. 1, No. 2 and No. 3 Grade hardwood factory-lumber sawlogs. Grade definitions are from A Guide to Hardwood Log Grading (Revised), Northeast Forest Experiment Station, Forest Service, U.S. Department of Agriculture, Upper Darby, Pa., 1965.

SECTION 3

1. Under discussion of hardwood remanufacturing No. 2 Grade lumber has been divided into 2A+ and 2A- Grade categories. This procedure, in compliance with dimension industry practices, is arbitrary; it serves to divide the total Grade into a high and low side, which assists rough-mill manufacturing operations and results in more efficient defect removal.

2. Economic (performer) profiles for Mode-1 facilities are premised on manufacture of a conservatively selected line of products. It would be easily possible to increase the net revenue of any one facility; e.g., to manage hardwood sawmilling or operations of the hardwood remanufacturing plant to optimize production of (high value) furniture squares. However, to do this could reduce the options for scope of facilities and restrictability to attract Mode-2 satellite units. It will be a management responsibility to optimize -- beyone the conservative projections in this report -- consistent with most advantageous evolution of the entire integrated processing facility.

Section 1

Forest, Human & Community Resources

1.01 SAWTIMBER RESOURCES

GENERAL OVERLOOK - STATE OF MAINE

An understanding of the sawtimber resources of the State of Maine is essential to complete awareness of the benefits of a 'fully integrated wood processing complex'. Maine is unique in that it alone holds best potential for wood processing in the Eastern United States, since, until recently, its high volume hardwood and softwood sawtimber resources have not been utilized to best advantage, or even recognized as being significant in East Coast wood products manufacturing/marketing strategy.

Maine, the 37th state in land area within the U.S., with 95 percent of its land covered by commercial forest -- more heavily forested than any other state -- holds 2.5 percent of the national inventory of hardwood sawtimber (11.07 billion board feet) and 1.5 percent of the inventory of softwood sawtimber (23.6 billion board feet).

More importantly, from the standpoint of the strategy of wood products manufacturing/marketing, among the 26 states east of the Mississippi River the sawtimber resource in Maine accounts for 3.7 percent of the hardwoods and 12.3 percent of the softwoods. 65 percent of the hardwood species are 'highly desirable' birch-beech-maple-ash, wanted for manufacture of furniture and quality wood items, and 60 percent of the softwood species are 'competitively desirable' spruce-fir, wanted for building construction and utility purposes.

MAINE INVENTORY COMPARED TO NEW ENGLAND/NEW YORK

In the populous New England/New York area (17.5 percent of U.S. population; 17.7 percent of the U.S. industrial market). Maine sawtimber accounts for 37 percent of the inventory.

- 22 percent of the hardwoods
- 55 percent of the softwoods
- Quantitatively; these data evidence a potential competitive (resource) advantage for Maine-based wood products industry.
- In species; the Maine inventory is advantaged by running heavily to beech-birch-maple and spruce-fir stand types.

CLASSES OF TIMBER

In Maine, sawtimber trees make up 38 percent of the net volume of timber on commercial forest land (24 billion cubic feet); poletimber trees 51 percent; rough and rotten trees the balance.

- Sawtimber trees are:
  "Live trees of commercial species, (a) that are of the following minimum diameter at breast height - softwoods 9.0 inches and hardwoods 11.0 inches, and (b) that contain at least one 12-foot merchantable sawlog and meet regional specifications for freedom from defect."
- Poletimber trees are:
  "Live trees of commercial species that meet regional specifications of soundness and form, and are at least 5.0 inches in d.b.h. but are smaller than sawtimber size."
- Assessment of the timber resource has focused on utilization of sawlogs, which total 7.7 billion cubic feet -- 32 percent of the net volume of timber.
- Utilization of poletimber trees has been evaluated, and may prove important for preservatively treated products, medium density fiberboard, and hardboard, as examples.

SPECIES OF SAWTIMBER

HARDWOOD SAWTIMBER, 32 percent of total sawtimber in Maine, is represented by 25 species, eight of which comprise 95 percent of the hardwood volume. Data for 1973 in the following volume table have been projected from U.S.D.A. Forest Service Resource Bulletin NE-26, 1972 (used as a basic reference to this report) on the basis of a 2.98 percent net increase in volume per year for the State -- based on available growth/removal data.

Hardwood Sawtimber Volume

	VOLUME - billion board feet		
Species	1971	1973	% of Total
Red oak	.69	.73	6.2
Yellow birch	1.61	1.71	14.6
Paper birch	.65	.69	5.9
Sugar maple	3.23	3.43	29.2

(continued)

Hardwood Sawtimber Volume *(cont'd)*

Species	VOLUME - billion board feet 1971	1973	% of Total
Soft maple	2.12	2.25	19.2
Beech	1.00	1.06	9.0
White ash	.49	.52	4.4
Aspen	.69	.73	6.2
Other hardwoods	.58	.62	5.3
TOTAL HARDWOODS	11.06	11.74	100.0

SOFTWOOD SAWTIMBER, 68 percent of total sawtimber in Maine, is represented by 13 species, six of which comprise 99 percent of the softwood volume. Data for 1973 in the following volume table have been projected on the basis of a 1.45 percent net increase in volume per year for the State.

Softwood Sawtimber Volume

Species	VOLUME - billion board feet 1971	1973	% of Total
White pine	4.57	4.70	19.5
White spruce	1.27	1.31	5.4
Red spruce	8.04	8.27	34.3
Balsam fir	4.53	4.66	19.3
Hemlock	2.67	2.75	11.4
No. white cedar	2.14	2.20	9.1
Other softwoods	.23	.24	1.0
TOTAL SOFTWOODS	23.46	24.13	100.0

SAWTIMBER OCCURENCE

The 35.87 billion board feet of sawtimber in Maine (1973 volume estimate) will occur 68 percent in sawtimber stands, 23 percent in poletimber stands, and 1 percent in 'other' stands.

- Sawtimber stands (average 3800 bf/acre) are:
  "Stands that are at least 16.7 percent stocked with growing-stock trees, with half or more of total stocking in sawtimber or poletimber trees, and with sawtimber stocking at least equal to poletimber stocking."
- Poletimber stands (average 18 cords/acre) are:
  "Stands that are at least 16.7 percent stocked with growing-stock trees of which half or more of this stocking is in poletimber and/or sawtimber trees and with poletimber stocking exceeding that of sawtimber."

- Out of 16.9 million acres of commercial forest land in the State -- 6.1 million acres (35%) are in sawtimber stands; 5.3 million acres (32%) are in poletimber stands; 5.2 million acres (31%) are in sapling-seedling stands; 1 percent is non-stocked.

SAWTIMBER TYPE/DISTRIBUTION

Because the four preselected site areas fundamental to Project Woodchip Study are located in central and northern Maine (see locating map on page 14) only three out of the five forest types within the State have been important to study determinations.

- Maple-Beech-Birch type (53% of the hardwood sawtimber) comprises:

  "Forests in which sugar maple, beech, or yellow birch, singly or in combination, make up a plurality of the stocking. (Common associates include hemlock, elm, basswood, and white pine)."

- Aspen-Birch type (12% of the hardwood sawtimber) comprises:

  "Forests in which aspen, balsam poplar, paper birch, or gray birch, singly or in combination, make up a plurality of the stocking. (Common associates include maple and balsam fir)."

- Spruce-Fir type (59% of the softwood sawtimber) comprises:

  "Forests in which spruce or balsam fir, singly or in combination, make up a plurality of the stocking. Cedar swamps are also in this type. (Common associates include white cedar, maple, birch, tammarack, and hemlock)."

- Soft Maples -- (mostly) Acer rubrum and (some) Saccharinum in Maine, and not a forest type -- are under-utilized and command attention as a resource for Project Woodchip. The inventory of rubrum is increasing at the (average) rate of 2.8 percent per year.

- Current shortage of domestic hardwood lumber has forced acceptance of soft maple in fabricated wood products in which it has not been used, or used sparingly. It is anticipated that this acceptance will endure because of the lower market price for

soft maple -- compared to sugar maple, birch, or beech.

- o 70 percent of the spruce-fir type is found in Aroostook, Penobscot, Piscataquis, and Somerset counties -- the area of focus of Project Woodchip study.

SAWTIMBER GROWTH/REMOVAL

The rate of removal of six out of nine principal species of hardwood sawtimber (including the category of 'other' hardwoods) exceeds net growth in the State. One other hardwood species will fall into this category in 1973. Soft maples and aspen are the only hardwood species evidencing annual increment increase in volume.

Hardwood Sawtimber Growth & Removals

Species	Annual Growth	Annual Removals
Northern red oak	36.7	51.3
Yellow birch	18.8	63.0
Paper birch	39.4	38.7
Sugar maple	71.0	75.3
Soft maples	129.1	105.8
Beech	9.7	17.3
Ash	26.1	32.2
Aspen	44.2	12.7
Other hardwoods	23.1	24.6
TOTAL	398.1	420.9

** 1970 data, values in million board feet*

The rate of removal of only two species of softwood sawtimber -- white pine and northern white cedar -- exceeds net growth in the State.

Softwood Sawtimber Growth & Removals

Species	Annual Growth	Annual Removals
White pine	281.9	312.8
Spruce	490.4	261.8
Balsam fir	268.1	145.5
Hemlock	139.0	107.8
No. white cedar	33.4	47.8
Other softwoods	11.2	2.3
TOTAL	1224.0	878.0

** 1970 data, values in million board feet*

The annual rate of growth of softwood sawtimber volume exceeds that of hardwood by nearly 50 percent; conversely, the rate of removal of hardwood sawtimber is nearly one third more than the softwood rate.

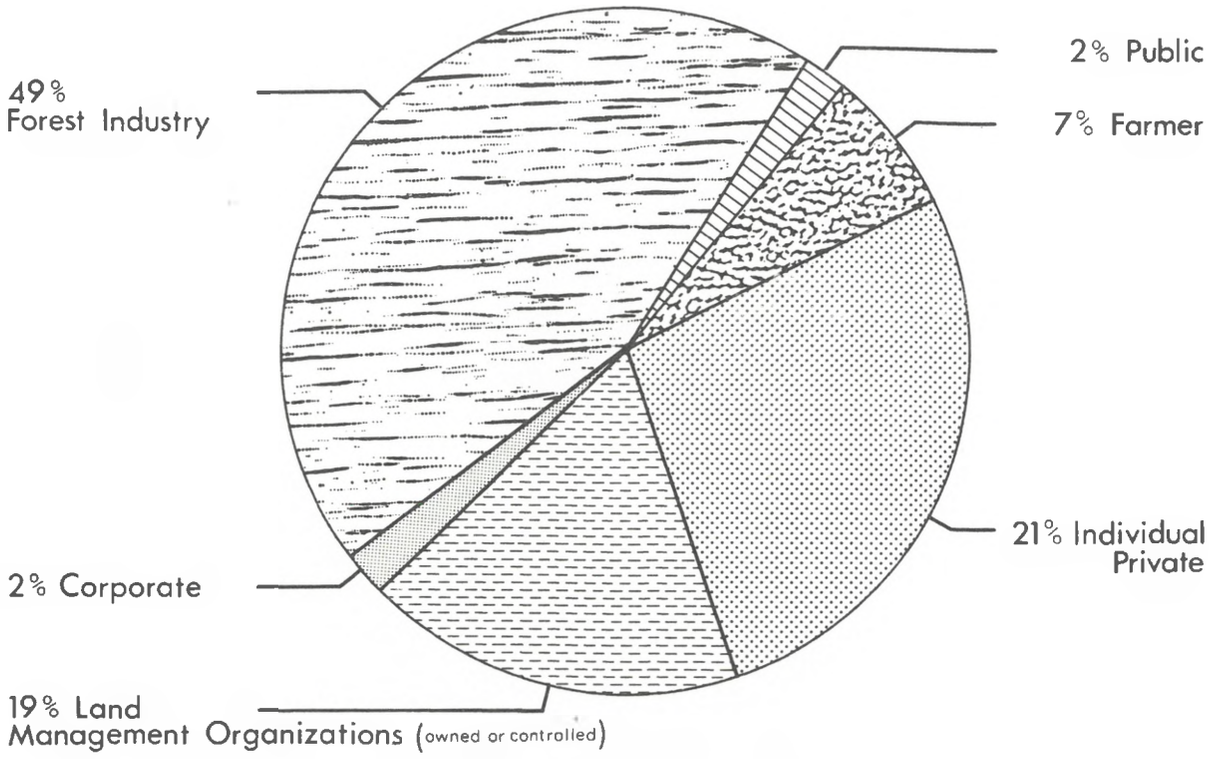
- The prevailing 'fragmented' pattern of hardwood ownership is not conducive to effective or active management. The present growth rate of 2.5 percent per year and the removal rate of 5.9 percent per year are not likely to change soon.
- If incentive were given for active management of hardwood stands, growth rate could increase to 3.5 to 4.0 percent per year.
- Present extensive management of softwood stands is expected to (or could) change to intensive management, which would result in increasing the 3.7 percent growth rate. Softwood removals are at the rate of 4.5 percent per year.
- Theoretically, the rate of growth of timber on 80 percent of Maine's commercial forest land could exceed 50 cubic feet per acre per year. On 45 percent of the land this could be increased to 85 cubic feet per acre per year. The present average is 42 cubic feet per acre per year, with forest industry land and farmer/private land respectively experiencing average growths of 46 and 38 cubic feet per acre per year.

SAWTIMBER OWNERSHIP/PROCUREMENT

Ninety eight percent of the commercial forest land in Maine is privately owned. The remaining two percent is in public ownership, standing as the lowest percentage of public ownership in any forested state and region in the Nation. This means that sawtimber-based industry in the State has three alternative approaches to sawtimber procurement (raw material control): (1) be a major owner of timberland, (2) rely on open-market purchase of sawlogs, or (3) combine ownership of timberland with open-market purchase. These alternatives approach being unrealistic for modestly scaled industry, such as a Project Woodchip venture, when equated to the existing pattern of timberland ownership, under which 88 percent of the ownership is effectively committed to vested interests by forest industry firms and land management organizations.

OWNERSHIP OF COMMERCIAL FOREST LAND

STATE OF MAINE



Sawtimber is distributed on the commercial forest land in a manner that gives control of 55 percent of the volume to existing forest-based industry. Actually, the percentage of 'controlled' inventory is considerably more (data not available) as a result of close working relationships between land management organizations and forest industry firms.

Ownership of Sawtimber

1970 data

	Softwood		Hardwood		All Species	
	MMbf	%	MMbf	%	MMbf	%
National Forest	40	*	105	1	145	*
Other Public	280	1	104	1	384	1
Forest Industry	12,615	54	6,450	58	19,065	55
Farmer & Other	10,521	45	4,404	40	14,925	43
TOTAL	23,456	100	11,063	100	34,519	100

* *Less than .5%*

"Common and undivided interest" ownership of commercial forest land and its associated dependence on land management organizations has, in many instances, resulted in development of channels of sawtimber marketing that are closely allied to the processing needs of established primary conversion facilities. 1/

- Although competitive with one another in marketing their finished products, the major manufacturers exercise considerable cooperation on sawtimber (and pulpwood) procurement. Species, location of cutting areas, road construction/maintenance, and other critical factors influencing timber management and operational economics are strategically interfaced to mutual advantage. Disruption of important aspects of such interfacing will not be considered unless improved advantage is apparent -- to multiple parties in many instances of timber ownership, and in accordance with frequently diverse management and ownership objectives.
- A new manufacturing facility (as Project Woodchip would involve) drawing upon the sawtimber resource must coordinate with existing procurement strategy or be out of the picture insofar as 'assured' procurement of timber from industry/land management ownerships is concerned.

If sawtimber is not available for purchase from forest industry or land management organizations, due to inability of a new manufacturing facility to demonstrate significant advantage over the status quo, the 'procurable' volume will reduce to that growing on no more than 28 percent of the commercial forest land.

- Much of that land is unmanaged, poorly stocked, or marginally accessible. An expected condition of availability would be short-term price and delivery agreements.
- Like industry and land management organization ownerships/control -- many individual and private ownerships would not be responsive to supplying the sawtimber needs of new industry; preferring to abide with established relationships that in some cases have matured into interdependency.

1/ Forest ownership patterns in Maine are unique. The concept of common and undivided interest prevails, where two or more owners of a given township have equal voice in the use of that township's resources.

- A small scale new facility, requiring a minimal volume of sawtimber, could survive with the conditions that prevail. A larger operation, able to meet the Project Woodchip key objective must have more positive assurance of sawtimber availability.

Reliance on dealers, jobbers, or contractors would not be an answer to the improbability of assured sawtimber supply from major ownerships and/ or land management firms.

- Such operators are characteristically working at a balanced level between available sawtimber through their own channels of supply, and the market they serve.
- Alteration of the balance would mean (a) 'difficult' extension of procurement to satisfy increased volume for a new customer; or, more likely, (b) no change in volume, but imposition of a price-competitive situation to the disadvantage of established customers.
- It is unlikely that an independent supplier of sawtimber already operating at acceptable cash flow and profit levels will expand (equipment, labor, or operationally) without enhanced profit advantage -- which would induce increased prices. The type of activity and order of size magnitude envisioned for a Project Woodchip facility cannot abide with circumstances having this portent.

"Most" individual private and farmer sawtimber ownerships are selling as much sawlog volume as prudent forest management will allow. This is verified by the growth/removal data presented above in this report.

- Field investigations by the consultant have evidenced that such ownerships are aware of good forest management principals, and most are practicing what they consider good management on their holdings. This means there is little elasticity in the sawlog supply from these ownerships.

Perhaps the single most important consideration in sawtimber procurement, and inhibitor to assured procurement, is sawlog grade.

- Project Woodchip has evolved a manufacturing concept that can economically utilize lower grade timber than is presently the practice -- to be corrective to the well documented fact that Maine's resource of hardwood sawtimber (in particular) has been high-graded. Regard-

less, dealers, jobbers, and contractors can, and prefer to continue selling upper grade sawlogs.

- In spring 1972 high grade yellow birch veneer logs averaged $279/Mbf delivered, the best sawlogs $96/Mbf, and low grade sawlogs $63/Mbf. These 'average' prices compare to respective stumpage values of $44/Mbf, $33/Mbf, and $21/Mbf. Other species have comparable relationships.
- Consideration of the price differentials between stumpage and delivered prices of the same items makes it quite apparent that a dealer would be profit-motivated to deliver the highest grade sawtimber product, thus realizing the best attainable margin on his investment in stumpage, labor, equipment, and fixed overhead. Under these circumstances a 'dependent' processing facility would surely be vulnerable to sawlog procurement problems that could induce serious economic consequences.

SAWLOG GRADES

"Utilization of species and grades of sawtimber not now in great demand..." is a Standard of the Project Woodchip key objective. Satisfying that standard will require processing volumes of No. 2 Grade and lesser sawlogs far exceeding utilization that has taken place in the State in the past. Under the circumstance, sawlog grade relationships are critically important. The economic feasibility of the Woodchip complex will be resultant of log grade ratios, lumber grade yields, and market value of finished wood products.

- 66 percent of the hardwood sawtimber inventory in Maine is in No. 3 Grade and lesser sawlogs.
- The occurence of No. 3 and lesser in the important birch-beech-maple forest type -- at 64 percent of the type -- is slightly improved over the average occurence of No. 3 for all hardwood species in the State.
- Sugar maple, 29 percent of the total hardwood sawtimber in the State, considered to be the key species in the economic relationship of timber resource to market potential, occurs 57.3 percent No. 3 Grade and lesser; a desirable improvement over the average occurence of No. 3 for all hardwood species in the State.
- Log grade classifications used in this report are in compliance with presentations in U.S.D.A. Forest Service Resource Bulletin NE-26 1972, and A Guide to Hardwood Log Grading, published by the Northeast Forest Experiment Station.

Grade Distribution of Hardwood & Softwood Sawtimber
State of Maine

	Grade by Percent of Sawlog Volume				Billion Feet
	No. 1	No. 2	No. 3	No. 4	1971
Northern red oak	17.7	23.2	49.7	9.4	.69
Yellow birch	12.8	26.0	52.7	8.5	1.61
Paper birch	7.8	22.5	61.5	8.2	.65
Sugar maple	17.5	25.2	46.0	11.3	3.23
Soft maples	7.2	20.3	57.5	15.0	2.12
Beech	1.8	7.7	70.7	19.8	1.00
Ash	18.2	26.1	40.5	15.2	.49
Aspen	4.9	16.3	56.6	22.2	.69
Other hardwoods	17.2	26.3	47.0	9.5	.58
STATE AVERAGE	12.0	22.0	53.0	13.0	. . .
TOTAL HARDWOODS	. . . . .				11.06
Eastern white pine	3.6	8.9	49.8	37.7	4.70

Notes: *Softwood species other than pine have not been graded into standard-lumber logs.*

Grade No. 4 applies only to pine. For hardwoods the identified No. 4 volumes are for construction logs.

SAWTIMBER EXPORT TO CANADA

There is heavy and increasing volume in export of sawlogs to Canada from Maine -- accounting for 71 percent of U.S. softwood sawlogs, bolts, and squares exported to Canada in 1971; 55 percent of hardwood exports in the same product categories.

- 218.1 million board feet of softwood logs exported to Canada in 1971 had a declared value of $11.72 million; average $53.73 per thousand board feet. Exports for the first eight months in 1972 were markedly up, reaching a value of $12.87 million (adjusted to 1971 average sawlog price levels, which were down 11 percent).
- 20.0 million board feet of hardwood logs exported to Canada in 1971 had a declared value of $1.48 million; average $74.04 per thousand board feet. Exports for the first eight months in 1972 were markedly up, reaching a value of $2.21 million (adjusted to 1971 average sawlog price levels, which were down 7 percent).

- Analysis of data has shown that the volume and value of exports to Canada from Maine have increased every year during the last decade. The particularly heavy 1972 increase in hardwood log export is consistent with an increasingly short supply of 'quality' hardwoods in Canada and the United States.

Export of Maine's Sawtimber & Lumber to Canada

Items Exported - 1971 Data:	Thousand Board Feet	Value in Thousands of Dollars
Softwood sawlogs (incl. rough logs, bolts, squared logs)	218,111	$11,718.4
Hardwood sawlogs (ditto above)	19,975	1,488.9
Rough Lumber:		
softwood (mostly pine, spruce)	12,712	1,279.3
hardwood (mostly beech, birch, maple)	3,153	365.7
Finish/dressed lumber & wood products:		
dressed lumber (mostly pine, spruce)	4,479	580.6
softwood flooring	24	3.9
handleblanks, hardwood dimension	8	2.5
hardwood flooring	117	28.7

Source: *U.S. Customs, Washington, D.C.*

A number of well equipped and well operated softwood sawmills have been built in recent years along the Maine border in Quebec and New Brunswick. These sawmills draw heavily on Maine's resource of spruce-balsam and birch-beech-maple sawtimber.

- Within 25 miles of the border -- approximately 88 sawmills are located in Quebec; 10 in New Brunswick.
- Softwood lumber manufactured by the Quebec and New Brunswick sawmills, largely from Maine sawtimber, is shipped into the New England/New York market area where it competes without current price controls against lumber manufactured in Maine sawmills (which is price controlled).
- The same circumstance prevails in hardwood lumber (and dimension), although considerably reduced in traffic volume.
- The situation is not limited to mild escalation;

worsening of hardwood sawtimber drain through export can be expected as a result of programmed heavy increase in hardwood furniture manufacture in Quebec -- to draw upon upper grades of Maine hardwoods.

- The average value declared for softwood and hardwood sawlogs exported to Canada probably does not include the cost of transportation. Therefore, prices paid by Canadian sawmills should be considered high in comparison to average 1971 prices in Maine at $55 and $52/Mbf respectively for maple-birch.

Export of sawlogs to Canada can be expected to continue without consequential restraint.

- This means that meeting the sawtimber needs of a (major) new wood products manufacturing facility that does not have assured sawtimber availability through ownership or other positive control will involve price competition against Canadian sawmills.
- Because of government subsidization of their labor and capital costs, Canadian sawmills have, and can maintain a price competitive advantage in sawtimber procurement.
- The advantage held by Canadian mills adds to the precariousness of new sawtimber based enterprise in Maine that does not have sources committed to supply at least its break-even volume requirement.

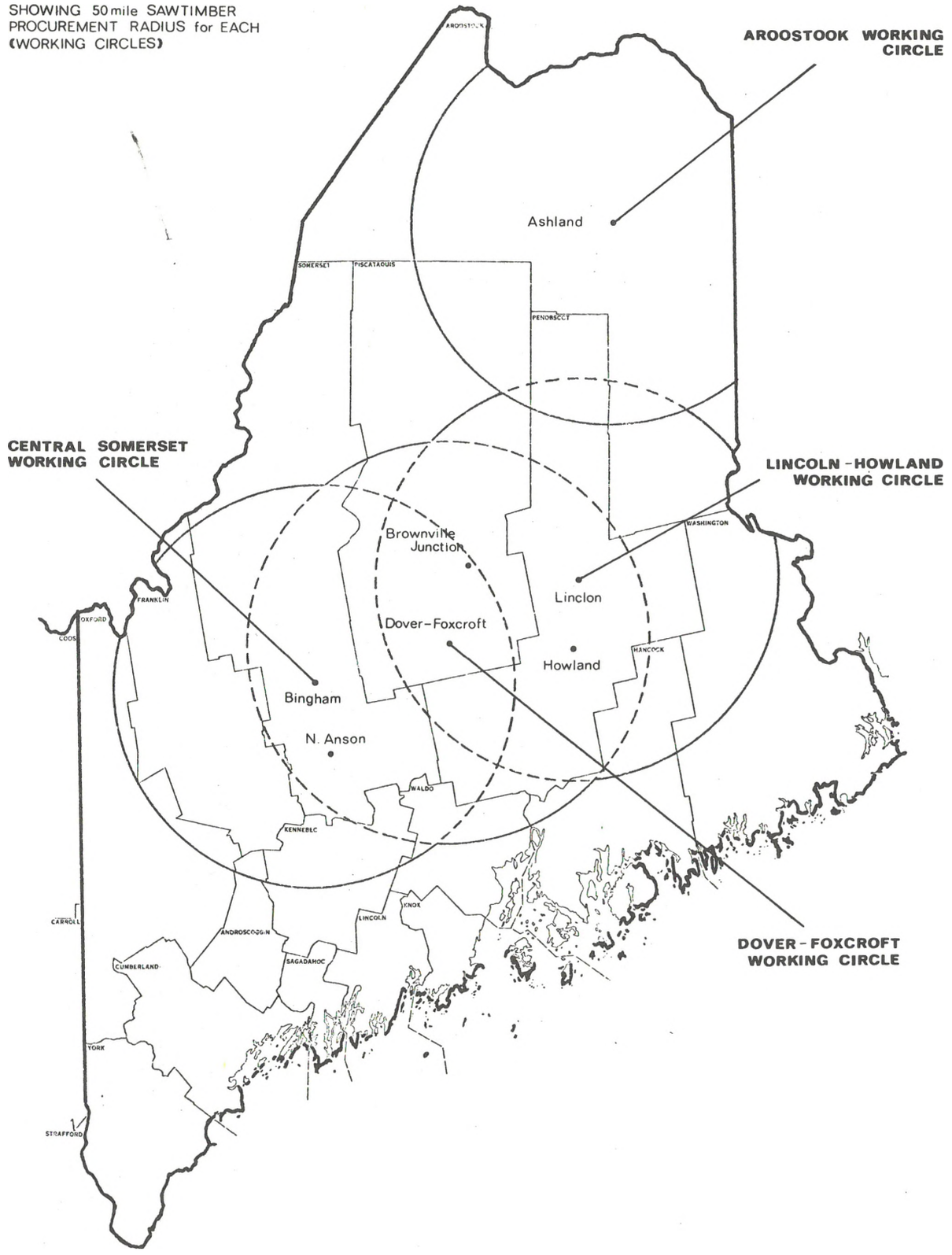
GENERAL OVERVIEW - PRESELECTED SITE AREA SAWTIMBER RESOURCES

Four preselected areas (shown by map on the opposite page) considered to evidence best potential for support of a fully integrated wood processing complex have been overviewed during project study, resulting in selection of the best potential site for location of facilities. The following data and information treat, separately for each preselected site area, sawtimber resource identification, quantification and characterization.

Although that portion of Aroostook County located north of U.S. Route 2 and State Route 159 has been selected as having best potential for support of the complex, sawtimber resource data are presented for the four preselected areas with expectation that wood industry firms might find

PRESELECTED SITE LOCATIONS

SHOWING 50 mile SAWTIMBER PROCUREMENT RADIUS for EACH (WORKING CIRCLES)



desirable circumstances outside Aroostook County in terms of venture objectives. Data below show that Aroostook County is not singularly qualified in sawtimber resources; its selection has been premised on best supportive potential taking into consideration all factors.

HARDWOOD SAWTIMBER (AROOSTOOK WORKING CIRCLE)

Sugar maple, soft maple, beech, and aspen are preponderant in volume, with growth substantially exceeding removal. Yellow birch, while present in volume, is being removed at a rate that exceeds growth, with shrinkage in volume forecast to and beyond 1983. The rates of removal of ash and paper birch are expected to exceed growth before 1983.

Volume/Species Ratio - 1971 Data

	Million Board Feet	%
Yellow birch	267.57	11.40
Paper birch	85.44	3.64
Sugar maple	830.06	35.37
Soft maple	388.12	16.54
Beech	328.12	13.98
White ash	114.27	4.87
Aspen	247.60	10.55
Other hardwoods	85.77	3.65
TOTAL VOLUME	2346.95	
1973 VOLUME	2453.03	

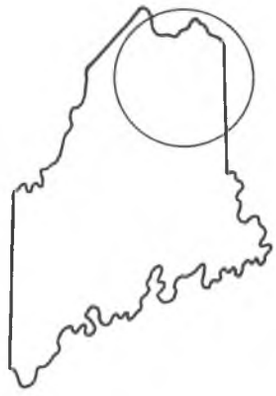
Grade/Average Diameter - 1971 Data

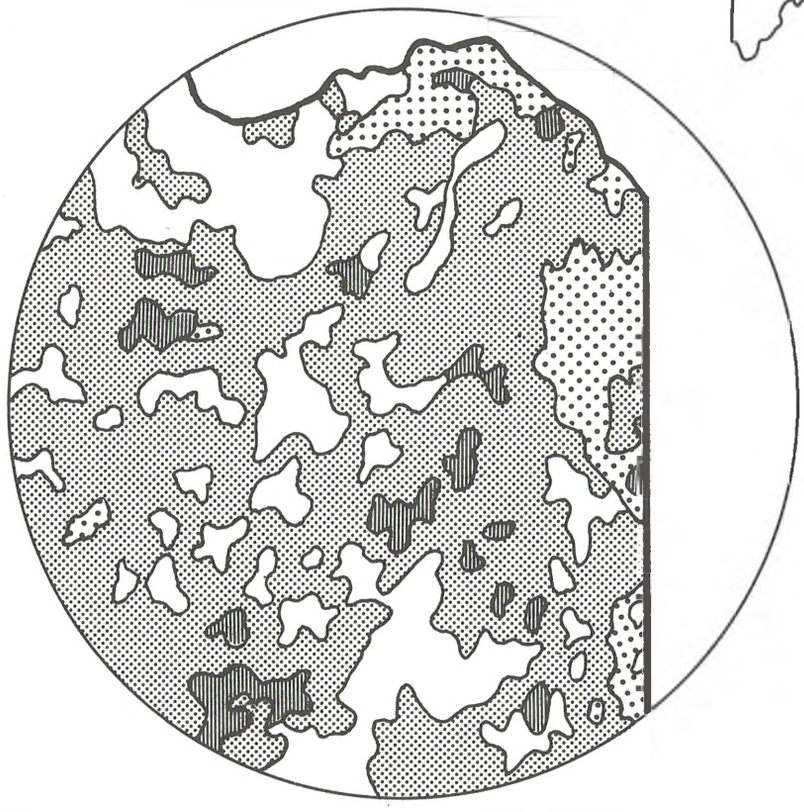
	Million Board Feet				
	No.1	No.2	No.3	No.4	dbh
Yellow birch	26.60	72.45	147.64	20.88	15.6
Paper birch	7.85	20.70	49.97	6.92	13.5
Sugar maple	118.80	219.66	388.96	102.64	17.3
Soft maple	38.99	97.65	189.36	62.12	14.9
Beech	3.22	31.13	249.37	44.40	14.4
White ash	20.56	29.68	42.11	21.92	14.1
Aspen	7.69	45.15	140.72	54.04	13.8
Other hardwoods	16.17	15.15	39.21	15.24	15.1
TOTAL VOLUME	239.88	531.57	1247.34	328.16	
% OF TOTAL	10.22	22.65	53.15	13.98	

Note: *Grade No. 4 identifies hardwood construction logs.*

AROOSTOOK
WORKING CIRCLE (86.9 percent Forested)

50-Mile Sawtimber Species Distribution





FOREST TYPE / SPECIES

SOFTWOODS 71%

spruce-fir 77%

HARDWOODS 29%

maple-birch-beech 60%

aspen-birch 14%

NONFORESTED

519,210 acres

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
Yellow birch	*.90*	*1.16*	[*1.24*]	[*2.44*]
Paper birch	3.24	2.70	*4.45*	*5.68*
Sugar maple	6.68	3.56	9.20	7.49
Soft maple	13.52	6.57	18.64	13.83
Beech	3.39	1.81	4.67	3.81
White ash	3.51	3.02	*4.85*	*6.36*
Aspen	9.40	.88	12.96	1.86
Other hardwoods	2.43	1.50	3.36	3.15
TOTAL GROWTH	43.07	. .	59.37	. .
TOTAL REMOVAL	. .	21.20	. .	44.62
1973 TOTALS	45.02	22.83		

Notes: *Volumes in millions of board feet/year.*

[ ] *denotes volume reduction.*

Values in italics = removal exceeds growth.

SOFTWOOD SAWTIMBER (AROOSTOOK WORKING CIRCLE)

Red spruce and balsam fir are preponderant in volume. The resource of white pine is limited; 71 percent occuring in No. 3 and No. 4 Grade sawlogs. Northern white cedar, 11.5 percent of the sawtimber volume, is being removed at a rate that exceeds growth. The growth/removal ratios of other softwood species evidence opportunity for increased utilization.

Volume/Species Ratios - 1971 Data

	Million Board Feet	%
White pine	312.7	5.44
White spruce	414.7	7.04
Red spruce	2348.9	40.88
Balsam fir	1667.4	29.02
Hemlock	282.5	4.92
No. white cedar	661.9	11.52
Other softwoods	67.2	1.17
TOTAL VOLUME	5745.3	
1973 VOLUME	6169.0	

Grade/Average Diameter - 1971 Data

Softwoods other than pine are not graded

	No.1	No.2	No.3	No.4	dbh
White pine	31.41	57.91	137.65	82.10	18.5
White spruce	-	-	-	-	12.5
Red spruce	-	-	-	-	13.0
Balsam fir	-	-	-	-	11.1
Hemlock	-	-	-	-	15.3
No. white cedar	-	-	-	-	11.8
Other softwoods	-	-	-	-	12.1
% OF TOTAL	10.16	18.74	44.54	26.56	

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
White pine	4.60	3.77	7.36	6.67
Spruce	90.83	34.31	145.66	60.81
Balsam fir	61.74	19.99	99.02	35.43
Hemlock	5.18	2.58	8.30	4.58
No. white cedar	*9.12*	*11.01*	*14.62*	*19.51*
Other softwoods	1.74	.26	2.80	.47
TOTAL GROWTH	173.21	. .	277.76	. .
TOTAL REMOVAL	. .	71.92	. .	127.47
1973 TOTALS	193.13	81.98		

Notes: *Volumes in millions of board feet/year*

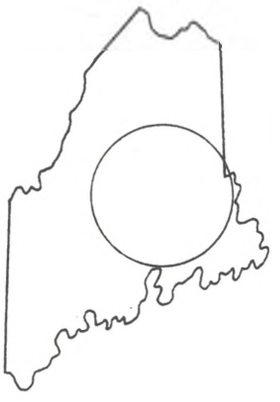
Value in italics = removal exceeds growth

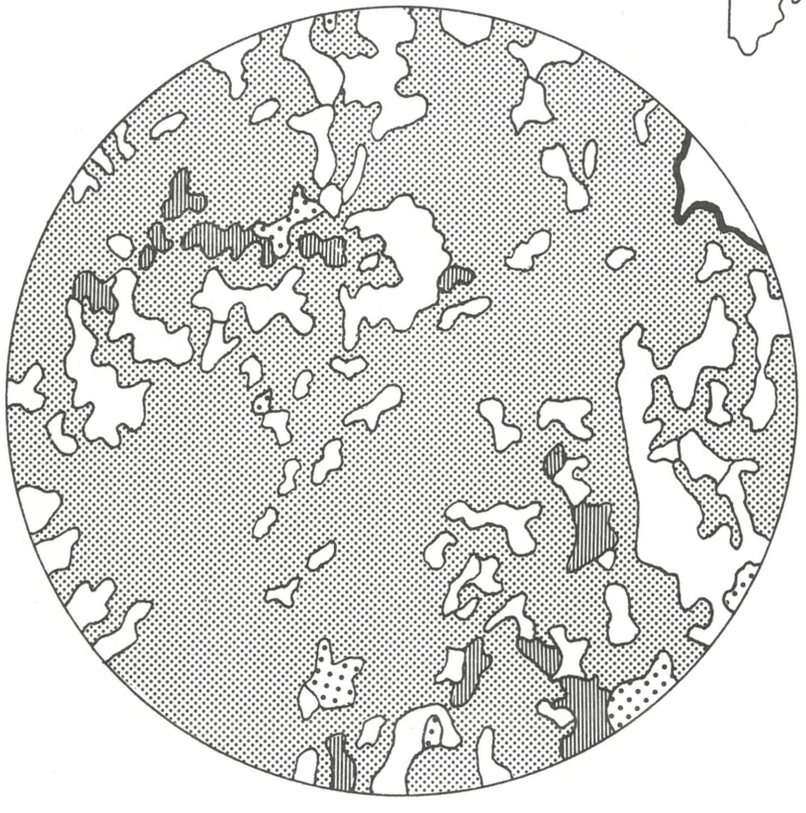
HARDWOOD SAWTIMBER (LINCOLN-HOWLAND WORKING CIRCLE)

Sugar and soft maple, 55 percent of the hardwood sawtimber resource, and aspen, another 5 percent of the sawtimber, are the only commercial hardwood species in this working circle that have desirable growth/removal ratios. The sawlog grade distribution of sugar maple is particularly favorable; made up of 52 percent No. 1 and No. 2 Grade sawlogs, of which 28 percent are No. 1 Grade. The volume of soft maple amounts to 96 percent of the volume of sugar maple, whereas in the Aroostook working circle it amounts to only 46 percent. This relationship

LINCOLN - HOWLAND
WORKING CIRCLE (86.6 percent Forested)

50-Mile Sawtimber Species Distribution





FOREST TYPES/SPECIES

SOFTWOODS 71%

spruce-fir 60%

HARDWOODS 29%

maple-birch-beech 48%

aspen-birch 10%

NONFORESTED

587,226 acres

is considered significant in view of anticipated increased acceptance of soft maple by the furniture industry. However, the sawlog grade distribution of soft maple is comparatively poor; made up of 72 percent Number 3 and 4 Grades. The average/most common mill delivered price of sugar maple sawlogs (spring 1972) was 40 percent higher than the price of soft maple.

Volume/Species Ratio - 1971 Data

	Million Board Feet	%
Red oak	66.0	2.6
Yellow birch	292.0	11.5
Paper birch	141.6	5.6
Sugar maple	716.8	28.1
Soft maple	690.4	27.1
Beech	224.6	8.8
White ash	175.0	6.9
Aspen	120.1	4.7
Other hardwoods	122.9	4.8
TOTAL VOLUME	2549.4	
1973 Volume	2598.8	

Grade/Average Diameter - 1971 Data

	Million Board Feet				
	No. 1	No. 2	No. 3	No. 4	dbh
Red oak	20.70	18.49	22.80	5.88	17.6
Yellow birch	26.33	75.35	149.12	19.75	15.1
Paper birch	16.14	36.35	82.75	10.47	13.8
Sugar maple	220.04	188.31	301.15	74.91	17.2
Soft maple	45.37	144.25	391.67	104.00	14.6
Beech	14.07	10.38	172.03	35.62	14.4
White ash	30.46	43.31	70.69	22.10	15.1
Aspen	23.31	19.88	71.00	27.14	13.0
Other hardwoods	31.12	28.74	55.69	10.03	16.6
TOTAL VOLUME	427.54	565.06	1316.90	309.90	
% OF TOTAL	16.32	21.57	50.27	11.83	

Note: *Grade No. 4 identifies hardwood construction logs*

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
Red oak	*1.65*	*3.30*	*2.27*	*6.94*
Yellow birch	*[2.55]*	*5.22*	*1/*	*11.00*
Paper birch	5.99	4.41	*8.26*	*9.28*
Sugar maple	9.03	5.72	12.45	12.04
Soft maple	24.43	14.56	33.68	30.68
Beech	[2.51]	2.03	*1/*	*4.28*
White ash	*5.62*	*5.74*	*7.75*	*12.10*
Aspen	4.72	.77	6.51	1.62
Other hardwoods	3.14	1.82	4.33	3.83
TOTAL GROWTH	59.64	. .	75.25 2/	. .
TOTAL REMOVALS	. .	43.57	. .	91.77
1973 TOTALS	53.34	71.73		

Notes: *Volumes in millions of board feet/year*

[ ] *denotes volume reduction*

Values in italics = removal exceeds growth

1/ No basis for projection
2/ Exclusive of yellow birch and beech growth

SOFTWOOD SAWTIMBER (LINCOLN-HOWLAND WORKING CIRCLE)

Red spruce is predominant in volume, accounting for 41 percent of the softwood sawtimber. White pine, balsam fir, and hemlock, in approximately equal proportion, account for another 43 percent of the sawtimber volume. The quality of pine is low, 77 percent occuring in No. 3 and No. 4 Grade sawlogs. The inventory of that average quality is low due to over maturity; removals, now in balance, will exceed growth (by 8%) in 1978. Northern white cedar, 11 percent of the softwood sawtimber volume, is being removed two thirds faster than it grows.

Volume/Species Ratios - 1971 Data

	Million Board Feet	%
White pine	802.8	13.4
White spruce	258.1	4.3
Red spruce	2446.7	40.8
Balsam fir	875.1	14.6
Hemlock	883.5	14.8
No. white cedar	658.0	11.0
Other softwoods	65.8	1.1
TOTAL VOLUME	5990.0	
1973 VOLUME	6397.9	

Grade/Average Diameter - 1971 Data

Softwoods other than pine are not graded

	Million Board Feet				
	No.1	No.2	No.3	No.4	dbh
White pine	70.09	115.01	389.12	242.85	17.3
White spruce	-	-	-	-	12.0
Red spruce	-	-	-	-	12.4
Balsam fir	-	-	-	-	10.8
Hemlock	-	-	-	-	14.0
No. white cedar	-	-	-	-	11.7
Other softwoods	-	-	-	-	12.4
% OF TOTAL	8.68	14.08	47.62	29.72	

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
White pine	18.72	18.34	29.95	*32.46*
Spruce	96.74	41.16	155.13	72.94
Balsam fir	32.61	23.93	52.29	42.41
Hemlock	26.05	2.79	41.79	4.92
No. white cedar	*8.38*	*13.54*	*13.44*	*32.99*
Other softwoods	3.25	.33	5.20	.58
TOTAL GROWTH	185.75	. .	297.80	. .
TOTAL REMOVAL	. .	100.09	. .	186.30
1973 TOTALS	207.11	114.10		

Notes: *Volumes in millions of board feet/year*

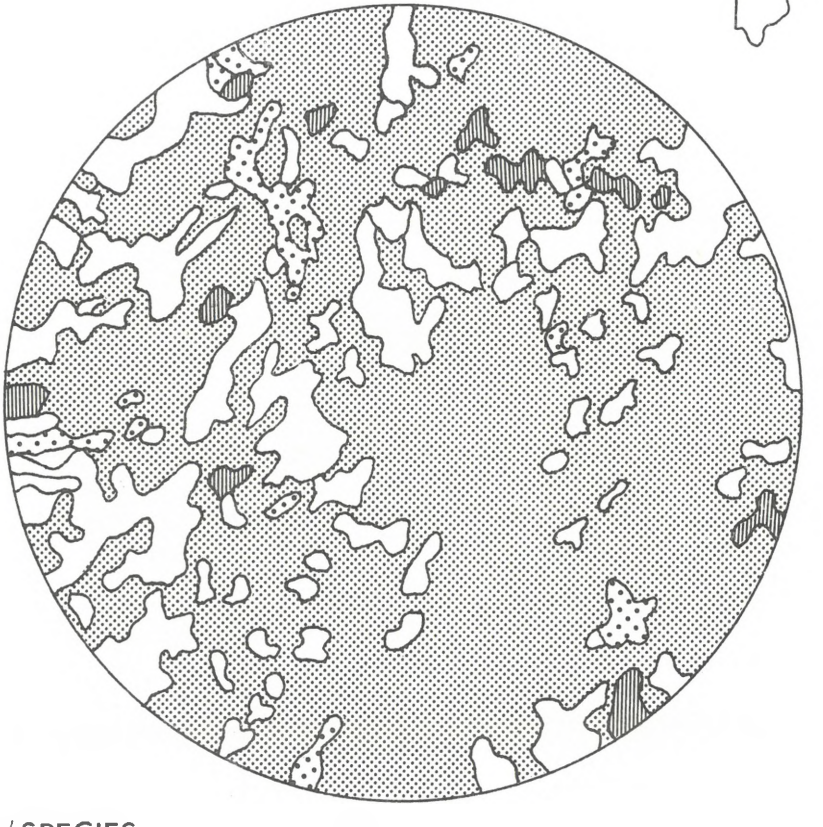
Value in italics = removal exceeds growth

HARDWOOD SAWTIMBER (DOVER-FOXCROFT WORKING CIRCLE)

Sugar and soft maples (in a 2:1 volume ratio) account for 55 percent of the hardwood sawtimber. Growth and removal of these species are in balance now, but are expected to cross over to an unfavorable relationship before 1983. Sawlog quality for both is comparable, running 59 percent No. 3 and No. 4 grades for sugar maple; 61 percent for soft maple. Beech, 9 percent of the total sawtimber in the working circle, is limited in quantity and poor in quality -- 90 percent No. 3 and No. 4 Grade sawlogs. Aspen, less than 3 percent of the total, is in short supply. Ash and paper birch are heavily utilized; expected to cross over to unfavorable growth/removal ratios by 1983. Red oak and yellow birch growth and removal are heavily out of balance at this time.

DOVER - FOXCROFT
WORKING CIRCLE (90.9 percent Forested)

50-Mile Sawtimber Species Distribution



FOREST TYPES / SPECIES

SOFTWOODS 65%

spruce - fir 63%

HARDWOODS 35%

maple - birch - beech 61%

aspen - birch 8%

NONFORESTED

394,500 acres

Volume/Species Ratios - 1971 Data

	Million Board Feet	%
Red oak	53.3	1.9
Yellow birch	447.5	15.9
Paper birch	153.6	5.5
Sugar maple	1028.1	36.5
Soft maple	518.9	18.4
Beech	252.6	9.0
White ash	119.7	4.3
Aspen	81.7	2.9
Other hardwoods	164.2	5.8
TOTAL VOLUME	2819.6	
1973 VOLUME	2875.0	

Grade/Average Diameter - 1971 Data

Grade No. 4 identifies construction logs

	Million Board Feet				
	No.1	No.2	No.3	No.4	dbh
Red oak	16.2	17.87	14.72	4.63	18.5
Yellow birch	64.7	126.10	219.22	38.65	15.5
Paper birch	11.5	23.16	83.94	13.07	14.3
Sugar maple	200.8	266.23	459.95	110.08	17.2
Soft maple	32.6	107.49	299.05	74.69	14.9
Beech	8.1	17.05	174.64	53.38	14.8
White ash	18.1	29.58	55.15	15.84	14.3
Aspen	3.0	12.86	48.93	17.01	13.3
Other hardwoods	34.7	44.89	73.61	11.51	16.7
TOTAL VOLUME	389.7	645.23	321.19	338.86	
% OF TOTAL	13.91	23.01	50.99	12.09	

Note: *Grade No. 4 identifies hardwood construction logs*

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
Red oak	*1.68*	*3.45*	*2.31*	*7.26*
Yellow birch	*3.12*	*7.98*	*4.30*	*16.81*
Paper birch	6.13	4.07	*8.45*	*8.58*
Sugar maple	17.85	12.54	*24.60*	*26.41*
Soft maple	19.87	12.99	27.38	27.36
Beech	3.74	.62	5.15	1.30
White ash	4.54	3.63	*6.25*	*7.65*
Aspen	3.59	1.58	4.95	3.32
Other hardwoods	4.15	2.41	5.73	5.08
TOTAL GROWTH	64.67	. .	89.12	. .
TOTAL REMOVAL	. .	49.27	. .	103.77
1973 TOTALS	69.65	58.52		

Notes: *Volumes in millions of board feet/year*

Values in italics = removal exceeds growth

SOFTWOOD SAWTIMBER (DOVER-FOXCROFT WORKING CIRCLE)
Inclusive of Brownville Junction Area

Growth of all species of softwood sawtimber within this working circle exceeds removal, with expected mild cross-over in removal of white pine and Northern white cedar around 1983. With second highest volume of spruce-fir in the Project Woodchip study areas (Aroostook first), removal of these species is the lowest -- 28 percent of growth, compared to 36 percent in Aroostook, 47 percent in Lincoln-Howland, and 33 percent in central Somerset.

Volume/Species Ratios - 1971 Data

	Million Board Feet	%
White pine	681.1	13.0
White spruce	285.0	5.5
Red spruce	2030.2	38.8
Balsam fir	951.6	18.2
Hemlock	629.1	12.0
No. white cedar	634.5	12.1
Other softwoods	20.5	0.4
TOTAL VOLUME	5232.0	
1973 VOLUME	5653.0	

Grade/Average Diameter - 1971 Data

Softwoods other than pine are not graded

	No.1	No.2	No.3	No.4	dbh
White pine	49.20	105.00	321.19	207.51	17.8
White spruce	-	-	-	-	12.4
Red spruce	-	-	-	-	12.4
Balsam fir	-	-	-	-	10.8
Hemlock	-	-	-	-	14.3
No. white cedar	-	-	-	-	12.5
Other softwoods	-	-	-	-	12.1
% OF TOTAL	7.20	15.38	47.03	30.39	

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
White pine	17.84	11.99	28.60	21.25
Spruce	81.31	20.97	130.39	37.16
Balsam fir	39.26	12.98	62.96	23.00
Hemlock	17.56	6.94	28.15	12.31
No. white cedar	2.68	2.38	4.27	4.21
Other softwoods	1.58	.09	2.54	.15
TOTAL GROWTH	160.23	. .	256.91	. .
TOTAL REMOVAL	. .	55.35	. .	98.08
1973 TOTALS	178.68	63.17		

Note: *Volume in millions of board feet/year*

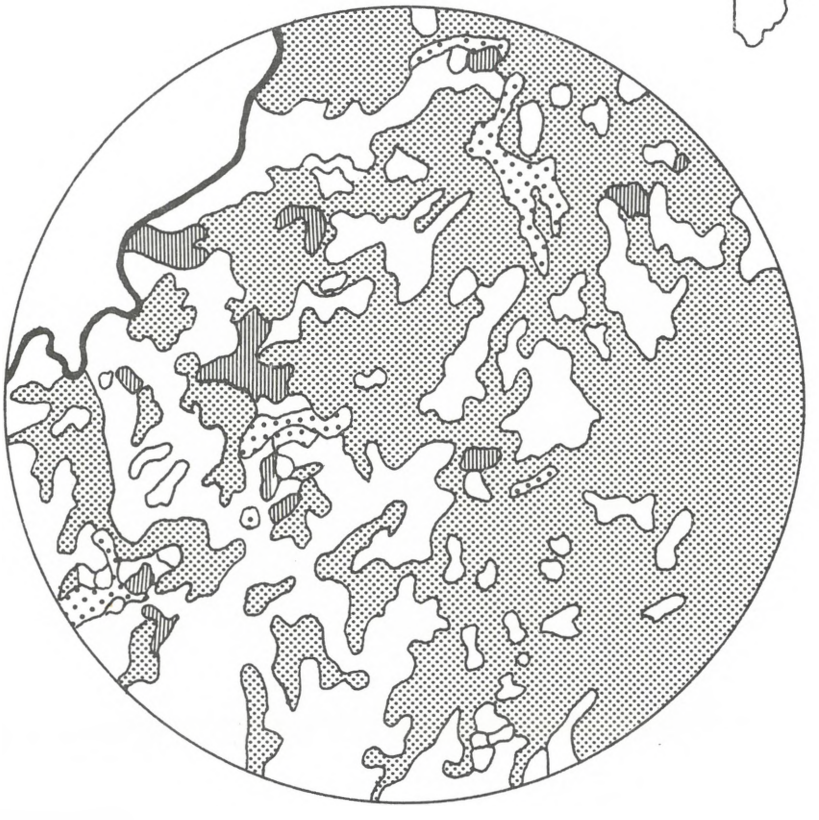
HARDWOOD SAWTIMBER (CENTRAL SOMERSET WORKING CIRCLE)

Inclusive of North Anson

Sugar maple and yellow birch are preponderant in volume, but growth/removal ratios are not satisfactory, particularly for sugar maple. Growth and removal of soft maple sawtimber, third in hardwood volume, are presently in balance, with cross-over expected around 1983.

CENTRAL SOMERSET
WORKING CIRCLE (91.1 percent Forested)

50-Mile Sawtimber Species Distribution



FOREST TYPES / SPECIES

SOFTWOODS 61%

spruce - fir 66%

HARDWOODS 39%

maple - birch - beech 64%

aspen - birch 11%

NONFORESTED

357,600 acres

The rates of growth of paper birch, white ash, and aspen, accounting together for only 13.7 percent of the sawtimber volume in the working circle, exceed removals and are expected to continue through 1983. Saw-log grade distribution for all species approximates the Lincoln-Howland and Dover-Foxcroft areas.

Volume/Species Ratios - 1971 Data

	Million Board Feet	%
Red oak	90.8	3.1
Yellow birch	570.0	19.7
Paper birch	184.4	6.4
Sugar maple	1037.8	35.9
Soft maple	412.9	14.3
Beech	242.7	8.4
White ash	82.3	2.8
Aspen	128.9	4.5
Other hardwoods	139.2	4.8
TOTAL VOLUME	2889.0	
1973 VOLUME	2938.0	

Grade/Average Diameter - 1971 Data

	Million Board Feet				
	No.1	No.2	No.3	No.4	dbh
Red oak	19.1	23.9	29.2	7.2	18.1
Yellow birch	52.5	157.1	294.2	47.9	15.9
Paper birch	15.2	47.4	106.6	15.1	15.0
Sugar maple	115.5	259.6	489.5	113.0	16.7
Soft maple	27.6	80.1	247.5	60.3	15.0
Beech	2.7	16.8	152.6	64.8	14.8
White ash	16.7	19.0	37.8	10.6	13.9
Aspen	11.2	19.3	70.8	27.1	13.6
Other hardwoods	24.8	39.0	63.4	10.2	16.4
TOTAL VOLUME	285.3	662.2	1491.6	356.1	
% OF VOLUME	10.2	23.4	53.7	12.7	

Note: *Grade No. 4 identifies hardwood construction logs*

Growth/Removal Relationship - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
Red oak	4.36	4.19	*6.01*	*8.82*
Yellow birch	*9.76*	*11.07*	*13.45*	*23.31*
Paper birch	6.97	3.66	9.61	7.72
Sugar maple	*6.72*	*14.10*	*9.26*	*29.71*
Soft maple	17.28	11.56	23.82	23.35
Beech	*.23*	*.76*	*.32*	*1.61*
White ash	3.18	1.69	4.37	3.56
Aspen	5.44	2.05	7.50	4.31
Other hardwoods	3.93	2.44	5.42	5.15
TOTAL GROWTH	57.87	. .	79.77	. .
TOTAL REMOVAL	. .	51.52	. .	107.54
1973 TOTALS	62.32	61.19		

Notes: *Volume in millions of board feet/year*

Values in italics = removal exceeds growth

SOFTWOOD SAWTIMBER (CENTRAL SOMERSET WORKING CIRCLE)
Inclusive of North Anson Area

Removal of white pine sawtimber exceeds growth. Other species are under-utilized. The volume of spruce-fir is considerably less, and, interestingly, average tree diameter (dbh) is one inch smaller than in the other Project Woodchip study areas. White pine is poor quality; 81 percent falls into No. 3 and No. 4 sawlog grades, with one third of that quantity classified No. 4 Grade.

Volume/Species Ratios - 1971 Data

	Million Board Feet	--%
White pine	643.6	14.7
White spruce	290.5	6.6
Red spruce	1559.6	35.5
Balsam fir	1040.6	23.7
Hemlock	381.3	8.7
No. white cedar	457.6	10.4
Other softwoods	20.0	0.4
TOTAL VOLUME	4393.2	
1973 VOLUME	4648.8	

Grade/Average Diameter - 1971 Data

Softwoods other than pine are not graded

	Million Board Feet				
	No.1	No.2	No.3	No.4	dbh
White pine	32.40	87.70	330.30	193.20	16.4
White spruce	-	-	-	-	11.8
Red spruce	-	-	-	-	11.4
Balsam fir	-	-	-	-	9.9
Hemlock	-	-	-	-	13.0
No. white cedar	-	-	-	-	12.0
Other softwoods	-	-	-	-	11.8
% OF TOTAL	5.03	13.63	15.32	30.02	

Growth/Removal Relationships - 13 Year Projection

	1970		1983	
	Growth	Removal	Growth	Removal
White pine	*28.32*	*29.66*	*45.42*	*52.56*
Spruce	67.64	17.04	108.48	30.20
Balsam fir	45.64	20.57	73.19	36.45
Hemlock	13.00	6.53	20.84	11.58
No. white cedar	1.36	1.86	2.18	3.29
Other softwoods	.40	.68	.65	1.21
TOTAL GROWTH	156.36	. .	250.76	. .
TOTAL REMOVAL	. .	76.34	. .	135.29
1973 TOTALS	174.36	87.13		

Notes: *Volumes in millions of board feet/year*

Values in italics = removal exceeds growth

1.02 VALUE ANALYSIS (LOW GRADE HARDWOOD)

Determination of the economic feasibility of a fully integrated wood products manufacturing facility consistent in function and operating results with the Project Woodchip objective must focus on conversion of low grade, low value hardwood sawtimber into high value products. Excluding consideration of fiber-based products, there is clear evidence from successful manufacturing ventures in Maine that conversion of the principal species of softwood sawtimber into lumber and other conventional manufactured products does not inherently involve questionable economic feasibility. The same condition applies to venture premised on conversion of upper grades of hardwood sawtimber. Utilization of primarily low grade hardwood sawtimber, on the other hand, can not be viewed with the same secure predetermination. Therefore, the study must include value analysis of low grade hardwood sawlog utilization to confirm feasibility of a system concept that would either (a) process No. 1, No. 2, and No. 3 Grade sawlogs in the proportion in which they occur on commercial forest land, or (b) limit processing to No. 2 and No. 3 Grade sawlogs in the proportion in which they occur.

LUMBER GRADE YIELD

Birch-beech-maple sawlogs were selected as key species for determination of value relationships and feasibility. Woods-run grade distribution of these species averages 12.3% No. 1, 22.6% No. 2, and 65.1% No. 3. Excluding procurement of No. 1 Grade sawlogs, the ratio becomes 25.8% No. 2 and 74.2% No. 3.

- Grade yield of lumber from sawlogs will vary with log grade, diameter (which will average differently with species and log grade), and species. Average diameters for Maine sawtimber (inches inside bark, by log grade) are:

	No. 1	No. 2	No. 3
Yellow birch	16	15	14
Beech	15	14	13
Sugar maple	19	18	17

o Grade Yields Of Lumber From Birch-Beech-Maple Sawlogs
Showing Percentage Relationships

	Lumber Grade Yields							
	FAS	SEL	1C	2C	SW	3A	3B	Tbrs.
Yellow Birch:								
No. 1 Sawlogs	27.5	7.0	30.8	14.1	-	5.0	15.6	-
No. 2 Sawlogs	13.1	7.7	26.0	21.2	-	6.5	25.5	-
No. 3 Sawlogs	1.2	0.4	9.2	21.2	-	21.2	46.8	-
AVERAGE - Woods-Run	8.2	3.4	17.0	20.2	-	14.8	36.4	-
AVERAGE - No.2 & No.3	5.1	2.8	14.8	21.2	-	16.3	39.8	-
Beech:								
No. 1 Sawlogs	14.8	15.6	39.9	10.7	-	3.5	15.5	-
No. 2 Sawlogs	5.4	6.1	31.6	24.1	0.5	9.3	23.0	-
No. 3 Sawlogs	0.7	1.4	13.0	31.2	9.5	10.9	33.3	-
AVERAGE - Woods-Run	1.5	2.2	15.4	30.0	8.6	10.5	31.8	-
AVERAGE - No.2 & No.3	1.2	1.9	14.8	30.5	8.6	10.7	32.3	-
Sugar Maple:								
No. 1 Sawlogs	27.9	11.1	31.8	13.9	-	2.7	11.7	0.9
No. 2 Sawlogs	7.0	8.8	33.3	22.2	-	6.2	22.1	0.4
No. 3 Sawlogs	1.0	2.9	15.7	34.2	-	16.3	24.1	5.8
AVERAGE - Woods-Run	8.0	6.2	23.9	26.8	-	10.7	21.1	3.3
AVERAGE - No.2 & No.3	2.6	4.4	20.3	31.1	-	13.7	23.6	4.3
Birch-Beech-Maple:								
AVERAGE - Woods-Run	6.9	4.7	20.5	25.5	1.5	11.8	27.2	1.8
AVERAGE - No.2 & No.3	3.0	3.5	17.8	28.3	1.5	13.9	29.5	2.4

LUMBER VOLUME YIELD, COST, AND MARGIN OF PROFIT

The volume of lumber sawn from each 1000 board feet of sawtimber (log scale measure) will vary in relationship to log diameter and the log rule applied to determine sawtimber volume. Volumetric data concerned with sawtimber in Section 1 of this report are in accordance with International $\frac{1}{4}$-inch Rule. Volumetric data in this value analysis have been adjusted to Holland (or Maine) Rule, which is the standard for sawtimber procurement in the areas under consideration.

- For average birch-beech-maple sawlogs overrun will be -8.6 percent for woods-run sawlogs; -13.9 percent for No. 2 and No. 3 Grade sawlogs.
- 1000 board feet of woods-run sawlogs will yield 914 board feet of sawn lumber.

- 1000 board feet of No. 2 and No. 3 Grade sawlogs will yield 861 board feet of sawn lumber.

- Lumber Yield Per 1000 Board Feet of Birch-Beech-Maple Sawtimber

Grade	Board Feet of Sawn Lumber From Woods-Run	Board Feet of Sawn Lumber From No. 2 & No. 3
FAS	63	26
SELECT	43	30
1 C	187	153
2 C	233	244
SW	14	13
3 A	108	120
3 B	250	254
TIMBERS	16	21
TOTAL LUMBER	914	861

For purposes of analysis it is assumed that fixed and variable overhead costs of a typical sawmill in Maine would be $31.00 per 1000 board feet of lumber manufactured. This cost, plus the cost of sawlogs, will equal the cost of manufacturing hardwood lumber on a routine operating basis.

- Adjusted spring 1972 mill-delivered prices for birch-beech-maple sawlogs were $60.30/Mbf low average, $94.47/Mbf high average, and $78.80/Mbf average of most common.

- Applying the high average price as the cost of woods-run sawlogs, the cost per 1000 board feet of sawn lumber would be $103.36. Adding overhead, the total cost to manufacture lumber from woods-run sawlogs would be $134.36/Mbf (lumber scale).

- Applying the average-most common price as the cost of No. 2 and No. 3 Grade sawlogs, the cost per 1000 board feet of sawn lumber would be $91.40. Adding overhead, the total cost to manufacture lumber from a representative mixture of these logs would be $122.40/Mbf (lumber scale).

The average October 1972 f.o.b. sawmill price for birch-beech-maple lumber sawn from logs representative of the grade mix for woods-run sawlogs was $132.51/Mbf; for lumber from No. 2 and No. 3 Grade the price was $125.00/Mbf.

Average Market Prices For B-B-M Lumber
f.o.b. mill, October 1972

	Dollars per Thousand Board Feet		
Grade	Yellow Birch	Beech	Sugar Maple
FAS	360	195	295
SELECT	340	180	275
1 C	195	152	205
2 C	105	86	100
3 A	83	72	80
3 B	70	70	70

Source: Hardwood Market Report

- Comparison of the cost of manufacturing sawn lumber to market prices -- $134.36 to $132.51/Mbf for processing woods-run birch-beech-maple; $122.40 to $125.00/Mbf for processing No. 2 and No. 3 Grade only -- and consideration of the price spread between upper and lower grades of lumber clearly identifies why sawmills in Maine have historically high graded the resource of hardwood sawtimber.

ADDING VALUE TO SAWN LUMBER

There is good chance that a large, efficient sawmill in Maine could, through the economics of scale, experience a better margin between cost of manufacture and average sales revenue than demonstrated above. However, the latitude of opportunity would be very narrow and not at all attractive to investors. A modestly scaled sawmill could not expect significant improvement over the projections. Alternative to restriction to this simplistic pattern, option could be exercised, through increasing the scope of processing, to include yielding sawn log-run lumber to improve the average grade.

- If facilities were provided at the sawmill to remove defects from 2A+ and lesser grade lumber, by programmed removal of knots and other defects, in boards, average market value could be increased.
- It can be assumed with reasonable certainty that 40 percent of the lumber sawn from birch-beech-maple sawlogs will grade out 2A+ and better. Processing the remaining 60 percent by cross-cut and rip saw removal of defects should yield 30 percent solid wood waste (usable for fuel, fiber-based products, or salable) and 70 percent upgraded lumber that would average No. 1 Common Grade. Under these circumstances 1000 board feet of mill-run lumber

would yield 790 board feet of 1C and better lumber, and the equivalent of 210 board feet of solid residue.

- Based on average grade yields from sawing woods-run or No. 2 and No. 3 Grade sawlogs, October 1972 market prices for birch, beech, maple lumber, and adjustment of grade and volume yields that would result from defect removal -- average market prices would increase to $156/Mbf when sawing woods-run, and $144/Mbf when sawing No. 2 and No. 3 Grade.
- Adding $10/Mbf to sawmill operating costs for upgrading, these (before tax) margins evidence;
  - for woods-run $16/Mbf, or 10.3 percent margin above costs.
  - for No. 2 and No. 3 $12/Mbf, or 9.1 percent above costs.

While the margins demonstrated above are substantially better than could be expected from manufacture and sale of mill-run rough (but graded) lumber, they are still insufficient to attract consequential investor interest. However, considerable additional margin advantage can be derived by taking processing one step further, to include remanufacturing operations to produce hardwood dimension (squares, dimensowood, etc.) for sale to the furniture industry.

- Skip planing rough (upgraded) lumber, the simplest extent of processing, will result in approximately 10 percent volume loss. Further processing to standard sizes or special-order dimensions could result in an average aggregate loss of as much as 40 percent of initial volume. In this case, 1000 board feet of rough sawn lumber, reduced to 790 board feet of No. 1 common and better grade, would shrink further to 474 board feet of salable product.
- The equivalent of 526 board feet of lumber would be converted into shavings and solid waste during processing.
- Through selective marketing the 474 board feet of hardwood dimension could return an average net sales revenue of $375/Mbf. This calculates to $178/Mbf for each 1000 board feet of sawlogs processed through the sawmill. Allowing $15/Mbf additional to cover processing costs for these operations, the result will be an approximate increase of three percent in profit margin, increased cash flow, and more jobs than attainable through restriction to simply upgrading rough lumber.

APPLICATION OF ANALYSIS

The analyses of selected operating approaches and activities presented above evidences that sawmill-based industry in Maine can profitably convert essentially low grade hardwood sawtimber into wood products. But, a sawmill alone cannot operate profitably (unless it high-grades the resource) if its activities are limited to manufacturing rough lumber, particularly if sales are based on mill-run rather than graded shipments. Each advancement of processing that adds value to the lumber product contributes strength to economic feasibility.

- Additional impetus to feasibility will derive from extending secondary processing activities to include product fabrication -- e.g., wood parts, furniture -- and to utilize processing residues as raw material for manufacture of fiber or wood particle based products.
- For every 1000 board feet of sawlogs processed by a sawmill that is vertically integrated through manufacture of hardwood dimension, the equivalent of as much as 1526 board feet of residue may be generated as raw material (or fuel) convertible into additional jobs, cash flow, and profit.

1.03 SITE SELECTION STUDY

Four preselected site areas considered to potentially have the timber and human resources and industrial support capabilities required by a wood processing complex have been evaluated by site selection study. Of these areas, Ashland, in Aroostook County, has been selected as having best circumstances for support of the proposed complex, at the expense of the others. This is not to infer that the other areas do not qualify for further consideration, rather it proffers the Ashland area as evidencing the best potential for rapid implementation of the concept.

It is beyond the purpose of this report to definitively analyze each of the four preselected areas, however, a comparative analysis is provided in table form to give the reader a 'to the point' comparison of the assets and deficiencies of each of the areas with respect to their potential for support of a wood processing complex.

Data and information gathered for each of the areas evidence comparable potential for establishment of less ambitiously structured wood processing enterprise in place of the complex envisioned in this Report. Selection of Ashland was made on the basis that implementation of new or expanded venture would not be delayed by the time requirement necessary to stimulate sound investment or commitment of venture capital, since this has been accomplished for the Mode-1 configuration as explained in Section 3. Ashland in fact has slight advantages over the other three site areas in terms of industrial support, human resources, and availability of sawtimber.

PRESELECTED SITE CHARACTERIZATION

In addition to Ashland in Aroostook County, the three other localities selected for concentrated analysis within each of the respective site areas were: North Anson in Central Somerset County; Brownville Junction in the Dover-Foxcroft (Piscataquis County) area; and Lincoln in the Lincoln-Howland area.

Results of the analysis of each area for selection of the best in terms of offering the best potential for establishment of a wood processing complex are shown by table below, which illustrates significant differences and similarities of each of the four preselected site areas and evidences the reasons for selection of Ashland over the other areas.

LINCOLN SITE

Lincoln, with a population of 4,750, evidences best potential for support of a wood processing complex within the Lincoln-Howland Working Circle and would be considered as second choice, after Ashland, for location of a wood processing complex as envisioned in this Report. As shown by the chart on page 39, the labor supply is not considered sufficient and is one major factor against selection of this area as the primary site location for Project Woodchip. Industry in the area does support the Woodchip concept and would, in all probability, take initiative to implement the concept if factors were found to be supportive to such an undertaking.

The Lincoln area is in close proximity to acceptable sawtimber resources (commitment of those resources to the complex would be a major problem) and an acceptable industrial supportive environment and compares favorably with the Ashland area as evidenced by table on page 14. The area is eligible for qualification as a Redevelopment Area under persistent unemployment provisions contained in Title IV of the Public Works and Economic Development Act of 1965. At this time it is uncertain what effect, if any, the dissolution of the Economic Development Administration will have on this classification.

Lincoln, and sites within the Lincoln-Howland Working Circle (see page 14 for location), does provide an ideal location for a smaller scale wood processing enterprise; either a primary products manufacturer like a sawmill (hardwood or softwood) or a secondary products manufacturing firm such as furniture manufacture. There is a possibility that such an enterprise could be tied with the Woodchip Complex at Ashland, or it could be independent if a raw material supply could be located and assured over the long-term.

BROWNVILLE JUNCTION - NORTH ANSON SITES

The two preselected site areas not considered suitable for support of a wood processing complex are Brownville Junction in the Dover-Foxcroft Working Circle and North Anson in the Central Somerset Working Circle (see page 14 for locations). Both sites were selected within their respective working circles as evidencing best potential for support of a Woodchip concept complex. Further investigation resulted in their disqualification from consideration as primary sites since they did not compare favorably with the other preselected site locations, as evidenced by the table on page 39.

This characterization, with regards to potential for Project Woodchip, does not intend to infer that either of the areas could not support forest products based industry. There is every indication that both areas could well support some degree of wood processing industry, perhaps even a scaled down version of the fully integrated wood processing complex recommended for location in Ashland by this Report.

COMPARISON OF THE FOUR PRESELECTED SITE LOCATIONS - EVIDENCING POTENTIAL FOR SUPPORT OF A FULLY INTEGRATED WOOD PROCESSING COMPLEX

		ASHLAND	LINCOLN	BROWNVILLE JUNCTION	N. ANSON
(1)	Industrial Support Capability	*adequate*	*good*	*poor*	*adequate*
(2)	Sawtimber Availability	*excellent*	*good*	*poor*	*marginal*
(3)	Land Owner/Manager Cooperation	*good*	*good*	*marginal*	*marginal*
(4)	Access to Transportation Networks (Rail & Highway)	*good*	*good*	*excellent*	*good*
(5)	Ability to Acquire Private Financial Assistance	*good*	*good*	*N/A*	*N/A*
(6)	Ability to Acquire Public/ Government Financial Assistance	*good*	*good*	*good*	*good*
(7)	Industrial Site Availability	*yes*	*yes*	*yes*	*yes*
(8)	Labor Supply	*marginally adequate*	*poor*	*poor*	*marginally adequate*
(9)	Intent by Private Firms to Carry Out Program Through Implementation	*positive*	*possible*	*N/A*	*N/A*
(10)	Locational Advantage With Respect To Major Markets For Products To Be Manufactured (of the 4 sites)	*adequate*	*good*	*good*	*good*

ASHLAND AREA CHARACTERIZATION

Ashland, having a population of 1,760, has been selected as evidencing best potential for support of the Woodchip concept wood processing complex. Ashland, located in northern Aroostook County, is in close proximity to acceptable industrial support factors (as outlined below) and an acceptable resource of timber necessary to properly operate the wood processing complex on a long term basis. The area surrounding Ashland, primarily located within the confines of the Caribou-Presque Isle Redevelopment Area as defined by the Northern Maine Regional Planning Commission, is eligible for qualification as a redevelopment area under persistent unemployment provisions contained in Title IV of the Public Works & Economic Development Act of 1965, on the basis of a Smaller Area Report dated May 20, 1971. This is particularly significant since, in all probability, the Economic Development Administration is expected to receive federal support for at least one additional year, after previous indications that the agency would be terminated at the end of fiscal 1973.

The Ashland area evidences suitable factors that would contribute positively to the operation, maintenance, and sustenance of a Woodchip concept wood processing complex. Development groups, specifically the Northern Maine Regional Planning Commission, stand ready to assist where they are able in efforts necessary to establish a wood processing complex such as envisioned in this Report. Great Northern Nekoosa, a major land owner/timber processor in the Ashland area has expressed support of the Woodchip concept (in a news release dated October 3, 1972) and has been following the project closely.

MANPOWER RESOURCES

The Ashland area complex, sized to fit the economically available wood raw material resource in the Aroostook Working Circle, would eventually provide employment for as many as 600 workmen; 300 at first. It can be anticipated that recruitment of employees will be largely confined to residents of the Caribou-Presque Isle Redevelopment Area (C-PIRA). In addition, there may be a limited resource of employable manpower from outside this area who would look upon Ashland and vicinity as a desirable habitat, justifying their relocation.

The Caribou-Presque Isle Redevelopment Area accounts for approximately one-half the population of Aroostook County. Population (1970 Census) within a 25-mile radius of Ashland is 32,148; increasing to 53,631 in the C-PIRA. These figures indicate a 13.9 percent trend downwards from 1960 Census figures; out-migration over the 10-year period from 1960 through 1970 was 32.7 percent, or one person in three, losses occuring mostly in the 0-14 and 25-44 age groups. The remainder of the population in the area is, therefore, characterized by an abnormally high percentage of persons in dependency years, with a less than adequate

percentage of working age individuals available to assume the additional economic burden this represents.

Demographic trends mentioned above can be best explained by the lack of concerted industrial development in the area. The major industry in the area, potato growing and processing, has been economically marginal in past years, not prone to exceptional expansion (especially with the failure of the recent sugar beet venture), working on a somewhat status-quo basis. The other major industrial enterprise of the area, the timber industry, has been characterized by a small number of large scale timber owners/managers who control a majority of the timber resource. In the past, these timber owners/managers have not indicated it to be in their best interest to offer long-term timber supply contracts to outside firms considering location in the area. This attitude is slowly diminishing, but not enough to justify large capital investment by an outside firm desiring to locate within the C-PIRA confines. The answer, of course, to this particular problem is to obtain support of major timber owners/managers in the area, which has been accomplished by efforts connected with Project Woodchip. There exists no other major industrial segment in the area that will be expanding within the foreseeable future (shoe manufacture is the only other private industry of magnitude located within the C-PIRA). It is important to note that a significant demographic characteristic evidenced within the C-PIRA is the unwillingness of inhabitants to relocate for any specific job; however, most people in the area will drive for a distance of up to 45 miles daily (one way - 90 miles round trip) to maintain a given job. The majority of the out-migrants are forced to depart for lack of work rather than dislike of the living environment. In fact, many former out-migrants return if and when they are able (evidenced in the discrepancy between out-migration of 32.7 percent and net change in population size of -13.9 percent over a 10-year period).

Labor force data below is inclusive of the total Caribou-Presque Isle Redevelopment Area since it is entirely probable that labor necessary to run the complex could be recruited from that area.

- The labor force numbers 20,893 persons.
- 60 percent of the labor force is unskilled.
- There is a severe shortage of workers evidencing proficiency in critical forest products manufacturing skills. Major responsibility jobs (head sawyer, shift foreman, etc.) will most likely require importation of talent from outside the confined of the C-PIRA.
- An average of 4,230 persons are unemployed (1972 monthly average), 20.2 percent of the labor force.
- 22 percent of the age group between 45-54 and 20 percent of the age group between 25-44 are unemployed.

- o 47.7 percent of the unemployed are male.
- o 13.7 percent of the unemployed have been out of work more than one year, 86.3 percent unemployed less than three months.
- o The median number of school years completed by persons 25 years and older is 11.4
- o On-the-job training programs (at State and Federal levels) are necessary if the Woodchip complex is to survive through the realization of economic breakeven.
- o Family income data reflects overall wage scale trends in the Ashland area:

  18.6% under $3000 per year

  15.4% $3000 to $4999 per year

  27.4% $5000 to $7999 per year

  14.2% $8000 to $9999 per year

  24.4% $10,000 and over per year

- o Labor unions have not been a significant factor in the Ashland area. Larger forest products companies do have organized unions that are, at this time, attempting to gain a foothold in small enterprises in the Ashland area.

THE INDUSTRIAL SUPPORTIVE ENVIRONMENT

The Ashland area has a sufficient industrial supportive environment to service the proposed Woodchip Complex. Basic details are listed below for reference purposes only.

Commercial Support:

- o Comprehensive industrial support services inclusive of machine shops, tool and die service, and electrical motor repair are available within the C-PIRA or within reasonable proximity (Bangor).
- o Adequate banking/financial facilities are available.
- o Fuel oil

  Fuel oil pricing for #2 heating oil (recommended for Woodchip applications at Ashland), subject to price escalation, is presently $.1569 per gallon delivered.

  Propane/natural gas are both available as back-up to oil - rates are quite high and would

not warrant consideration of use as prime sources of energy over oil.

- Electric power

  Industrial electric power rates (subject to a 10% increase in the near future)

  Maine Public Service Company

  (1) 50 KW minimum
  Demand - $2.00/KW/mo.
  Energy - 2.05¢/KWH (1st 300 hrs.)

  (2) 200 KW minimum
  Demand - $2.00/KW/mo.
  Energy - 1.45¢/KWH

  (3) 500 KW minimum
  Demand - 1st 500 KW or less - $880/mo.
  Next 2,500 KW - 1.60¢/KW/mo.
  Over 3,000 KW - 1.25¢/KW/mo.
  Energy - 1st 200 hrs - 1.35¢/KWH
  Next 200 hrs - 1.00¢/KWH
  Over 400 hrs - .70¢/KWH

Transportation Services:

- Ashland is served by the Bangor & Aroostook Railroad - four trains per day.
- Three licensed, inter-state motor freight carriers serve the community in addition to several local jobbers.

COMMUNITY RESOURCES

Municipal Services:

- Council-Manager type local government structure
- No county zoning ordinance; city zoning ordinance
- 25-man volunteer fire department. Fire insurance ratings; DPS 1 in Ashland, DPS 3 outside city

Housing Costs:

- Average cost of construction for residential housing is eight dollars per square foot.

Educational Facilities:

- One elementary school and one junior high school. Presque Isle opened a regional vocational-technical center to serve central Aroostook County in 1968. Presque Isle also hosts a campus of the University of Maine (liberal arts orientation).

Taxation:

- Basic tax rate within the community per $100 assessed value is $4.20

Medical, Social, & Religious Services:

- There are four hospitals within the C-PIRA, equating to:

  149 persons per available bed

- C-PIRA ratio of population to doctors is 1,420:1
- There are three Protestant and two Catholic churches in the community of Ashland. No other denominations are represented.
- Serious crime rate is low - 13 complaints per 1000 population in the C-PIRA.
- The Ashland area is characterized as a prime outdoor recreational sporting area, all season.

Ashland community support will provide the key for attracting and retaining a proper sized labor force for the complex. Desirable actions would include:

- New, suitable, and attractive housing, either rental or for sale with equitable long term financing.
- Addition or services, perhaps a supermarket and so on, to properly provide for additional population in the community.
- Recreational development, e.g., golf course, swimming pool, recreational park or other suitable/ desirable undertakings that will contribute to the well being of the community.

It must be accepted that the complex will, in all likelihood, draw employment from past northern Maine residents who now reside in Massachusetts and other populous areas (having been forced by economics to depart from northern Maine). These people will prefer support services (e.g., groceries, shopping centers, etc.) similar to what they had become

accustomed to in those areas in which they resided and were employed. Their desire to return to northern Maine's way of life is strong, but it will be tempered by their new found experiences.

Secondly, attraction of high level management will require a proper living environment; good quality housing, good community support services, recreational opportunity, and access to cultural activities. It is unlikely that it will be possible to employ individuals already located in the vicinity of Ashland who have qualifications necessary to successfully manage a particleboard plant. The top production, technical, and sales positions should be staffed by experienced persons. Suitable candidates for management positions are in short supply within the particleboard industry in the United States. To properly confront this situation, the plant must offer competitively high salaries. Furthermore, since the location of Ashland would be considered marginally attractive by most qualified management types, significant fringe benefits should be offered as a supplemental inducement to attract and hold desirable individuals. This would apply, at least in part, to management positions required by the other components of the complex.

1.04 SAWTIMBER AVAILABILITY - ASHLAND AREA

PROCUREMENT AREA

The 50-mile working circle, selected as the index for projecting sawtimber availability and planning procurement logistics, encompasses 5,026,049 acres, with this pattern of ownership/control:

- 863,444 acres assured available (34.5%)
- 1,199,605 acres other ownerships/control (48.0%) 1/
- 439,000 acres organized (17.5%)

Procurement of sawtimber for the Ashland facility is expected to extend beyond the procurement area -- a 100-mile truck haul considered not uncommon. However, volume allocations are premised on harvesting sawtimber growing within the working circle.

PROCUREMENT POLICY

90 million board feet of tree-length sawtimber per year have been allocated to sawmill processing by the Ashland area complex from an available reserve of 1.98 billion board feet of hardwood within a 50-mile working circle. 2/ Softwood sawtimber, predominantly spruce/fir, will comprise 80 million board feet per year. Assignment of softwood will generally be made on the basis of butt diameter size -- over 16 inches to be processed into lumber at the Ashland facility; under 16 inches to be sold for processing into chips. Hardwood sawlogs, maple predominating, will not be selected by diameter. The average 16-foot hardwood sawlog, cut from tree-length material delivered

1/ Timberland primarily controlled by large private ownership and land management firms; foremost would be International Paper Company, Great Northern Nekoosa, and 7-Islands Land Company. Assured available equates to acreage of timberland available to Project Woodchip at this time.

2/ Dependent upon forming close working ties with established land ownership/management firms in the Ashland area.

to the complex, is expected to be about 12.6 inches d.i.b. at the small end.

A 'model' complex should be at least as definitive in its identification of availability and allocations as has been the case in planning the Ashland facilities. Criteria could well be unchanged, within the allowances of the Aroostook resource base identified in Section 1 (or other area), except, volume would reduce to 60 million board feet total of which 50 million would be softwood.

VOLUME RELATIONSHIPS

The following data characterize and quantify merchantable softwood and hardwood sawtimber that would, in all probability, be available to the complex at Ashland, 1/

VOLUME OF MERCHANTABLE SOFTWOOD SAWTIMBER

The 1.98 billion board feet of merchantable softwood sawtimber within the 50-mile working circle -- inventoried in 1968 -- has been classified in accordance with the following species and volume relationships:

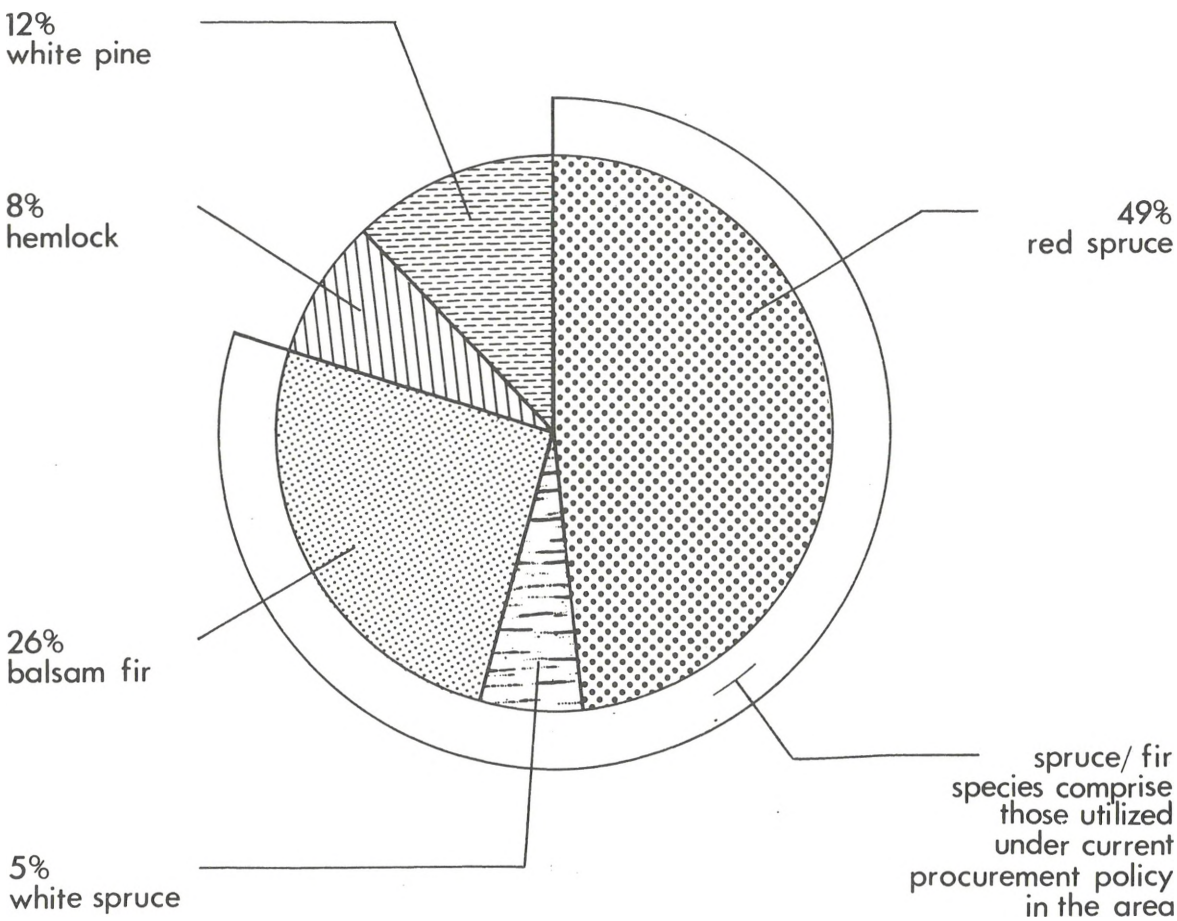
Available Softwood Sawtimber

	SUPPLY AREA		SPECIES	
	ASSURED AVAILABLE	OTHER OWNERSHIPS/CONTROL	TOTAL	PERCENT
Red spruce	643.3*	325.0*	968.3*	49
White spruce	69.1	38.5	107.6	5
Balsam fir	220.2	292.7	512.9	26
Hemlock	38.0	114.6	152.6	8
White pine	67.3	172.8	240.1	12
AREA TOTAL	1037.9	943.6	1981.5	
PERCENT	52.4	47.6		100

* *1968 data, values in million board feet.*

1/ Refer to pages 15-18 for Aroostook 50-mile working circle gross sawtimber statistics. See page 16 for species distribution map covering distribution within the Aroostook working circle.

SOFTWOOD VOLUME
RATIO BY SPECIES
AROOSTOOK WORKING CIRCLE



VOLUME OF MERCHANTABLE HARDWOOD SAWTIMBER

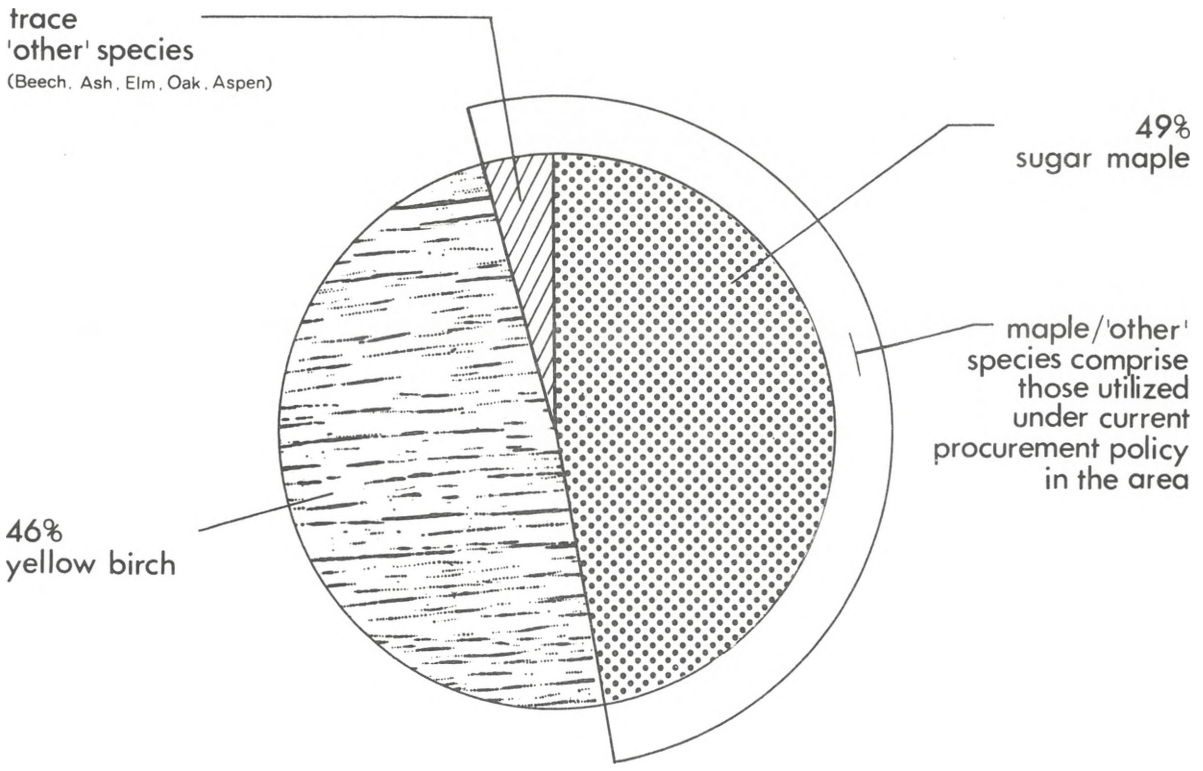
The 1.01 billion board feet of merchantable hardwood sawtimber within the 50-mile working circle evidences the following species and volume relationships:

Available Hardwood Sawtimber

	SUPPLY AREA		SPECIES	
	ASSURED AVAILABLE	OTHER OWNER-SHIPS/CONTROL	TOTAL	PERCENT
Sugar maple	211.5*	281.4*	492.9*	49
Yellow birch	177.0	340.9	517.9	51
AREA TOTAL	388.5	622.3	1010.8	
PERCENT	38.4	61.6		100

* *1968 data, values in million board feet.*

HARDWOOD VOLUME
RATIO BY SPECIES
AROOSTOOK WORKING CIRCLE



HARDWOOD SAWLOG GRADE DISTRIBUTION

An objective of Project Woodchip is to devise economic means to utilize low grade hardwood sawlogs. Proforma analyses of operating results projected for various operating models have evidenced conclusively that processing (excluding conversion into pulp) other than limited proportions of No. 3 Grade and lesser sawlogs, which account for 66.6 percent of the inventory of hardwood sawtimber in Aroostook County, would not be economically feasible. Emphasis at Ashland will be directed to utilize No. 2 (maple) sawlogs. Although this approach does not fully satisfy the grade utilization objective of the Project, it does represent a strong and important step away from the 'high grading' that has typified hardwood conversion industry in Maine. Average 'mill' grade ratios expected to prevail initially at Ashland are:

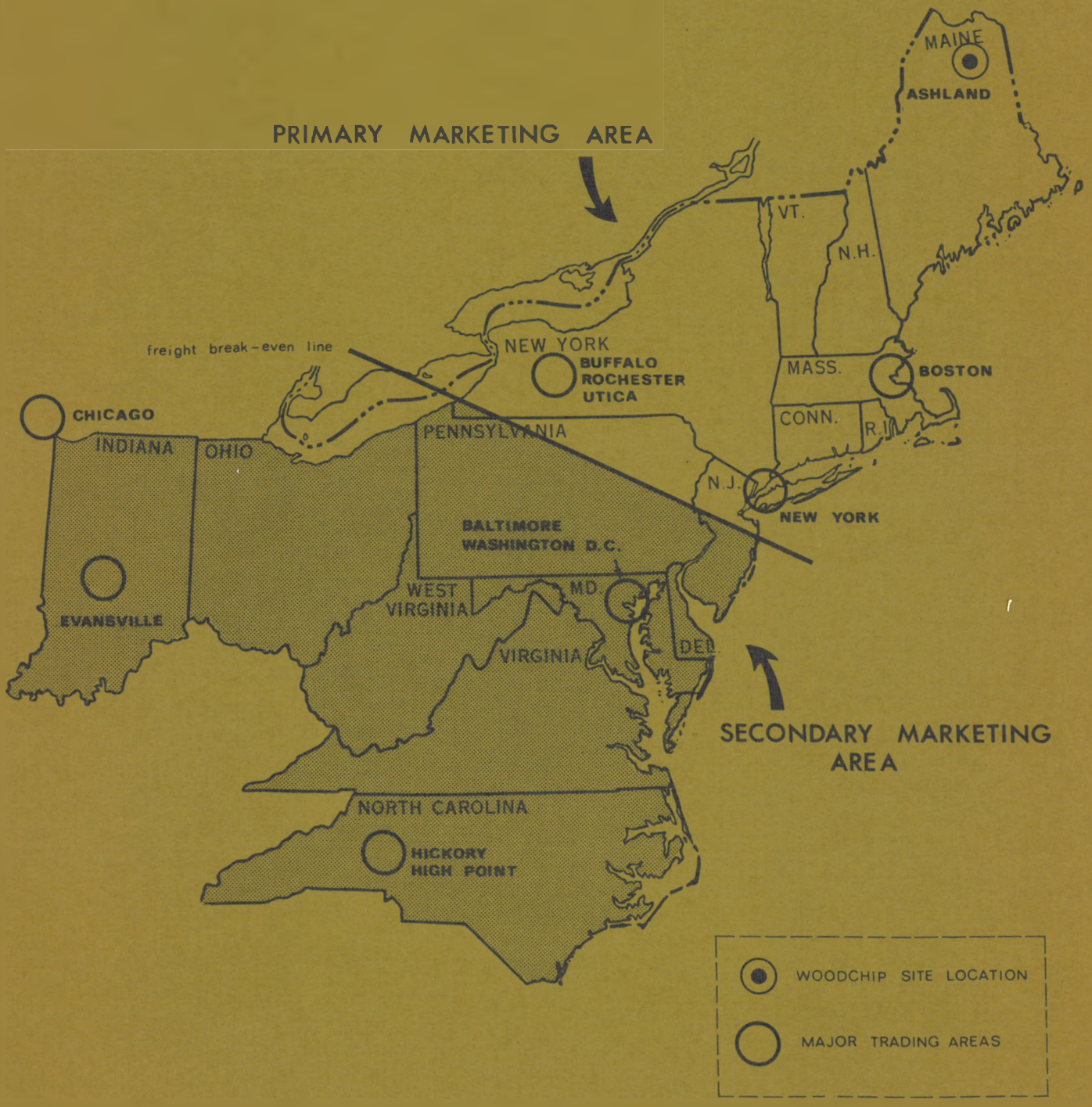
MILL GRADE	PERCENTAGE PROCESSED	IDENTIFYING CHARACTERISTICS
No. 1	13%	½ heart, 12" diameter and up
No. 2A	10%	small heart, 10" diameter and up
No. 2	72%	brown heart, 12" diameter and up
No. 3	5%	black heart, 10" diameter and up

The foregoing mill grade distribution transposed into U. S. Forest Service hardwood log grades becomes: 6 percent No. 1; 42 percent No. 2; 47 percent No. 3; and 5 percent No. 4. This schedule of log grade utilization is a strong departure from past practices of high-grading the saw timber resource, with expected additional advancement toward the 'Woodchip' grade utilization objective to result from operating experience and favorable adjustments by the Ashland area complex in its sawing and remanufacturing methods.

Section 2

Markets, Products & Marketing

PRIMARY & SECONDARY MARKETING AREAS



2.01 MARKETING TERRITORY

PRIMARY & SECONDARY MARKETING AREA IDENTIFICATION

The marketing territory accessible from Ashland has been divided into primary and secondary segments; illustrated on the opposite page. They constitute an important, concentrated, and expanding market for timber based products in the Eastern United States. The primary area, extending from the tip of northern Maine to a boundary line drawn between Buffalo, New York to just south of New York City (the freight break-even line) 1/ encompasses seven states and portions of two more, 124,530 square miles, and 3.5 percent of total United States land area. That area supports a population of 36,040,500 with 11,640,250 households (17.9 and 17.4 percent respectively of the United States total) and accounts for 20.26 percent of total wholesale trade activity within the United States. 2/

The above data illustrate significant latent advantage to a wood processing complex located in Maine. The primary marketing area is relatively slow in following trends evident in other portions of the United States, however, economic pressures are ever increasing the necessity to follow those trends. Past reluctance to accept particleboard as a standard material of construction for building, and in furniture and cabinet manufacture is a prime example. The area has constituted a 'last holdout' to the traditional standard of solid wood over particleboard. This has changed in the past two years, with particleboard now gaining rapid acceptance at the marketplace, primarily as a result of escalating prices and a restricted supply outlook for solid wood and plywood. Acceptance of building materials is subject to the same 'attitudinal' generalities. Constructively viewed, this can be interpreted as a potential advantage to on-coming regional sources of advanced products.

Regional location of new product manufacturing facilities has been inhibited by the above circumstance, placing dependence on materials

1/ The freight break-even line represents a geographic zone in which the costs of product shipment to major east coast trading areas from competitive points of origin are equalized with rates applicable to shipment of the same products from Ashland.

2/ 1973 data - extracted from Rand McNally & Company projections.

shipped in from sources in other producing regions. Thereby, an increasing vacuum is developing between advancing (enlightened) demand and sources of supply, promising competitive advantage to new sources; such as an integrated complex at Ashland, programmed to manufacture products in theme with new patterns of demand that prevail elsewhere in the country.

The secondary area is important for its potential as a center of demand for speciality items that find very limited marketability in the primary area. The Middle Atlantic furniture production region (inclusive of Virginia, North Carolina, and South Carolina) and the Indiana center of mobile home manufacture (both included within the secondary area) can be expected to provide good markets for certain products manufactured at Ashland, if buyers can justify the additional freight costs that Ashland would impose. The secondary area can be equated to a safety valve, providing extra market potential over and above that evidenced in the primary area. Ability to market products manufactured at Ashland in that area is not essential to the feasibility of the complex.

Data and information in this section are concerned with characterization of the primary marketing area, and quantification/qualification of potential for products selected for manufacture at Ashland. The secondary area will be treated as it is characterized above; a supplemental area evidencing good potential but having limitations. It is unlikely that products manufactured at Ashland will be marketed outside the boundaries of the two marketing areas characterized above. In cases of exception, the product(s) would probably be speciality items unique to Maine.

2.02 GENERAL MARKET TRENDS (FOREST PRODUCTS)

RESOURCE VERSUS MARKETS

To index market trends as they will affect an integrated complex in northern Maine, it is first necessary to understand the circumstances surrounding production and marketing of sawtimber based products, equating them to the available resource.

The manufacture of wood products is unique in that the basic raw material, timber, is a renewable resource. If properly managed and utilized to optimum advantage, timber stands can be expected to last as long as there is sufficient land area and a proper growing environment. At this time, the renewable aspect of the resource is being threatened by a number of factors; notably, excessive (selective) demand, ineffectual timberland management (not necessarily in Maine), and social pressures to assign more land to industrial, residential, and recreational usage. Resultant pressures are forcing timber processors to improve utilization practices, while at the same time directing their attention to assure that the resource can maintain proper balance for continued renewal. This is making mandatory the usage of previously avoided species, lower grade sawlogs, and all processing residues; accentuated by present day economics. Therefore, the instigation of the Woodchip program has been a natural and timely consequence.

It is improper for timber processors to assume that they can 'invent' new and different usage for given grades or species of wood with the expectation that immediate marketability (if any) can be realized. Products must be manufactured which can be marketed in a profitable manner from the start, geared to existing or clearly predictable near-term potential. Therefore, emphasis should not be centered around new product panaceas, but rather, around ways (better) to utilize the available resource while allowing for the renewable aspect of timber management in a manner that will result in economic gain. Processors must solve this problem, but they must also comply with the existing markets. The profile of market acceptance can change from conventional to new products, but the process is slow and is governed by the law of supply and demand, not by the desires, no matter how well intended, of those who might wish adjustment to serve fresh objectives.

A major problem confronting wood products industry is not failure of the

resource, as is ostensibly the case in the oil industry today, but rather improper, sometimes confused, correlation with supply and demand. There is a point where demand will cut into the renewable resource concept and thus endanger the resource by not allowing it to replace itself on a predetermined schedule (in a Malthusian sense, the progression would be geometric, increasing the vulnerability of the resource base with each successive year). This point, which could be termed the point of reserve depletion, has been reached in many portions of the world and is rapidly becoming reality in the United States. Reserve depletion in softwoods may be reached within the forseeable future; it has been reached in hardwoods. This situation is not critical in Maine, where the majority of the timber is now, and has been, under intensive management policies geared to provide for a sustained yield forest. The best way, and perhaps the only way, to avoid this problem will be through continually effective forest management coordinated with application of restraint, cognizance, and advanced manufacturing methods by processors.

Historically, markets have evidenced ability to adjust to reserve depletion trends, as has been the case with hardwoods in the United States. Hardwood processors are stretching the available supply with a number of effective techniques, including usage of lower grade sawlogs and lumber, substitution of species to those less desirable from favoritism and aesthetic standpoints, and usage of thinner cross sections of wood material in end applications. Markets are responding, some even vigorously, by adjusting to new product criteria; extending to acceptance of substitute materials (plastics primarily) used in conjunction with wood.

PRESENT MARKETS AND PAST TRENDS

The following authoritative material excerpted from the January 1973 issue of Wood & Wood Products Magazine evidences an optimistic outlook for wood products manufacturers in 1973. 1/

> ". . . In this year's Outlook report we saw such a spectacular jump in planned expenditures - a tripling of the previous five year's average - that we took a closer look at what's happening in the economy as a whole.
>
> Apparently we will have a prosperous 1973. The

1/ January 1973 Wood & Wood Products Magazine. Editorial; Outlook for 1973 - more expansion, James Saul.

momentum we have built up will take us through the year, regardless of what happens in Viet Nam or whether the Administration changes its mind on wage-price controls.

The wood industry, with the rest of the economy, has enjoyed a well-balanced expansion.

Beyond 1973, the picture begins to get a little fuzzy, though, for instance, no one knows . . ." how long ". . . price and pay controls will continue . . ., though Federal Reserve Board Chairman Arthur Burns says they should continue through the year. If they should continue, we don't know in what form they will continue.

Aside from influences such as these, now in the hands of the policymakers, we might learn something if we look at the place we occupy at this moment in this particular business cycle.

The recovery we see now started two years ago, according to official measurements. It seems shorter to many of us, because business didn't pick up noticeably until the late summer of 1971. Using the latter, practical, yardstick instead of the theoretical one, we can reason that we stand at an earlier stage of recovery than if we said the recession ended two years ago. Having started later, we have longer to run before leveling off.

The relative gentleness of the 1970 downturn also leads us to believe the current good conditions will continue beyond 1973. It was only half as sharp a downturn as earlier business cycles.

So we had a gentle recession, it got up off the floor slowly, and we have enjoyed balanced growth through 1972.

We would like to see the recovery continue in this balanced way. If it can continue in such a sensible pattern, it will last through 1973 and beyond, making it a longer expansion than the average.

To maintain the balance, though, the nation's policymakers will have to show some fiscal restraint. If we approach the full employment, full investment, full capacity ideal too rapidly, we might overshoot and aggravate the inflationary cycle, wiping out our gains. . . ."

". . . . With enlightened restraint, we can look forward to

good gains in sales, a strong rise in profits, gains in productivity, and no controls-caused squeeze on profit margins, recession, or credit crunch. . . ."

The expectations reflected by Wood & Wood Products will be tempered in all probability, by the forthcoming Phase 4 price controls proposed by the Administration to take effect in late summer or early fall 1973 which are anticipated to place more stringent controls on certain forest products above and beyond previous controls beginning with Phase 1 in 1972. 1/

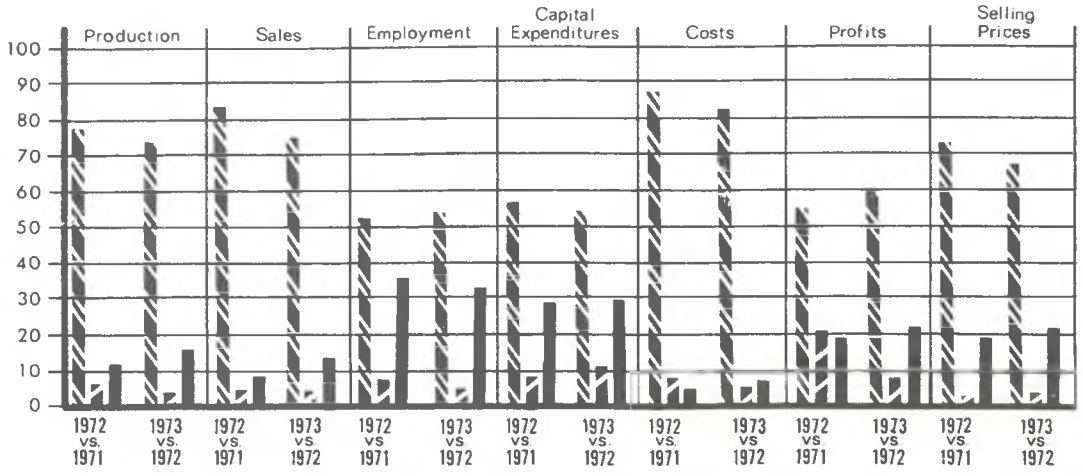
For this reason, speculation into the future of forest products marketing trends will prove to be more conjecture than reality until such time as Federal controls on the industry are either stabalized or lifted. Therefore, projections of future marketing trends in this report should be eyed with caution, remembering that they are based on the best available information at this time, and that this information may or may not prove valid in years (and even months) to come. Conservatism has been utliized in all projections to place the best possible reliability factor on them.

1/ The June 15, 1973 issue of Random Lengths, a weekly report on lumber and plywood/prices and marketing, has the following to say about impending Phase 4 price controls: ". . . With the implementing regulations only just prepared at the end of the week, it is not possible to provide more than a general outline of the new rules. The period on which the freeze prices are to be calculated is June 1-8. Prices are to be based on the highest at which at least 10% of transactions were made. In cases of items not sold in the base period, a firm can go back to the next most recent week in which sales did occur. . . ."

". . . There is some immediate inclination to discount the effect of the coming Phase 4 on forest products marketing. Prices in many instances already are below the levels at which they were frozen. Besides, Phases 1-3 were not especially effective, why should Phase 4 be different? Real effectiveness, however, does not seem to be the sole criterion. The actual distortions and price pressures which will build up under a freeze, virtually demand that a new round of regulations be rigid. So, too, will the political need for an appearance of greater effectiveness than was achieved under the earlier programs. Because of its place on the market cycle, forest products may escape the public censure that it received earlier; the industry can hardly hope, however, to escape close regulations and inspection of its practices. . . ."

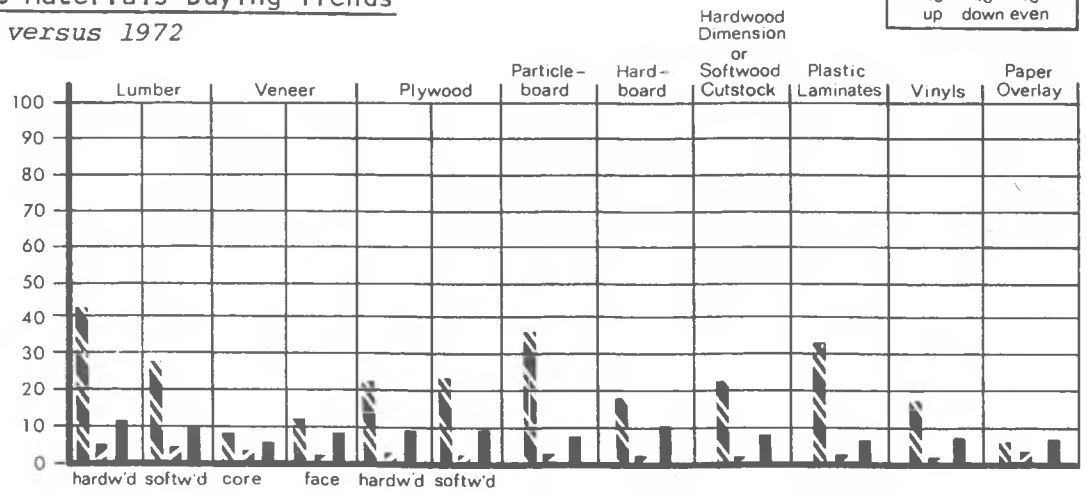
The following bar graphs, excerpted from Wood & Wood Products Magazine, show wood products industry trends evidenced in a survey of the industry by the magazine in early 1973, comparing to trends in 1971 and 1972. 1/

Wood Products Industry Trends - Total Wood Products



Basic Materials Buying Trends

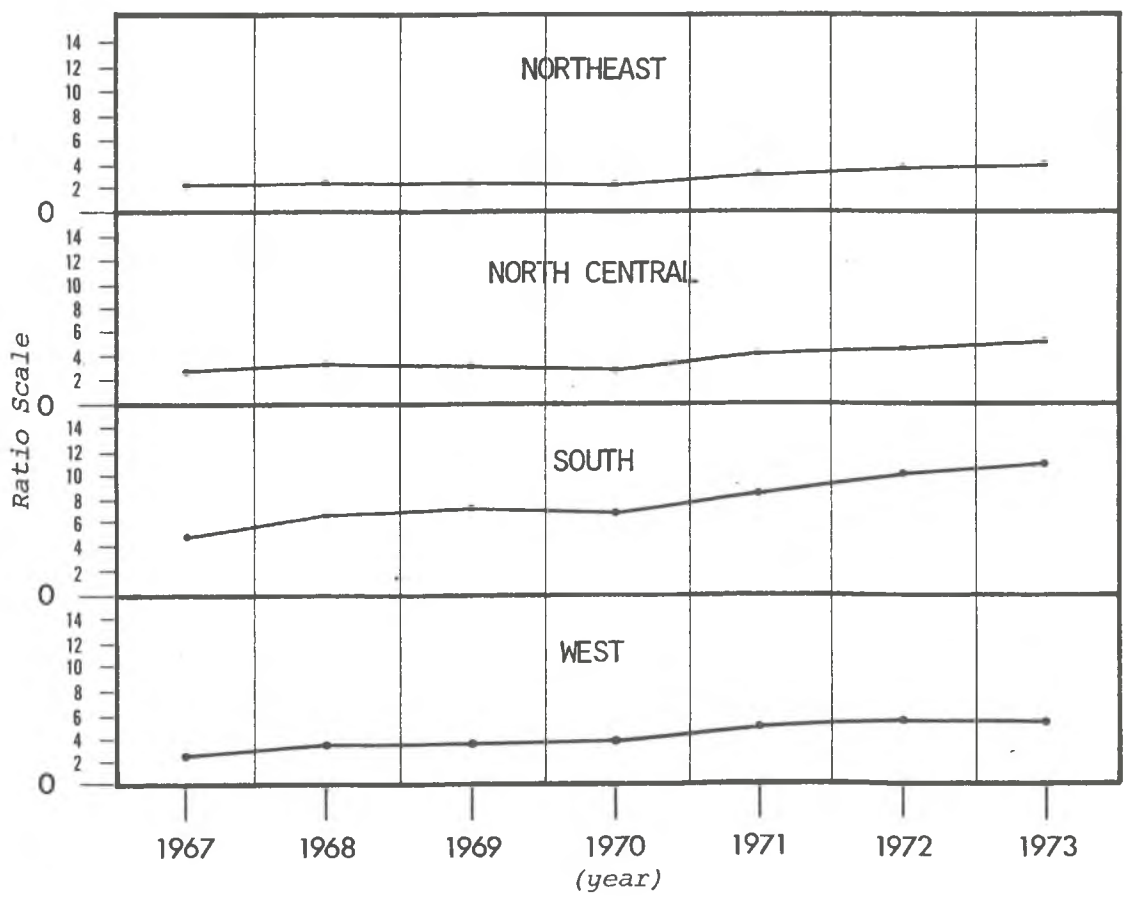
1973 versus 1972



1/ January 1973 Wood & Wood Products Magazine. Editorial; Outlook for 1973 - more expansion, James Saul.

Housing starts provide an excellent barometer of the general health and status of wood products markets. The graph below identifies new housing start trends for private housing from 1967 through April 1973, for each geographic region of the United States. It illustrates quite clearly that the Northeastern region of the U.S. is less dynamic in terms of homebuilding activity than other regions; it does not show that the area is representative of approximately 20 percent of National wholesale activity, which would indicate a higher percentage of timber products sales than evidenced by housing statistics. This trend is difficult to isolate in a quantitative manner, but it is supported by recent development of forest products industry of consequential magnitude in the Northeastern region. This is clearly evidenced by announcement of the location of (major) new stud mills in Maine within the past year by four large scale forest products industry firms.

New Private Housing Starts - Regional Totals - One Year Averages
1967 to 1973 - In hundreds of thousands housing units



1/ April 1973, U.S. Department of Commerce, Bureau of the Census data. Extracted from Bureau of the Census Document C20-73-4.

The general status of the economy seems supportive to the contention that markets will continue strong, regardless of present political and related economic pressures that would have us believing the contrary. The general market trend is upwards. Increased population (at a rate approaching 1 to 1.5 percent per year) is forcing the market to expand regardless of other factors. At this time, disposable income is increasing, wages are escalating, and the general buying power of the public (regardless of dollar devaluation trends) has improved considerably over past years (particularly since 1969). A short term recession could be in the offing, but recovery should be quicker than in 1969 (and the recession should be milder) and the period following will, in all probability, support increased stability of the general economy and thus promote more spending, and, consequently improve markets for timber based products.

2.03 MARKET POTENTIAL AS RELATED TO PRODUCT SELECTION

MARKET POTENTIAL DEFINED

Market potential is one of the more critical factors that will affect large-scale production of wood products at Ashland. The Ashland vicinity (basically within the confines of the Caribou-Presque Isle Redevelopment Area) has the labor supply, industrial site, and raw material required to support the wood processing complex recommended by this report. However, its location in northern Maine raises question of competitive accessibility to adequate markets. In northern Aroostook County, industrial development has emphasized food processing and manufacture of shoes and pulp and paper. Manufacture of lumber and other wood products (exclusive of pulp and paper) has been limited; however, this is changing, promising to bring Maine into focus as a producer in a manner commensurate with its large resource of sawtimber. Project Woodchip is intended to hasten this change by evidencing better opportunities to be gained through the concept of fuller utilization of the sawtimber resource (toward total utilization).

Because of the critical importance of marketing information to establishing a complex, and in view of the relative remoteness and historical patterns of trade affecting the Ashland area, this report section presents detailed analysis of market potential for products that will be manufactured by the complex at Ashland with expectation that they will be accepted favorably, and that they can be marketed competitively, in volume, and for profit throughout the primary marketing area. The conversion of timber into pulp and paper is not treated in this Report since that segment of the timber industry in Maine is considered to be adequately (if not over) developed.

ORGANIZED SELLING

Confinement to a poor market territory will limit growth of a business, however, there is no assurance that access to a good territory will result in sales success. Customers must be identified, approached, nurtured, won, and retained regardless of market vigor. Success requires a good product line, planned effort, and application of expert sales capability. Good markets exist for wood products that will be manufactured at Ashland. However, ability to command those

markets will be directly proportional to the quality of selling. A wood processing complex can be designed to meet needs of marketing as effectively as it can be designed to extract best economic potential from the wood resource. Its size will allow employment of professional sales personnel. Its diverse manufacturing activities will allow a broad product line, and add efficiency to sales efforts. It will be able to budget money for missionary sales effort and service contacts. It can do many other things that could not be afforded under normal conditions of modestly scaled single-product manufacture. 1/ Herein lies important competitive advantage, and the basis for validity of an integrated complex as an important source of contribution to solution of enlightened timber utilization objectives.

Product acceptance becomes easier to promote with a broader product line. Customers relate new products to brand name, detect more substance in suppliers, and as a consequence become more receptive to sales overtures. In short, they appreciate the luxury of attention that more limited business is unable to offer. Yet, in buying from a complex of the nature recommended, the customer is assured of personal interest by the management of a relatively small satellite manufacturing unit within the complex configuration which will be the source of industrial and consumer products.

PRODUCTS TO BE MANUFACTURED

Selection of products to be manufactured by the Ashland area complex has been premised on compatibility with the raw material resource, marketability, economics of production, and the production system required. Certain basic items must be produced in order to correlate favorably with the timber resource and production economics. Beyond this, products which are optional but which offer favorable potential have been included to give this report broad application.

Mode-1 production facilities (identified on page 115) will saw softwood and hardwood lumber, remanufacture lumber (emphasis hardwood) into furniture dimension and semi-fabricated items, and convert self-generated processing residues into particleboard. The resulting solid wood items and fiber/particulate panel products are identified as key basic products. They, in turn, will be fabricated into an array of products permitted by species

1/ The wood industry must compete to hold its place in markets where it belongs. Effective 'other' actions include wider use of sales motivating techniques, as used by competitive industry; e.g., packaging, wrapping, palletized shipment, product stamping, grade stamping, and prefinishing. Such treatments should be applied extensively.

availability and market demand.

Initial production facilities will be comprised of: (1) a softwood sawmill, (2) a hardwood sawmill, (3) a remanufacturing plant, and (4) a particleboard manufacturing plant. 1/ Products selected for treatment in this Section as showing best potential have been divided into basic and value added categories; the definition of a basic product being one used as a material of construction or for remanufacture to optimize value added. Softwood and hardwood lumber, fiber and particulate panel products manufactured from residues of lumber production are key basic products. They, in turn, can be fabricated into an array of products, as allowed by species availability, as justified by market potential, and to as advanced a stage of value added as possible.

The order of magnitude of size of an integrated complex will have much to do with selection of basic and value added products. Apart from that consideration, the products treated in detail below have been selected in accordance with the sawtimber and residue resources available to the Ashland area complex, taking into consideration anticipated success at the marketplace.

BASIC PRODUCTS 2/

(1) Softwood framing/dimension lumber.

(2) Hardwood lumber (exclusively for processing in the remanufacturing plant to yield pallets, hardwood dimension stock, laminated panels, and possible future precision machined and fabricated parts).

(3) Particleboard - Industrial grade, stock panels or panels overlaid with melamine or vinyl; with limited cut-to-size capability.

(4) Chips for pulping.

FABRICATED PRODUCTS 3/

(1) Furniture (case goods, tables, upholstered, and specialty fields).

(2) Furniture parts.

1/ See Section 3 for details of Mode-1 and Mode-2 complex configurations.
2/ These products are recommended for manufacture in the Mode-1 configuration of the proposed complex.
3/ These products are recommended for manufacture in the Mode-2 configuration of the proposed complex.

(3) Fencing

(4) Prefabricated cabinets and store fixtures

(5) Architectural plywood

(6) Speciality items (i.e., bowls, carved novelties, etc.)

'OTHER' PRODUCTS TO BE ADDED AS FOUND DESIRABLE

(1) Hardwood flooring

(2) Millwork

(3) Residue products (i.e., animal litter, bark mulch, fiber mulch, etc.)

MARKET EVALUATION APPROACH

Definitive marketing information in this report is restricted to treating products qualified through evaluation in conformity with the Aroostook sawtimber resource. It is unfortunate that a considerable volume of the timber comprises unmerchantable species and low quality growing stock that, under present circumstances of price and demand, cannot be harvested and processed economically. It is improper to consider that an integrated complex can provide a fast solution, but it would have better opportunity to lead in this direction than possible by individual sawmills or other single-product processing plants.

The most significant factors in equating the resource to market potential are species, quality, quantity, cost, and availability; assuming logistics of procurement have been solved. Consideration of differential species divides the overall marketing task into (a) a softwood sector, which associates most heavily with construction usages, and (b) a hardwood sector, which connotes to industrial applications.

Product-line recommendations for the 'model' complex, as well as the Ashland area complex have been limited to items precisely in context with timber resources in the Aroostook working circle, which do not differ appreciably from resources within 50-mile working circles characterized in Section 1 for the other three preliminary Woodchip site areas. Thus, there is a practical relationship between products and manufacturing facilities recommended for the Ashland study locale and application to other locations in northern Maine.

A manufacturing venture (integrated complex or otherwise) predicated on timber processing must manufacture products that will sell readily and yield acceptable margin between cost of manufacture and net revenue from

sales. Focus of manufacturing attention, beyond efficient output and quality control, should be toward proven items that are in demand at the marketplace, presently and into the foreseeable future.

A prime advantage of an integrated complex over individual facilities lies in the potential offered by satellite manufacturing units; not only for economic appreciation through value added during manufacture, but for better attunement to potential through product-line flexibility and broadness. Satellites will provide a captive market for basic products that would otherwise be largely shipped to destinations outside Maine for value-added fabrication.

For reasons identified, market data and information in this Report are singularly concerned with characterizing products that have been screened for practicality and feasibility from both resource and market viewpoints. Interpretation of normal indexes to market potential has been adjusted to provide consideration for heretofore nonexistent circumstances.

2.04 LUMBER MARKET POTENTIAL

UNITED STATES MARKET TRENDS - HARDWOOD AND SOFTWOOD LUMBER

The national market for lumber in the past three years from 1970 has shown significant improvement in terms of demand and volume, recovering handily from the recession period of 1969-1970. In 1971, new housing completions reached 1.70 million units, approximately twenty percent above the level of completions in 1970. Completions in 1972 were at the level of 1.98 million units, and seasonally adjusted starts in March 1973 (the most current data) were at 2.03 million units, showing substantial gain over 1971 with prospects of continuing growth through 1973. Since the number of housing starts is an excellent barometer of the health of both the construction and industrial products sides of the forest products industry, it follows that the outlook for hardwood and softwood lumber in the future should be favorable.

Wooden pallet production, a major use category for (lower grades of) hardwood and softwood lumber, has exceeded 1970 levels of production significantly, and forecasts point to an even higher level of usage in the future (as outlined on page 97 below). Wood furniture production has increased at a relatively modest but steady rate since 1970, with prospects for increased production in the future bright (as outlined on page 93 below).

Total lumber production in 1972 was approximately 37.8 billion board feet, evidencing a gain of five percent over 1971 levels, largely attributable to the surge in housing construction. Hardwood production has remained at a relatively constant rate over the past 20 years, with minor fluctuations due to the status of the economy at any given time. Although the level of hardwood lumber production has remained relatively constant, the expanding demand is being satisfied by increased acceptance of lower grades, decreased thicknesses, and substitute species. Although hardwood lumber prices are constantly rising, acceptance concessions mentioned above facilitate ability of industrial users to maintain approximately equal production per unit of product manufactured from hardwoods.

It is difficult to project lumber consumption trends for 1973 and 1974 due to prevailing economic conditions. One school of thought would have continuing general economic growth from 1969 base levels, with a moderate increase in housing starts. Another school would have us believe a general economic recession is in the offing with implicit negative affect

on housing starts and resultant restriction on the volume of lumber demanded for construction and industrial uses. It is the contention of this Consultant that the economy will experience mild recession followed (soon) by quick recovery, increased housing starts, and moderate increase in lumber consumption. Anticipated continued expansion of the population at present rates will keep demand for housing up. It could be argued that housing units will suffer in size, but at the same time, the volume of units necessary to accomodate the expanding population will more than compensate for the lesser lumber usage per unit.

The following table indicates present trends in total lumber production within the United States. 1/

SEASONALLY ADJUSTED ANNUAL RATES OF LUMBER PRODUCTION
MMbf

	APRIL 1973	MARCH 1973	% CHANGE	APRIL 1972	% CHANGE
PRODUCTION	37,283	39,338	-5.2	37,643	-1.0
Softwoods	31,258	32,468	-3.7	30,171	+3.7
Hardwoods	5,998	6,870	-12.7	7,472	-19.7
SHIPMENTS	38,424	39,562	-2.9	39,097	-1.7
Softwoods	31,135	32,549	-4.4	31,008	+0.4
Hardwoods	7,289	7,013	+3.9	8,089	-9.9

Projected continuing increase in demand for wood products is in the face of increasing shortages of hardwoods and softwood sawtimber in the United States and throughout the world. A large percentage of timber grows on commercial forest land under the jurisdiction/control of the government, thereby it is particularly vulnerable to the sometimes over reactive restrictions on harvesting resulting from well intended (but oftentimes poorly informed or directed) activities of pressure groups promoting the national good in terms of environmental protection. A processing facility as planned at Ashland, having an assured long-term supply of sawtimber from privately controlled/managed timberlands, will unquestionably experience advantage at the marketplace over competitors confronted with restricted resources to draw upon in terms of species, character, and volume. Softwood sawtimber to be processed by the complex, 85 percent spruce/fir, is directly competitive functionally with pine from the South

1/ June 22, 1973. National Forest Products Association. Bulletin NL-55-73, News.

and fir from Canada and the West, and it will become increasingly cost competitive as sources of supply in those forested areas diminish.

The resource of sugar maple, nearly 100 percent of the hardwood to be processed into remanufactured products at the complex, is highly coveted as a workable/demanded species. The once prodigious hardwood resources in Appalachia, New York/Pennsylvania, the Lake States, and the Mississippi Delta region are rapidly diminishing in quality/quantity. Many wood product fabricators in those regions are starving for wood raw materials, finding that substitute materials (plastics, etc.) are unsatisfactory or over priced. Maple hanger stock, presently manufactured at Ashland, is being shipped into the former heartland of northern hardwood territory - Grand Rapids, Michigan. It can be expected that with each passing year the hardwood resource in Maine (which has been relatively untapped - *volumetrically* - in the past) will be drawn upon more, with shipment of products to more distant market destinations becoming increasingly the rule.

Government statistics based on the assumption of continued economic stability and attainment of guideline housing goals promulgated by the Bureau of the Census, U.S. Department of Commerce, point to an approximate eight percent rise in lumber production by 1975 and ten percent by 1980, when compared to 1971. The value of total industry shipments of lumber is expected to rise to near $5.9 billion by 1975 and $6.0 billion by 1980, representing an annual growth of five percent from 1971 to 1975 and of 2.4 percent from 1971 to 1980.

SOFTWOOD LUMBER DEMAND IN THE PRIMARY MARKETING AREA

Demand within the primary marketing area for softwood lumber is largely satisfied by shipment from sawmills in the Northeastern United States and the Canadian Maritime Provinces. Although a two percent drop in sales volume of softwood lumber was experienced in the period between 1969 and 1970 (due to general recessive economic conditions in the United States at that time), recovery was realized within one year with a 12.2 percent increase in 1971. 1/ Even with the imposed price controls of 1972 (and into 1973), the value of lumber sales increased an estimated 5.7 percent, reaching an all time high exceeding four billion dollars. Price control regulations in the past two years have had particularly noticable effect against Northeastern/Maine forest products manufacturers;

1/ During the past 5-year period, softwood lumber sales have totaled an average of 83 percent of the lumber sold in the United States.

enabling Canadian mills, exempt from controls, to improve profit margins appreciably, thus allowing them to up-bid the price of U.S. sawtimber. Since relaxation of those price controls in mid 1972, the situation has eased to some extent regarding competition from Canadian timber processors for U.S. sawtimber. This situation will not, in all likelihood, repeat itself in Phase 4 controls since base prices for the freeze are considerably higher than they were at the onset of price controls in 1971 - 1972. Immediate and long-term prospects for softwood sawmilling as evidenced by conventional economic indicators (e.g. housing starts, GNP, and etc.) are very good. 1/ 2/

MARKETING & PRICING INFORMATION

Marketing and pricing information immediately below, limited to white spruce/balsam fir, is the most current available. It shows recent developments/trends in the primary marketing areas as well as throughout the United States. Pricing information is limited to random length, kiln dried, white spruce/balsam fir (averages) lumber since those species in that configuration provide an accurate index to trends of Northeastern softwood markets. Since the duration that Phase 4 controls will last is uncertain at this time, it is difficult to predict future prices for softwood lumber. The week of June 1 - 8 has been selected by the administration as the period on which freeze prices are to be calculated (based on the highest at which at least 10 percent of transactions were made).

Trends currently reported for the East Coast markets for spruce/pine/fir indicate a generally healthy trading environment, however, U.S. buyers are backing away from current asking levels and, as a consequence, Eastern mills are increasing sales to hungry European export markets. Some disparities are resulting from this limited sales picture; an example would be the fact that in Boston 2x4 lumber is selling for less than 2x6 lumber although it is in the range of about two dollars higher normally.

The relatively remote location of the Ashland area from major centers of population, trade, and building activity is not disadvantageous when viewed with the understanding that lumber must be manufactured in proximity to a supply of sawtimber. Competitive producers have no real advantage in that regard over an Ashland located mill.

1/ About 50 percent of the lumber produced in 1972 was utilized in residential construction, compared to 48 percent in 1970.

2/ The U.S. Forest Service reports the current level of usage at 11,000 board feet of lumber in a single family dwelling unit; and about 8,000 board feet per multi-family dwelling unit.

Year to Date Production/Shipments/Orders 1/
MMbf - Jan. to Mar. 1973 - Softwoods

	PRODUCTION	SHIPMENTS	ORDERS RECEIVED
TOTAL UNITED STATES			
1st 3 mo. in 1973 -	7895.8	7802.7	8186.2
1st 3 mo. in 1972 -	7732.9	7826.3	8258.9
PERCENT CHANGE	+2.6	+0.4	-0.8
PRIMARY MARKETING AREA			
1st 3 mo. in 1973 -	478.9	390.1	409.3

Monthly Production and Trade Statistics 1/
MMbf - March 1973 - Softwoods

	PRODUCTION	SHIPMENTS	ORDERS RECEIVED
PRIMARY MARKETING AREA	135.6	132.9	217.1
% CHANGE FROM NOV. 1972	+0.7	+0.7	+1.0

Average Reported Delivered Prices (Monthly) 2/
$/Mbf - Kiln Dried 2x4 Std & Btr Random Length Spruce/Fir

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1969-	143	161	153	132	116	108	108	98	99	101	105	99
1970-	96	100	99	105	99	101	103	106	104	100	102	104
1971-	113	128	128	125	124	135	141	142	136	130	134	136
1972-	146	149	151	154	153	152	168	175	186	203	193	186
1973-	198	202	206	215	202	196						

1/ May 1973. Fingertip Facts & Figures. National Forest Products Association - Primary Marketing Area data estimated by Consultant.
2/ 1973. A Weekly Report on Lumber and Plywood/Prices and Marketing. Random Lengths Publications, Inc. Data excerpted from weekly letters.

COMPETITIVE STATURE IN THE PRIMARY MARKETING AREA

The programmed output of 92 million board feet of softwood dimension/framing lumber per year for the Ashland area complex will equate to 4.18 percent of total production capacity in the primary marketing area and 5.13 percent of the market for United States manufactured softwood lumber in that same area. An approximate 5 percent market penetration requirement to account for total production capacity of the proposed softwood sawmilling portion of the complex should not be a difficult task for a well organized, effective sales organization as premised for the complex.

Identification of competitive producers in the region is not considered to be of significance to competitive stature. A large majority of competitive producers are small scale, and numerous. Their combined output is significant, but individually they do not pose a serious threat to marketing potential of softwood produced at the Ashland complex (which is quite large in comparison to the majority of competitive mills in the United States and Canada).

SOFTWOOD USAGE IN SELECTED INDUSTRIES

Approximately 70 to 80 percent of all softwood lumber manufactured in the Northeastern United States is directed toward construction markets (a large amount of that lumber is spruce/fir), the remaining 20 to 30 percent finds its way into the industrial sector of the market. The following tabular data is essentially based on a University of Massachusetts Experiment Station study titled Use of Lumber by Selected Wood Products Manufacturing Industries of Massachusetts. Information contained in the above report has been updated and directed towards emphasis of Eastern softwood species and is generally indicative of buying and usage practices (percentage relationships) within the primary marketing area at this time and for some time into the future. The tabular information below is intended to give only a basic indication of usage patterns and is by no means to be interpreted as a strict market orientation guideline.

All categories of Industrial users tabulated below are self explanatory with the exception of millwork. In the words of the authors of Bulletin 547; "Millwork is defined as ready-made carpentry work such as doors, windows, kitchen cabinets, etc." 1/

1/ T.S. Foster & R.S. Bond, Use of Lumber by Selected Wood Product Manufacturing Industries in Massachusetts, University of Massachusetts Experiment Station, Amherst, Mass., Bulletin 547, 1964.

Identification of Softwood Usage Trends in Several Northeastern Wood Products Manufacturing Industries

Percentage Relationships

	1/ FURNITURE	WOODEN CONTAINERS	PALLETS	MILLWORK	PREFAB BUILDINGS
TOTAL SOFTWOOD USED (%)	10	85	70	82	100
% Rough	10	95	100	70	3
% Dressed	90	5	nil	30	97
% Air Dry	20	85	5	5	60
% Kiln Dry	80	5	nil	90	15
% Green	nil	10	95	5	25
% PURCHASED MILL DIRECT	24	84	95	31	14
% PURCHASED THROUGH MARKET INTERMEDIARY	76	16	5	69	86
MAJOR EASTERN SPECIES (% of total softwood usage)					
White Pine	22	90	93	13	10
Spruce	nil	5	nil	2	40
Hemlock	nil	nil	nil	nil	5
White Cedar	nil	nil	nil	nil	nil

1/ Furniture manufacturers utilizing softwoods (generally white pine in the primary marketing area) most often produce case-goods and/or tables. Finished/unfinished pine furniture is a specialty item within the furniture industry and is primarily a product of the Northeastern United States.

HARDWOOD LUMBER/DIMENSION DEMAND IN THE PRIMARY MARKETING AREA

Sugar maple is the predominant species available in the Ashland area; therefore, hardwood marketing information must be predominantly considerate of potential for that species, which is excellent. The overall market for hardwood products is strongly a seller's market, with every indication that it will remain so for the foreseeable future. Hardwood dimension will be manufactured by the complex to assure economic feasibility; to stop at sawn lumber is not feasible or practical from a maximum value-added standpoint. As success of the original facilities becomes apparant, the output of dimension would assume critical importance as the prime attractant to satellite manufacturing operations, serving as the raw material for manufacture of further value-added products as outlined in Section 3 of this Report. Choice of dimension as the basic product to be processed from 10 million board feet of hardwood sawtimber available annually to the complex (with No.3 common and lesser grade lumber manufactured into pallets on-site) has been derived analytically as the most promising alternative for best long-term advantage, considerate of market potential, the sawtimber resource, growth of the complex, and projected ROI.

HARDWOOD LUMBER DEMAND

Demand within the primary marketing area for hardwood lumber is focused in furniture and wood products manufacturing centers in Massachusetts, New Hampshire, metropolitan New York City, and Western New York; with opportunity extending outward, but substantially limited by shipping costs, to destinations in the secondary marketing area, the Middle Atlantic furniture area, Quebec, and the Maritime provinces. On a national basis, production of hardwood lumber has shown very little annual change for the past 20 years; 7.35 billion board feet manufactured in 1950 compares to 7.14 billion in 1970, 6.95 billion in 1971, 7.15 billion in 1972, and a seasonally adjusted 6.73 billion board feet rate for the first three months in 1973. This relatively even production (and consumption) reflects restricted supply, not static growth in usage applications. As a rule, fabricators have been able to extend their hardwood lumber supply by using less solid wood volume in each manufactured item -- extending with smaller piece cross sections, and substituting other materials for solid hardwood (particleboard, hardwood plywood, cast plastics), simulating grain patterns and other natural wood features.

Lumber grade yields in relationship to the diminishing supply of upper grade sawlogs, their high cost, and low margin of profit

combine negatively to make manufacture and sale of hardwood lumber a marginal, or at best low profit business. 1/

Decision to process 100 percent of the hardwood sawn at the Ashland area complex into dimension products (as grade yields enable) is premised on the above aspects of venture feasibility. Apart from economic feasibility considerations, the market potential for hardwood lumber per se is virtually unlimited.

HARDWOOD DIMENSION DEMAND

The dimension plant to be integrated into the Ashland area complex will confront very little market competition either in the primary or the secondary marketing areas, due to the inbalance of supply versus demand for most hardwood species, particularly sugar maple. In context with treatment in this Report, hardwood dimension comprises rough furniture part blanks (70 to 80 percent), sap bending stock, squares, turning stock, and laminated panels. The manufacture of hardwood flooring could be included in dimension operations, to utilize 2A- grade lumber, however, marketing problems and the difficulty of obtaining enough acceptable 2A- grade hardwood lumber (sugar maple) combine to make entry into that business a marginal to poor risk when other product options listed above are considered from a practical as well as economic standpoint. High demand for sugar maple, as well as for birch and beech, coupled with short supply, is causing users of dimension products to substitute with soft maple and other less favored species. The price of sugar maple has increased at a relatively steady rate in the period between relaxation of Phase 1 through 3 price controls and implementation of Phase 4; therefore, it is safe to say that the trend of species substitution will continue. In spite of this, and because Northeastern furniture producers tend to stick with a species until either price or supply becomes economically restrictive, it can be conjectured that sugar maple will continue to receive special favor at the marketplace for some time into the future.

Historically, sugar maple has been subjected to up and down demand trends, the latest surge resulting from Japanese procurement for bowling alley construction. That situation has continued to a degree, but with lower grade requirements (No.2 Common) to satisfy the need for bowling pins; drawing stock away from the domestic flooring industry. The use of sugar maple in furniture manufacture has remained steady over the immediate past; but not at an exceptionally

1/ The woods-run grade distribution of birch-beech-maple averages 12.3% No.1, 22.6% No.2, and 65.1% No.3. Excluding procurement of No.1 grade sawlogs, the ratio becomes 25.8% No.2 and 74.2% No.3. See hardwood lumber grade yields on page 32.

high level, and many 'maple' furniture items contain beech, soft maple, or particleboard parts. Laminated table and counter tops are experiencing increased demand throughout the United States; sugar maple being the preferred species.

Hardwood dimension manufactured by the Ashland area complex will be subjected to good demand (during the interim until satellite operations are integrated into the complex during Mode-2) by New England furniture manufacturers. Their requirements are not expected to diminish in the foreseeable future, and their sources of supply will become increasingly restricted as furniture production in adjacent Canadian provinces continues expansionist trends.

Many furniture manufacturers in the Middle Atlantic and East Central producing regions are integrating dimension manufacture into their existing operations to improve costs, and most importantly, to avoid delays caused by failure of suppliers to accomodate delivery and production schedules. This trend has not become apparant in the Northeastern furniture production region, but it could become a factor in the not too distant future. To avoid this circumstance, a producer of dimension should (1) meet schedules and extend comprehensive customer services, (2) promote sugar maple as a most desirable species, and (3) maintain a reasonable price structure when price control regulations are relaxed or lifted. If the trend by furniture manufacturers to produce their own dimension stock does spread, the effect on hardwood dimension manufacturers would be twofold: First - since furniture manufacturers would rely on in-house capabilities, except during periods of above normal activity, they would become more susceptible to fluctuations in demand for finished furniture; and secondly - by necessity, they would become more specialty oriented, probably improving overall profit potential by increasing the value-added aspect of their product line, but undoubtedly requiring a more aggressive sales effort than would be otherwise needed. Effect upon the Ashland area complex, should this trend manifest itself in the near term future, would be negligible if Mode-2 satellites are integrated into the complex, premised on usage of the dimension produced at the complex.

MARKETING & PRICING INFORMATION

Marketing and pricing information below, comprehensive of birch, beech, and maple species indigenous to the Ashland area, is the most current available. It shows recent developments/trends as they relate to the primary and secondary marketing areas as well as throughout the United States. Pricing information is comprehensive of all grades, but is limited to 4/4 random length lumber except in the case of specific dimension parts pricing. Since the duration that

Phase 4 controls will last is uncertain at this time, it is difficult to predict future hardwood lumber/dimension prices, particularly when it is considered that freeze levels will be calculated from mill list prices (the highest 10 percent for the period between June 1 and 8) and that most hardwood mills do not make it a practice to publish list prices on a weekly basis.

Trends currently reported for East Coast markets for birch, beech, maple indicate a mildly recessive trading environment for lumber and a healthy, expanding demand for dimension stock.

The relatively remote location of the Ashland area from major centers of population, trade, and manufacturing activity is not disadvantageous when viewed with the understanding that lumber must be manufactured in proximity to the sawtimber resource. Competitive producers have no real advantage in that regard over a mill located in the Ashland area.

Year to Date Production/Shipments/Orders 1/
MMbf - Jan. to Mar. 1973 - Hardwoods

	PRODUCTION	SHIPMENTS	ORDERS RECEIVED
TOTAL UNITED STATES			
1st 3 mo. in 1973 -	1681.7	1969.2	1913.5
1st 3 mo. in 1972 -	1601.4	1904.7	1923.0
PERCENT CHANGE	+5.0	+3.4	-0.5
PRIMARY MARKETING AREA			
1st 3 mo. in 1973 -	506.2	592.7	576.0

Monthly Production and Trade Statistics 1/
MMbf - March 1973 - Northeastern Hardwoods

	PRODUCTION	SHIPMENTS	ORDERS RECEIVED
PRIMARY MARKETING AREA	170.6	193.3	197.9
% CHANGE FROM MAR. 1972	-1.7	-1.0	+0.3

1/ May 1973. Fingertip Facts & Figures. National Forest Products Association - Primary Marketing Area data estimated by Consultant.

Average Estimated Hardwood Lumber Pricing (monthly) 1/

$/Mbf - 4/4" Northern Hardwoods - F.O.B. Mill - Random Length/Width

	FAS	SEL	#1C	#2C	#3A	#3C
YELLOW BIRCH						
Jun. 1973 -	410	390	245	145	125	95
Oct. 1972 -	360	340	195	105	83	70
% DIFFERENCE	+14.0	+14.7	+25.6	+38.1	+50.6	+35.7
BEECH						
Jun. 1973 -	225	210	175	115	107	95
Oct. 1972 -	195	180	152	86	72	70
% DIFFERENCE	+15.3	+16.7	+15.1	+33.7	+48.6	+35.7
SUGAR MAPLE						
Jun. 1973 -	320	300	275	135	115	95
Oct. 1972 -	295	275	205	100	80	70
% DIFFERENCE	+ 8.5	+ 9.1	+34.2	+35.0	+43.8	+35.7

The market for hardwood dimension stock is heavily dependent upon the furniture industry for the majority of sales. As demand for furniture increases, the hardwood dimension market expands, however, when demand for furniture decreases, furniture plants characteristically purchase less dimension stock in favor of their own in-house dimension processing ability (as discussed on page 76). 75 percent of dimension stock is consumed as furniture dimension, 20 percent industrial, and 5 percent vehicle stock. Within the furniture industry, approximately 10 percent of the firms consume 50 percent of the dimension stock used within that industry while on the other side of the spectrum 70 percent of the firms in that industry consume only 7 percent of the dimension used.

Since pricing trends for hardwood dimension stock are consumated on a day to day basis, it is difficult to provide accurate base pricing information. Price data for hardwood dimension on the following page does not project current pricing but, rather, is intended to point out differences for various types of dimension.

1/ Price data extracted from Hardwood Market Report, Lumber News Letter. Abe Lemsky, Publisher.

Hardwood Dimension Stock Marketing Trends

	PERCENT OF DEMAND	DOLLAR SALES VOLUME PERCENTAGE
TURNINGS & CARVINGS	22	16.4
ROUGH FLAT STOCK	20	24.5
PARTIALLY MACHINED STOCK	15	25.0
SQUARES	15	12.2
FULLY MACHINED STOCK	9	21.8
DECORATIVE MOULDING & TRIM	8	
SHAPED FURNITURE PARTS	7	0.1
MISCELLANEOUS	4	
TOTAL	100	100.0

(note: partially machined stock includes glued furniture panels)

Relative Pricing Information (Hardwood Dimension Stock)

$/Mbf - 1st. Quarter 1973 - Base Information

		AVERAGE PRICES
A)	Glued Furniture Panels/ Partially Machined Stock (maple)	572
B)	Sap Bending Stock (maple/yellow birch)	500/550
C)	Small KD maple Squares	275/480
	Large KD maple Squares	450/750
D)	Rough Flat Stock (maple)	420/500

(note: glued furniture panels and partially machined stock are placed together - actual price ranges for glued furniture panels extend from a low of $500/Mbf to a high of $1130/Mbf depending upon size and quality)

COMPETITIVE STATURE IN THE PRIMARY MARKETING AREA

The programmed output of 10.55 million board feet of hardwood lumber per year for the Ashland area complex equates to 5.0 percent of hardwood lumber production capacity in the primary marketing area and 4.0 percent of the present market for hardwood lumber in that same area. An approximate 4 percent market penetration requirement (1 percent of the United States market for hardwood dimension; 4 percent of the primary marketing area) will account for total production capacity of the hardwood dimension manufacturing portion of the complex. All sawn lumber will be transferred internally to the hardwood dimension plant.

Similar to the softwood sawmilling situation discussed earlier in this Section, identification of competitive producers of hardwood dimension is not considered to be of significance to competitive stature. The single most important trend with regards to competition, discussed earlier, is the move by many furniture producers, particularly in the Middle Atlantic furniture production region, to incorporate dimension manufacture into their existing furniture plant facilities. Reasons for this trend include:

- Cost of purchased parts versus in-plant manufactured parts is to the advantage of the furniture producer (in most cases).
- Shipment of purchased parts has incurred some significant delivery delays, therefore adversely affecting the furniture fabrication process.
- Species of hardwood parts required/preferred in the manufacture of furniture.
- Reputation or business relationship (good or bad) of the supplier of the hardwood dimension parts to the furniture manufacturer.
- Desire by furniture manufacturers for close machining tolerances, adherence to lead time requirements, controlled moisture content, and strict grade specifications.

HARDWOOD USAGE IN SELECTED INDUSTRIES

As mentioned earlier, 75 percent of dimension stock is consumed as furniture dimension, 20 percent industrial, and 5 percent vehicle stock. The following tabular data is essentially based on a

University of Massachusetts Experiment Station Study titled Use of Lumber by Selected Wood Products Manufacturing Industries of Massachusetts. Information contained in the above report has been updated and directed towards emphasis of Northeastern Hardwood species and is generally indicative of buying and usage practices (percentage relationships) within the primary and secondary marketing areas at this time and for some time into the future. 1/ The tabular information below is intended to give only a basic indication of usage patterns and is by no means to be interpreted as a strict market orientation guideline.

Identification of Hardwood Usage Trends in Several Northeastern Wood Products Manufacturing Industries

Percentage Relationships

	FURNITURE	WOODEN CONTAINERS	PALLETS	MILLWORK	PREFAB BUILDINGS
TOTAL HARDWOOD USED (%)	90	15	30	82	nil
% Rough	95	100	100	100	nil
% Dressed	5	nil	nil	nil	nil
% Air Dry	55	65	nil	35	nil
% Kiln Dry	15	nil	nil	65	nil
% Green	30	35	100	nil	nil
% PURCHASED MILL DIRECT	25	65	95	25	-
% PURCHASED THROUGH MARKET INTERMEDIARY	75	35	5	75	-

1/ T.S. Foster and R.S. Bond. Use of Lumber by Selected Wood Product Manufacturing Industries in Massachusetts. University of Massachusetts Experiment Station, Amherst, Mass. Bulletin 547, 1964.

Industrial Particleboard - Basic Pricing

$/Msf - Estimated f.o.b. Mill Pricing - Stock Panels

	LIST PRICE
3/8-inch	$110.00
1/2-inch	125.00
5/8-inch	132.50
3/4-inch	147.50
1-inch	210.00
over 1-inch	225.00 - 250.00

Overlaid Industrial Particleboard - Basic Pricing

$/Msf - Estimated f.o.b. Mill Prices - Stock Sizes

	LIST PRICE	
	Surfaced 1 Side	Surfaced 2 Sides
VINYL OVERLAY		
1/2-inch	294	408
5/8-inch	314	428
3/4-inch	341	455
MELAMINE OVERLAY		
1/2-inch	302	420
5/8-inch	323	441
3/4-inch	350	469
SPECIALTIES (inc. shelving, etc.) 1/		
5/8-inch	600	680
3/4-inch	620	700

1/ Manufacturer's pricing on shelving, edge-banded 4 sides. Basic 6-inch by 24-inch piece.

As with other primary processing units programmed for the Ashland area complex, the particleboard plant will eventually hope for 100 percent consumption of its output within the confines of the complex. Until that time, however, orientation of product sales will be directed toward industrial markets, with emphasis placed upon vinyl and melamine overlaid products. Directly or indirectly, 20 percent of all industrial type particleboard ends up overlaid or surface printed (at an approximate ratio of 80 percent overlaid, 10 percent surface printed 1/).

It has been stated earlier in this Section, and it is reiterated for its significance to investment decision, that while presently lagging behind other regions in usage of particleboard, forces are now occuring that will bring the primary marketing area quickly into step with the rest of the nation. As this takes place, it can be expected that intermediate evolutionary steps of product usage experienced in other regions will be by-passed. It is certain, therefore, that expected strengthening demand in the primary marketing area will focus on advanced products and usages, which will be highly advantageous to a new plant able to supply the latest technology and offering the broad product line intended at Ashland. The majority of existing particleboard plants will not be at competitive advantage in these regards.

COMPETITIVE STATURE IN THE PRIMARY & SECONDARY MARKETING AREAS

The programmed output of 40 million square feet (3/4-inch basis 2/) of particleboard per year (300-day operating year, processing 200 tons of raw material per day) equates to 100 percent of total production capacity in the primary marketing area; 7 percent of the projected 1974 market demand for particleboard in that same area. An approximate 2 percent market penetration requirement within the primary and secondary marketing areas in 1974 would account for the total designed output of the Ashland area particleboard plant, 3.5 percent if only industrial board products are manufactured and sold.

There is one plant in the primary marketing area producing a product that could, in the broad sense of the word, be considered competitive to an Ashland area particleboard plant. The plant,

1/ Surface printing of particleboard is loosing favor at the marketplace due to extreme variances in quality control; and manufacturers are hesitant to surface print due to technical difficulties in the process.

2/ All quantum figures in this Report based on 3/4-inch thickness board.

owned by Celotex Corporation at Deposit, New York, manufactures Medium Density (MD) fiberboard (capacity 50 MMsf per year). It is not considered a competitive threat for reasons mentioned under the description of potential for MD fiberboard later in this Section. Essentially, the Celotex plant has freight and market proximity advantage over an Ashland located plant, but the product is utilized in highly specialized applications and is not generally competitive with high quality particleboard (industrial type), since in similar applications, particleboard performs better and costs less.

Although this Consultant does not believe that southern yellow pine based particleboard plants will pose a serious marketing threat to the plant at Ashland (producing a spruce/fir based board), it is important to make an accounting of them. There are 19 southern yellow pine based plants having competitive access to the primary and secondary marketing areas with total production capacity at 782 MMsf. Three other plants, utilizing species other than southern yellow pine, have total capacity to produce 51 MMsf. They can be discounted as being competitive to the Ashland area plant since two of them are producing Underlayment exclusively, and the third is approximately 80 percent captive. Since southern yellow pine is loosing favor in the industrial marketplace, these plants are finding it increasingly favorable to penetrate the construction sector of the market, leaving the industrial sector to plants on the West Coast that have the species density advantage mentioned on page 84. Influence is being felt in the industrial sector of the market as a result of the recent trend by furniture manufacturers and middle-men fabricators who overlay particleboard with vinyl film and melamine impreg papers. These firms are finding that southern yellow pine does not function properly for such applications and are being forced to buy board from Western sources which, primarily as a result of lower density characteristics, performs better than the board made from southern yellow pine. 1/

Therefore, major competition to the Ashland plant will be felt from West Coast sources of particleboard. Their freight cost to the Middle Atlantic furniture area is approximately $62 per thousand square feet (from the Portland, Oregon basing point), compared to an average cost from Ashland of $32 per thousand square feet, an advantage to the Ashland plant over West Coast producers of $30 per thousand square feet.

1/ Board manufactured from lower density species (douglas fir, spruce, ponderosa pine) requires more wood material for a given end-product density, resulting in superior physical characteristics and a smoother, more homogeneous surface layer due to the tighter bonding structure. This superior surface structure accomodates better bonding of vinyl film and melamine impreg papers. The end-product manufactured from lower density wood material also has better machinability and woodworking characteristics.

PARTICLEBOARD USAGE IN SELECTED INDUSTRIES

Division of the market for particleboard is approximately 60-70 percent industrial usage; 20-30 percent construction; and 10 percent miscellaneous (a sub-division of the construction sector). The following table shows usage trends in the primary and secondary marketing areas (not inclusive of the Middle Atlantic furniture production and Indiana mobile home manufacturing areas) as they relate to production of industrial type particleboard at Ashland. 1/

Industrial Type Particleboard Usage Trends in the Primary and Secondary Marketing Areas

	CABINETS & MILLWORK	FURNITURE	MOBILE HOMES	SOLID CORE DOORS	FIXTURES	MISC.
% of Total Particleboard Usage	31.6	32.8	20.7	2.0	5.0	7.9
Projected 1974 Demand (MMsf)	82.1	85.2	53.8	5.2	13.0	20.5
Primary Thickness Used	5/8"	3/4"	5/8"	over 1-inch	3/4"	all sizes
Average Usage per Employee (square feet)	9,000	10,400	8,220	16,100	3,150	7,785
% of Firms using Particleboard	72	70	84	100	87	-
% Stock Size Panels	95	31	16	nil	96	70
% Special Panels (C-T-S etc.)	5	69	84	100	4	30

1/ The usage trends in the Middle Atlantic furniture production and Indiana mobile home manufacturing areas speak for themselves. Average usage per employee/thicknesses used/and types of panels used are the same as above.

OTHER PRODUCTS THAT MIGHT BE MANUFACTURED IN LIEU OF PARTICLEBOARD AT THE ASHLAND AREA COMPLEX

Hardboard and Medium Density fiberboard are discussed below in relation to their potential as alternatives to the manufacture of particleboard at Ashland. Both products have excellent potential for production in one of the four preselected site areas mentioned in Section one, but that potential stops short of incorporation into the Ashland area complex. In addition to the two fiber-based products above, softwood plywood is also discussed on its merits and shortcomings for incorporation into the complex.

HARDBOARD or FIBERBOARD

These synonymous identifications apply to a product for which demand exceeds domestic production, placing reliance upon imports to meet requirements imposed by construction and industrial needs. Growth of the market over the past five years has approached 55 percent; with domestic shipments in 1972 estimated at 5.75 billion square feet (1/8-inch basis), and imports estimated at another 1.17 billion square feet. Valid long-range forecasts of potential are not available; the most authoritative survey, conducted by the U.S. Forest Service, is completely obsolete, domestic consumption in 1970 reached the level forecast for 1980.

An estimated jump of 80 to 90 percent in imports of hardboard during 1972, in the face of domestic capacity at 7 billion square feet (expected to increase to almost 9 billion square feet by 1974), serves to evidence the highly competitive character of the industry. U.S. producers, confronted with difficult price-competitive commodity marketing tactics by foreign producers, are modifying their plants to manufacture siding and other specialty fiber products. 1/ This is the underlying reason for the present imbalance between supply and demand.

Regardless of good volume potential at the marketplace, the manufacture of hardboard at the Ashland area complex must be disqualified comparatively on the basis of high investment cost ($14 to $18 million for a new plant), low margin, and absolutely no yield of chips as necessary to guarantee an assurred supply of sawtimber to the complex.

1/ Production of hardboard in the United States is limited to 17 firms operating 29 plants. None are located in the primary marketing area.

MEDIUM DENSITY FIBERBOARD

Although the manufacture of medium density (MD) fiberboard is ideally suited to utilization of the low-grade hardwood resource base, present limited market potential and restrictive economics preclude consideration of its manufacture by the complex. The product equals or exceeds (in certain applications) the technical and physical capabilities of 3-layer industrial type particleboard - with which it competes at the marketplace. However, its derivation from chips produced by whole-log chipping, costing from $11 to $20 per dry ton depending upon procurement practices, plus the high cost of installed manufacturing facilities, precludes price competitiveness with even the very best (and most expensive to manufacture) particleboard. Coupled with location of Ashland, remote from major furniture manufacturing region markets in which MD fiberboard finds its best application and volume potential, the economic negatives of this product serve to rule it out as being feasible at this particular time.

If the market improves, or furniture manufacturers decide that medium density board is the answer to their needs for the 'perfect' product, MD fiberboard would be a feasible venture. Ashland might not be the ideal location for the plant, but such a plant would provide for usage of the very lowest grades of hardwood available in Maine.

SOFTWOOD PLYWOOD

Softwood plywood production in the United States jumped 16 percent over 1970 to 16.36 billion square feet (3/8-inch basis) in 1971, followed by another substantial climb (data not yet released by the Bureau of the Census) during 1972. The American Plywood Association (APA) estimates production will exceed 19 billion square feet in 1976. Geographically, production is split volume-wise 77 percent west of the Rocky Mountains, and 23 percent in the Southern Yellow Pine Region, with no production north of the State of Virginia in the East. APA premises its estimates of future production on anticipated continuing increase in the annual rate of housing starts. Although the size of the average single family house is expected to become smaller (due to increased participation by the government in new home financing, rising prices, and a consequent emphasis on smaller, lower cost units) plywood consumption per unit is not expected to decline. Rather, usage per unit will be equalized by increases in such applications as single-floor systems and siding, and by progressive growth of the mobile, modular, and prefabricated housing industries, which currently use approximately 30 percent more plywood per unit than is used in conventional stick-built homes.

The general construction market for plywood is not rebounding as fast as expected from its 1970 slump, but it is expected to pick up momentum assuming economic conditions of early 1973 continue their

upward trend. Strength in the suburban office, shopping center, school, and church construction sectors is expected to provide good growth opportunities for softwood plywood.

The industrial market for plywood is expected to expand largely as a result of increased volumes in materials handling and transportation equipment uses. Other industrial uses are very strongly oriented towards particleboard over plywood, cost being the prime criterion.

The agricultural and over-the-counter markets for plywood are expected to grow at a rate slightly exceeding the rate of population growth.

Absence of softwood plywood plants in the Northeast is directly attributable to the characteristics of the timber resource in the region. Neither spruce/fir and other indigenous softwood species, nor the size of timber available have met acceptance under past standards. Now, circumstances have reversed to the extent that these aspects of the resource no longer stand as prohibitives. D.W. Taber and J.E. Shottafer sumarized in Maine Agricultural Experiment Station Bulletin 674 that the market potential for eastern spruce plywood would reflect national patterns of growth of the market for softwood plywood; they concluded:

> ". . . In general, it appears that spruce as plywood has a favorable potential for acceptance in the structural plywood market and fairly good acceptance as a possible decorative material. . . ."

Conversion of timber into softwood plywood at the Ashland area complex has been disqualified on the basis of comparative economic performance capability, in spite of reasonably good market potential. Capital investment in a plywood plant would be two or three times greater than the investment required to construct a sawmill and support facilities having comparable capacity. Return on invested capital would range from less than 10 percent to a maximum of 15 percent, whereas 20 to 40 percent return in not uncommon for sawmill operations. Significantly, in consideration of the pulp and paper orientation of wood conversion industry in Maine, and particularly in regard to Ashland area circumstances, the yield of chips per thousand board feet of sawtimber converted into plywood is one third of the yield that would be realized from conversion into sawn lumber.

2.06 MANUFACTURING HIGHLIGHTS - SATELLITE UNIT PRODUCTS

FURNITURE MARKET HIGHLIGHTS

As allowed by the resource and market potential, furniture might be manufactured at the Ashland area complex in three primary configurations: (1) hardwood case goods, tables, and chairs; (2) pine furniture (case goods and tables); and (3) upholstered furniture.

Furniture to be manufactured by satellite units should utilize as much raw material from the complex as is possible or practical. The marketing effort should be directed within the confines of the primary marketing area (local and regional distribution), stressing the northeastern corridor, with the selling approach based upon area demand characteristics.

Manufacturers shipments of wood household furniture and upholstered household furniture are expected to increase approximately eight percent over levels attained in 1972. 1/ 2/ 3/ The anticipated large increase for 1973 can be attributed to the expectation of exceptional gains in consumer spending for durable goods and continued high levels of housing starts. Although manufacturers shipments are increasing at a high rate, their being based primarily on cash sales does little to indicate the actual expansion or contraction of manufacturing activity. Rather, such data reflect changes resulting from price and cost of manufacturing increases. Actual output of the furniture industry has remained rather modest, growing to the tune of about one percent per year since 1967 (a total 4.1 percent increase from 1967 to early 1972 was recorded by the U.S. Department of Commerce).

The following aspects of marketing will greatly influence furniture

1/ The 1972 level of manufacturers shipments was $4,666 million; wood household and upholstered furniture. Shipments in 1973 are expected to reach $5,039 million.

2/ Wood household furniture; except upholstered, includes establishments engaged in the manufacture of wood household furniture commonly used in dwellings. SIC Code 2511.

3/ Upholstered household furniture: includes establishments primarily engaged in manufacturing upholstered furniture on wood frames, or manufacturing wood frames for upholstered furniture. SIC Code 2512.

manufacturing satellites incorporated into the Ashland area complex:

- Furniture is generally produced at three levels of quality: (a) high line - characterized as speciality oriented firms who produce high quality, high priced goods for a limited market; (b) middle line - characterized by the majority of existing furniture manufacturing firms, generally catering to the 'average' American demand for good quality, stylish furniture; and (c) low line furniture which is normally marketed as a commodity item in large discount houses (e.g., K-Mart) generally to low to middle income families, students, and apartment owners.

  High line furniture is expensive to manufacture and margins of profit are usually low unless the manufacturing firm is highly efficient in production and marketing technique. The firms can be generally characterized as made-to-order shops.

  Middle line furniture manufacture requires an efficient, organized production unit in order to realize an acceptable profit margin. This sector is dominated by such firms as Drexel, Thomasville, Ethan Allen, and Bassett.

  Low line furniture is perhaps the most attractive from the standpoint of profit potential and return on investment criteria. But, at the same time, the attrition rate is quite high due to occasional changes in market demand, chain store buying policies, and disposable income.

- Demand characteristics for furniture in the New England states are unique to that region. There is an affinity for colonial style, 'solid' hardwood furniture. This contrasts with other areas of the United States in which mediterranean and modern furniture designs are favored over colonial. It is a fact, however, that colonial style furniture is beginning to gain acceptance in other portions of the U.S. at this time, and it is conceivable that this type of styling could displace mediterranean in the near future.

- Upholstered furniture, unlike case goods, tables, and non-upholstered chairs, is produced on a regional scale. It is a difficult product to ship economically and regional markets tend to differ considerably, therefore making it highly preferable (and customary) to manufacture the product close to major market centers.

Establishment of a large-scale furniture manufacturing operation featuring solid wood is not practical considering the limited supply of hardwood lumber available from the complex and from other potential sources in the area -- in context with sharing usage with other satellite units.

The furniture manufacturing plant at Ashland must (desirably) incorporate plywood and overlaid/standard particleboard products from the complex in order to be viable, from a raw material availability standpoint.

HARDWOOD CASE GOODS, TABLES, AND CHAIRS

The market within the Northeastern United States for hardwood case goods, tables, and chairs is very strong. Particular favor is directed toward colonial style furniture, however, contemporary styles are also finding favor in younger generation consumer groups. One manufacturer of colonial style furniture indigenous to Maine has stated flatly that there is room in Maine for several more plants of magnitude (each employing approximately 100+ persons), pointing to the fact that he simply cannot produce enough furniture to satisfy demand. A comprehensive check throughout the primary marketing area has borne this contention out positively. Demand for good quality furniture (particularly colonial style) is far in excess of the available supply. Many buyers, when confronted with this situation, are forced to substitute with other types/styles of furniture, but their regional (New England) loyalty dictates (in most cases) that they would rather buy from a regional source than from an 'outside' firm.

Manufacture of hardwood furniture at Ashland must be based on usage of the available maple and yellow birch dimension, particleboard, and 'hardwood' plywood products manufactured at the complex. Other raw materials could be utilized, but not to the economic advantage of the furniture plant or the complex. It is conceivable that raw material availability could limit production of hardwood case goods, tables, and chairs as mentioned above. In that case, manufacturing operations could be geared towards producing fabricated (machined parts) components that would comprise parts of furniture to be manufactured at some other location.

Firms desiring to undertake the manufacture of wood household furniture at Ashland should have experience in manufacture and marketing of the line to be produced. Several existing manufacturers of furniture in Maine have expressed interest in assisting a firm desiring to locate in Ashland in any way possible, perhaps to the tune of joint participation.

PINE FURNITURE

The market for pine furniture is more wide-spread than for conventional hardwood furniture. In a sense, the regional aspects of demand versus supply indicated for hardwood furniture above apply to the demand

characteristics for pine furniture, with the exception that pine furniture is highly desirable as a consumer good throughout the United States (demand is more widespread and uniform). There is demand for both finished and unfinished configurations; economics will bear out which would be best for manufacture at Ashland. Unfinished furniture would offer good potential due to decreased costs of production, lower shipping rates, and increasing demand. High quality finished pine furniture, however, could also offer good potential, based on high demand and resultant high selling prices, if the market lasts.

Again, firms or parties desiring to undertake the manufacture of this type furniture at Ashland should have backgrounding experience that will enable them to make the best of the situation offered by the complex. Marketing and production knowledge will be essential to extract best income potential from this manufacturing activity.

It is doubtful that there will be sufficient pine lumber to support a good sized manufacturing plant. If this is the case, manufacture of specialized items/parts could be undertaken, perhaps as a subsidiary of an existing pine furniture manufacturer. Or, specific items could be produced that coordinate with the hardwood case goods, tables, and chairs that might be manufactured by a satellite of the complex.

UPHOLSTERED FURNITURE

Manufacturing of upholstered furniture in Maine is limited to four small plants (average 4 to 10 employees) operating primarily on a custom order basis. There is opportunity for the establishment of a medium sized upholstered furniture plant geared to produce items that would find consumer acceptance in nearby markets (shipping would limit the marketing range to approximately 300 miles). Production of upholstered furniture is characteristically on a regional basis, generally as a result of the high costs involved in packaging and shipping the odd shaped end-product items. There are exceptions, firms such as Kroehler, but the general rule is regional production rather than centralized.

An advantage of the Ashland location lies in proximity to raw materials; wood from the complex and textiles from Maine mills.

The upholstered furniture plant would be best suited to orientation (along style lines) with other furniture products manufactured at the complex, to the extent of being marketed as part of an offered furniture 'line'. This would simplify marketing procedures, and assure better sales volume for the upholstered furniture than would be the case otherwise. In order to assure the long-term viability of the upholstered furniture enterprise, practical background familiarity with the business by a firm wishing to establish at Ashland will be essential.

PREFABRICATED FURNITURE COMPONENTS (PARTS)

Manufacture of furniture components (parts) would be incorporated into the Ashland area complex primarily to satisfy demand created by existing or anticipated satellite furniture manufacturing activities.

With a captive sales outlet, the parts manufacturing satellite could then seek expanded regional markets for fabricated and semi-fabricated parts - to its best advantage.

Demand for furniture parts is strong, with many furniture producers seeking to reduce in-plant overhead and manufacturing costs by purchasing component parts and assembling them into finished furniture.

THE LABOR FORCE FACTOR

One factor that will vie against the manufacturing of furniture in the Ashland area is the level of skills the industry must have in the labor force. Manufacture of furniture generally requires skilled and semi-skilled labor to function profitably and properly. Skills associated with the furniture business are usually complicated and hard to teach. Ashland and the surrounding vicinity has no history of furniture manufacture and, thus, the labor force would be unskilled, requiring intensive education to bring them to acceptable proficiency levels.

PALLET MARKET HIGHLIGHTS

As advised by the National Wooden Pallet & Container Association (NWPCA): ". . . there are no statistics covering pallets either by type or end-uses. In 1971 there were more than 138 million wooden pallets produced and sold in this country. Of this number, about 65 percent were permanent reusable pallets and 35 percent were expendable pallets.

Estimated production of wooden pallets in 1972 increased 1.5 percent for the year to 140 million units. NWPCA projects a 400 million unit market by 1985; up 185 percent over the 12-year period from 1972. The quantities of lumber involved are evidenced by an average content of 13 to 15 board feet in an expendable type pallet; average 25 to 28 board feet in a reusable type. Pallets are not stocked by middlemen wholesalers/retailers to any appreciable extent. Rather, they are made to order and sold either factory direct or through a sales intermediary. The range of effective/profitable distribution in the Northeast is about 300 miles, indicating that sale of pallets manufactured at Ashland would tend to be limited to destinations in New England and eastern New York State, and northwest to Montreal in Canada.

Prices are generally arbitrated (or in the case of government usage, let for bid -- involving about 7 to 10 percent of total demand for pallets) on a customer to seller basis. There is no reliable pricing information since there are innumberable sizes/styles of pallets.

Pallets manufactured at Ashland, using hard maple as the primary species, will be best oriented toward the high quality, reusable pallet sector of the market. Hard maple (also birch and beech) is classed as a class C species for use in pallet manufacture: ". . . Class C - the heaviest hardwood species. They have the greatest nail holding power, greatest strength as a beam, and the greatest shock-resisting capacity. They are difficult to drive nails into, have the greatest tendency to split, and are difficult to dry. They are the heaviest and hardest domestic woods and are, therefore, hard to work . . ." 1/

PREFABRICATED KITCHEN CABINET MARKET HIGHLIGHTS

The market for prefabricated kitchen cabinets within the primary marketing area follows closely the market trends evidenced for furniture. Base indicators include population growth, the move toward modularized building, and housing starts.

More and more builders are incorporating the modular kitchen cabinet concept into their units. Apartments, modular housing, condominiums, and mobile homes presently account for the major volume consumption of factory built, modular kitchen cabinets (including bathroom/utility room cabinets). In addition, many large-scale retail outlets (e.g., Sears, Penneys) are stocking modular cabinet designs in their stores, selling them on a retail basis to regular customers.

Potential in Maine looks particularly good, considering the fact that usage of modular prefabricated kitchen cabinets is just beginning to take hold in the area. A plant located in Ashland will be able to capitalize on this new demand potential and, at the same time, will have competitive access to existing high volume demand areas such as Boston, New York City, Albany/Schenectady/Utica/Rochester/Buffalo, New York.

1/ Specifications and Grades for Hardwood Warehouse, Permanent, or Returnable Pallets. National Wooden Pallet Manufacturers Association.

FENCING MARKET HIGHLIGHTS

In the New England and North Atlantic states, within the primary marketing area, fencing has great demand. Fencing can be manufactured from either cedar or preservatively treated softwood species (cedar is preferred). High volume markets for fencing would include Boston, greater metropolitan New York City, and other concentration zones of population. The manufacture of fencing would most likely be undertaken by a satellite unit within the complex. It is difficult to predict the durability of growth in demand for fencing but at this time there seems to be an abundance of demand and a general shortage of supply, hinging on population growth, single family conventional housing starts, and the amount of disposable income that is available on a per capita basis. Pricing is forcing the market for fencing to decline slightly. The high cost of fencing is hampering demand characteristics because of the inflationary trends that are evident in the nation at this time. In other words, fencing is more a luxury item than a base necessity.

ARCHITECTURAL PLYWOOD MARKET HIGHLIGHTS

The market for industrial and architectural (I&A) hardwood plywood is both stable in terms of potential, and static in terms of industry dynamics. Market segments include the custom millwork market (less than 20 percent of the total potential), the furniture market, the television and phonograph market, and the kitchen cabinet market. There has been considerable, and continuing displacement in all segments by particleboard core plywood (wood veneer overlaid), particleboard with wood grain imprinted and plastic overlaid surfaces, and low-quality hardwood plywood from import sources (e.g., Africa, South and Central America, Japan, and the Philippines). These displacements have induced a highly competitive situation at the marketplace, with the result that conventional hardwood plywood constructions are increasingly restricted to the high quality, low volume top of the market. Domestic production of all types of I&A hardwood plywood has changed little over the 1966-1971 5-year period; registering a slight drop from 2165 million square feet - surface measure in 1966 to 2047 million square feet in 1971; 83 percent of the 1971 production was (conventional) veneer core construction.

The manufacture of I&A hardwood plywood requires top quality face veneer and good quality veneer for core construction. This is inconsistent with the Project Woodchip objective to utilize poorer grade timber. To place blame, much of the past hardwood high-grading in Maine has been caused by demand for quality veneers -- which carries through to the present. Combined with the restricted dynamics of the industry, the appetite for quality timber precludes serious consideration of hardwood plywood manufacture by the complex, unless the product can be utilized captively by furniture manufacturing satellites.

SPECIALITY ITEMS, MARKET HIGHLIGHTS

Speciality items, such as carved pieces, bowls, etc. offer good prospects to an individual or firm desiring to set up a small scale satellite unit. The market would be highly regional and would, in all probability, be quite lucrative if the right end-product is selected and raw material costs are kept low. Such specialized machinery as multiple spindle carving machines and multiple copy lathes should be installed for added efficiency, reduced labor costs, and end-product standardization.

FIBER MULCH MARKET HIGHLIGHTS

The market for natural wood fiber mulch (finely fiberized bark impregnated with fertilizer and selected grass seeds) in the United States is controlled by two major producing firms, Weyerhauser and Conwed. Conwed has cornered the East Coast market. The market is seasonal with highest consumption in the months of September, October, and November (roughly corresponding with the start of the rainy season and the resultant danger of soil erosion along newly constructed highways.

Major usage of fiber mulch is in freeway and roadside landscaping applications (primarily as a protective measure against soil erosion) but increasing popularity is causing intensified demand in architectural landscaping applications.

Without extensive marketing expertise in the area of fiber mulch sales it would not be possible or practical to break into the established end-user markets.

Profit potential/return on investment look especially poor when equated to the fuel equivalent value of power and steam at Woodchip. Total United States production of fiber mulch was less than 90 thousand tons in 1972. This equates to three 100-ton per day plants operating 300 days per year.

ANIMAL LITTER MARKET HIGHLIGHTS

There are three types of animal litter on the market today: (1) poultry and livestock bedding; (2) scientific animal litter; and (3) commercial pet litter. The following characterizations identify the different types:

- Poultry and livestock bedding - primarily consisting of chips, this type of litter is utilized in barns

and pens to simplify clean-up and to better assure sanitary conditions for poultry and livestock. It is generally marketed in local areas, with farmers usually going to the sawmills and picking up either loose or baled chips.

- Scientific animal litter - a product specifically designed for use as animal litter, not a residue. Chips are usually manufactured from non-toxic hardwood species (aspen), dried to a moisture content of 12 percent, classified as to size of chip after dust is removed, and packaged in 50 pound kraft bags. Total production in the United States is approximately 15,000 tons per year (three 15-ton per day plants). Market opportunity is limited, and engagement in the business with the sole purpose of producing animal litter is not lucrative. 1/

- Commercial pet litter - is generally manufactured from shavings, procured from nearby sawmills. The product is processed in much the same manner as scientific animal litter with the exception that quality control is not as stringent. A chlorophyll based chemical is added for scent and pathogenic control. This market is commodity in nature and is monopolized (on a national scale) by three firms specializing in pet products (Ralston Purina, Litter Green, and Hartz Mountain). Local outfits do a small scale business, but not enough to warrant consideration for inclusion into the Ashland area complex.

Animal litter in any one of the three mentioned configurations would not offer good profit potential to the Ashland area complex. The fuel equivalent value of shavings and the paper utilization value of chips alone swing economic consideration away from this type of manufacturing activity.

1/ Some buyers of scientific animal litter (e.g., General Service Administration, U.S. Government) will accept other species, including eastern white pine.

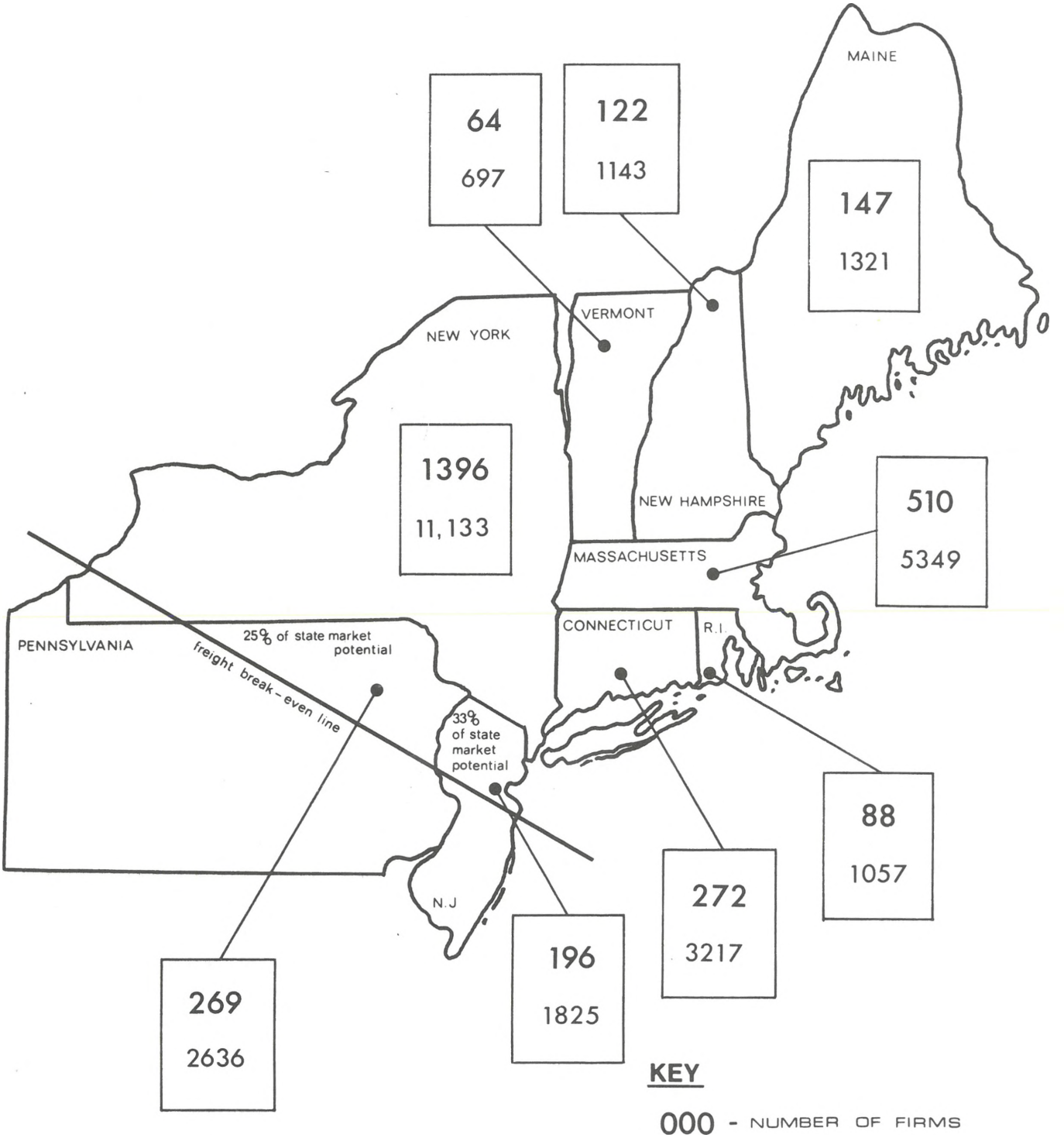
2.07 RETAIL/WHOLESALE OUTLETS IN THE PRIMARY MARKETING AREA

The following diagrams show SIC code numbers, and identify retail and wholesale establishments by state; quantifying numbers of firms and employees to show the best market areas within the Primary Marketing Areas for sale of products manufactured by the Ashland area complex. 1/

1/ Source of data: County Business Patterns 1972, U.S. Department of Commerce, Social and Economic Statistics Administration, Bureau of the Census.

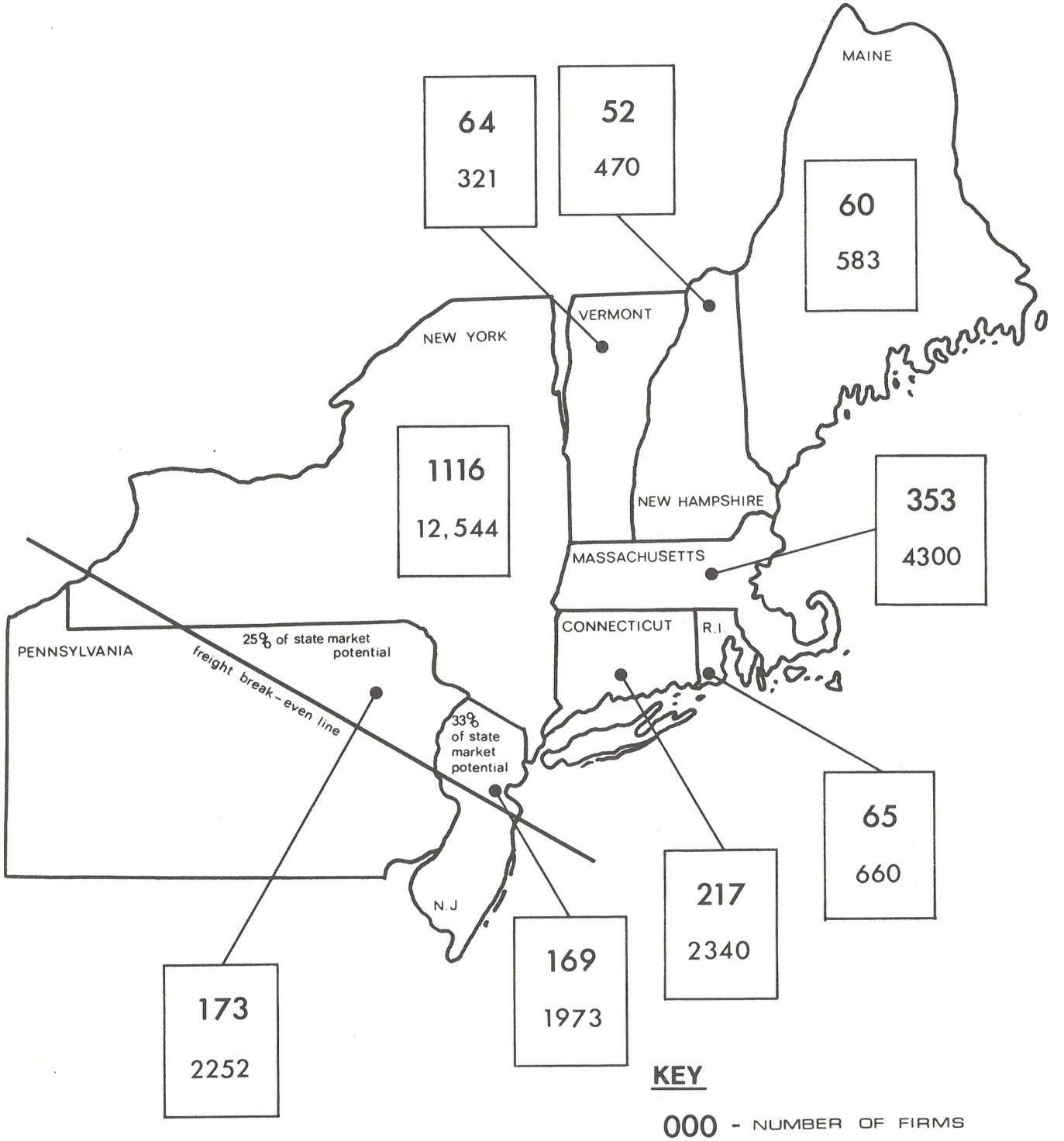
SIC 521

Lumber & Other Building Materials Retailers



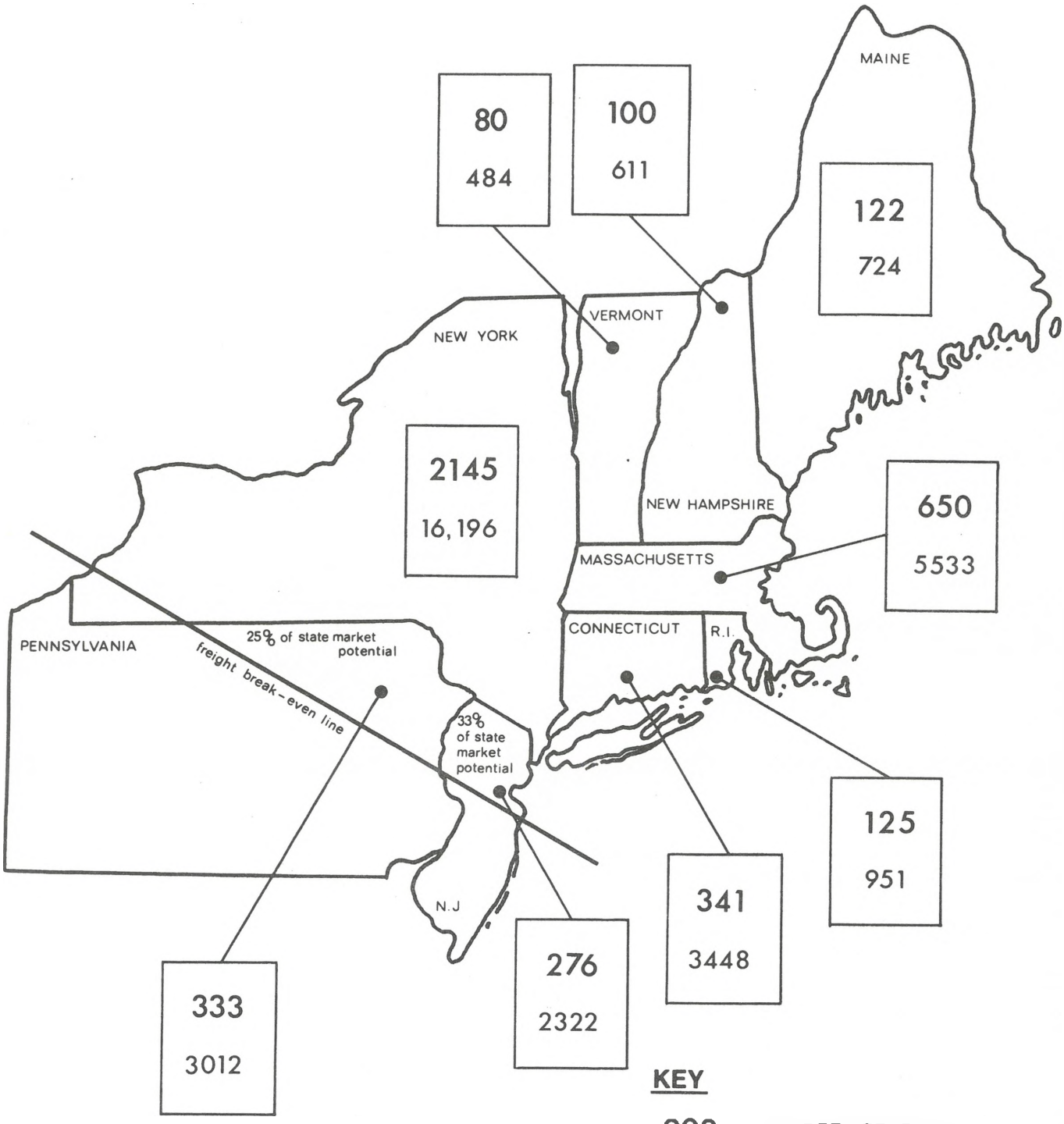
SIC 5098

Lumber & Construction Materials Wholesalers



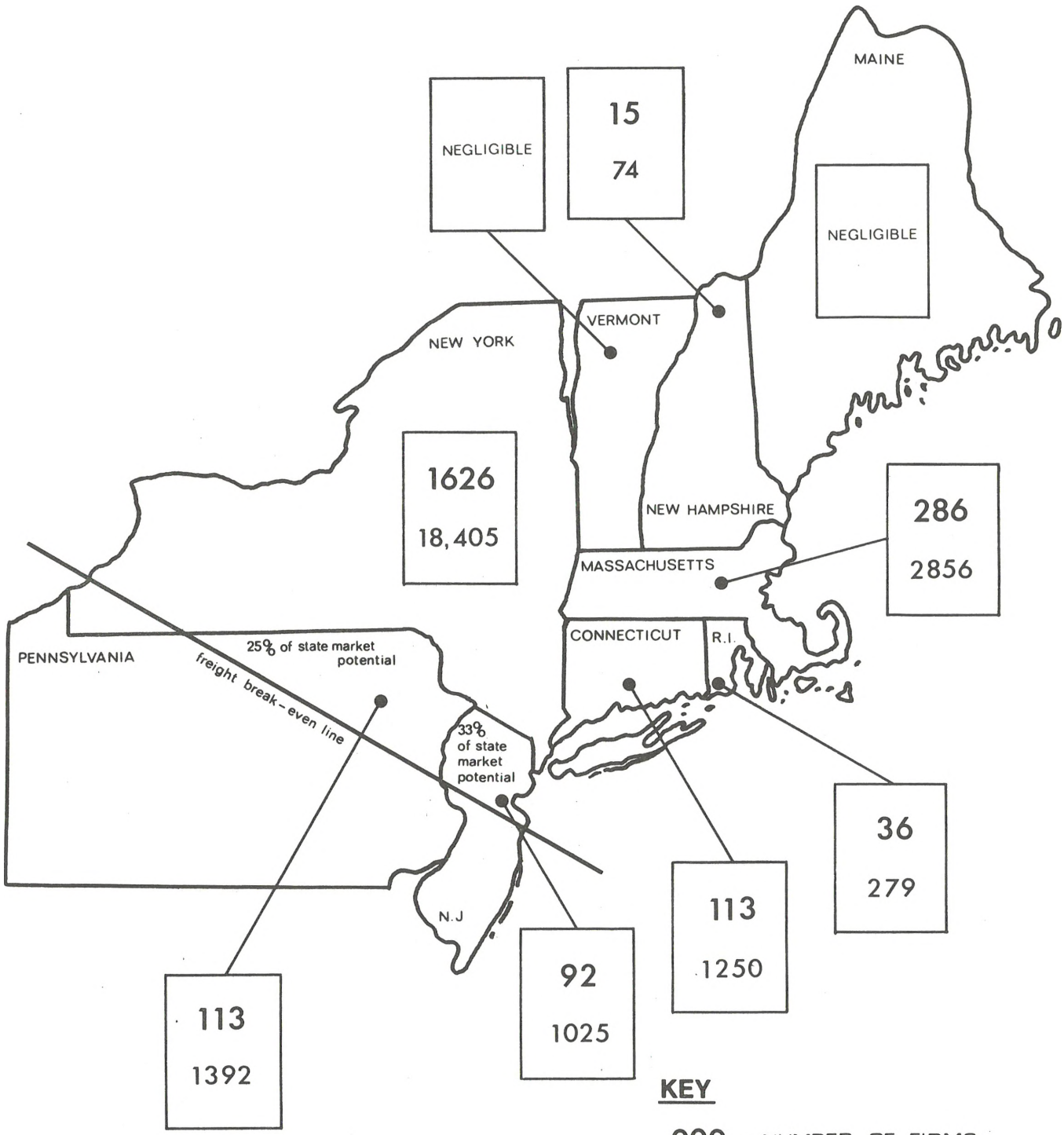
SIC 5712

Furniture Retailers



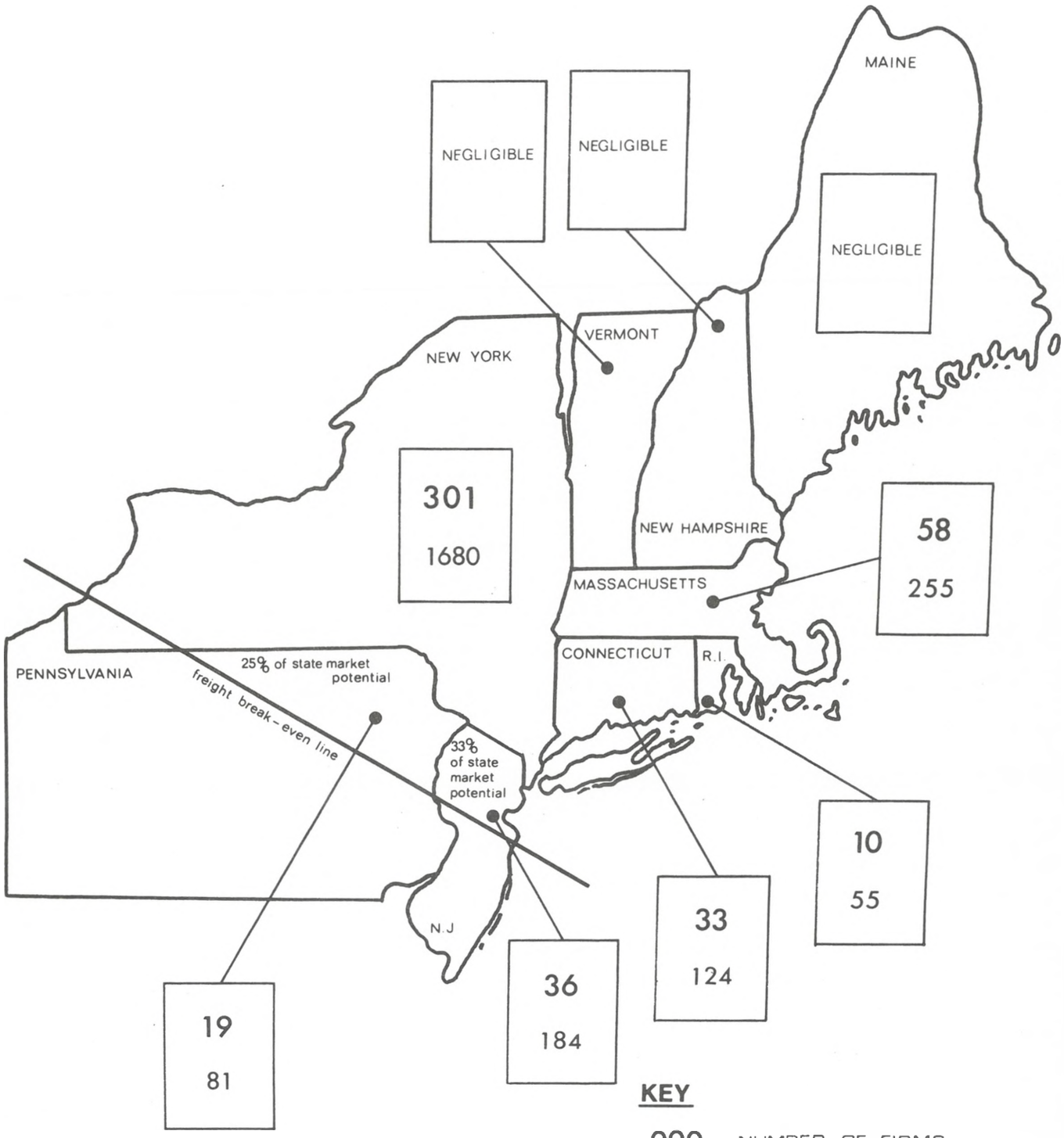
SIC 5097

Furniture & Home Furnishings Wholesalers



SIC 5719

Miscellaneous Home Furnishings Retailers



Section 3

System Planning

3.01 SYSTEM PARAMETERS

FUNDAMENTAL CONSIDERATIONS

The system of sawtimber processing and remanufacture outlined below is a prototype for establishing one or more fully integrated wood products manufacturing complexes in the State of Maine. It has been designed in harmony with the forest, human, and community resources of Aroostook County identified in Section 1 of this report, and with the product and market opportunities for Maine wood products identified in Section 2, as they correlate with the Aroostook sawtimber resource. Specifically, the System complies with locational, resource, environmental, and management aspects of operating a complex in proximity to Ashland.

Credibility of the System as a model for sawtimber based enterprise has not been jeopardized by the fact that planning has been limited to the material and human resources of the Ashland area, nor by necessity to adapt to the procedures and objectives of private sponsoring industry. To the converse, planning the System to comply with the actual resource, business, and market circumstances of that locale rather than theoretical criteria should benefit the validity and usefulness of this report.

It has already been demonstrated that the approach taken is justified. Based in part on disclosures in Phase Reports released during progress of the Woodchip study, a major forest products industry corporation indigenous to the State is investing in construction of the Mode-1 configuration of a fully integrated wood products manufacturing complex in the Ashland area. This early implementation is a meaningful advancement toward fulfillment of the Project key objective, which is:

> *". . . to locate, identify facilities and product line, characterize market demand, and prepare an operational plan for an integrated wood products manufacturing system that will qualify as a feasible and durable business venture able to contribute significantly to the economy of Maine and the local community; planning for the following results:*
>
> *(a) Utilization of species and grades of timber not now in great demand.*
>
> *(b) Maximization of the scope of processing; from forest to consumer.*
>
> *(c) Optimization of manufacturing efficiency.*
>
> *(d) Achievement of highest attainable value-added in product manufacture.*

(e) Responsiveness to changing potential at the marketplace.
(f) Profit making results.
(g) Contribution to community improvement; providing employment opportunities, cash flow, and leadership.
(h) Compliance with ecological considerations; from the timber resource through operational performances.

THE TIMBER AND PROCESSING PROBLEMS

Measured by volume of growing stock and acres of commercial forest land, there is an abundant resource of sawtimber in Maine to support expanded forest products industry. However, equation of the resource to induction of viable new business into the economy of the State is hindered by restricted timber availability, due to the patterns of ownership and the structure of procurement procedures. Land and timber ownership in Maine are essentially "in common" by large private firms; thereby strongly restricting opportunity for a meaningful free market in timber procurement. The resulting uncertainty of a dependable long-term supply of sawtimber to support new industry precludes formation of ventures without the participation, or at least sanction, of existing corporate or professionally represented landowners. Thus, regardless of the potential viability of a plan for an integrated sawtimber based complex, its transposition into a business entity could not be possible unless it was designed to fit precisely into existing strategies of forest management and timber utilization.

Specialization by wood processing industry in Maine has resulted in faulty timber utilization -- past and present. Best economic advantage has frequently not been achieved by processors, and value added per worker by manufacture in wood products has been only about 78 percent of value added by all manufacturing in Maine. The System recommended by this Report is considerate of these deficiencies by premising on the basis of utilizing lower grades of sawtimber than customarily sought, and planning for processing each ton of wood material to its most advanced value-added potential. These somewhat academic objectives have been tempered by interjection of economic reality into planning.

The identified problems are not prohibitive to Woodchip, but they are restrictive. It is only reasonable to assume that a plan of venture conceived as an integrated complex will attract investment capital as long as it offers attractive economic potential and is consistent with long-range plans for enlightened timber management and utilization. There is no intent by landowners to mismanage timber stands, nor is there intent by forest-based industry to continue highgrading and other practices that have been delaterious in Maine -- provided alternative options are practical and commensurately rewarding.

SCALE OF ENTERPRISE

Because of critical importance it is reiterated -- *". . . formulation of an integrated sawtimber processing complex must be keyed to existing resources of raw materials and labor, must be product oriented to accomodate existing markets, and must be highly conscious of value-added if the full spectrum of Woodchip's key objective is to be complied with . . ."* These broad requirements, while seemingly simple to fulfill, involve considerations that are sometimes overlooked and impose need to devise a concept of enterprise that will assure against pitfalls that heretofore have frequently inhibited most advantageous utilization of the sawtimber resource in Maine.

One weakness of sawtimber based industry in the State has been its profinity for small scale efforts launched without benefit of adequate capitalization or complete business acumen. There remains a tendency within the State to continue to sanction such ventures. This is negative to the Woodchip key objective in that to be profitable under present economic and market circumstances such ventures MUST highgrade the sawtimber resource, and they are genuinely unable to afford the investment in capital intensive facilities necessary to process basic raw materials into their optimized value-added end form.

The concept of an integrated complex, rather than being discouraging to formation of small wood products manufacturing enterprises, can provide a business matrix that justifies fostering interest in certain modest sized entrepreneurships affiliated with the management and operating structure of a complex itself. For purpose of identification in this report these businesses have been designated *satellites;* which could be independent corporations, assumed name businesses, subsidiaries of the corporate organization owning and operating the complex, or separate business owned by the principal corporation of the complex and outside investors. In keeping with this, an integrated complex could be either a single corporation or an affiliation of cooperating businesses, structured to best operational and economic advantages.

[ASSURED] ALLOCATED RESOURCES

A first consideration in structuring the operational profile of an integrated complex is identification of species, quantity, type, and character of wood resource materials that can be allocated to processing. The materials, singularly or in combination, may be sawtimber, primary products such as graded sawlogs, basic products such as lumber, or residue products such as shavings and bark.

For the Ashland area complex planned in this report annual availability of 80 million board feet of softwood sawtimber and 10 million

board feet of hardwood sawtimber has been assured. 1/ There is assured minimum annual availability of 30,000 tons of shavings within a 150-mile radius of procurement. And perhaps uniquely in the Ashland area, there is assured annual availability of more than 23,000 tons of mixed softwood and hardwood bark that, out of context with increasingly severe pollution control regulations, is presently incinerated.

These materials are the basic long-term supply of wood raw material upon which design of the Ashland area complex has been predicated. While identification of the types and quantities of materials has been simply stated here, the effort and time that has been expended in achieving reasonable guarantee that availability will persist for at least a 10-year amortization life against production machinery of the complex stands as the key predeterminant to economic feasibility, and to ability to attract the interest of sources of investment capital.

1/ See page 46, sawtimber availability, Ashland area for detailed identification of the available resource.

3.02 OPERATIONAL PROFILE

CHANGING ECONOMIC POSITIONS

Usage of Maine's timber resource has almost singularly been as raw material for pulp and paper manufacture, emphasizing processing of softwood species. In situations in which this has applied the usual classification of standing trees into poletimber and sawtimber classes has had little meaninfulness. The predominant spruce/fir softwood resource has been viewed by landowners, who have been and remain aligned largely with pulp and paper industry firms, as a warehouse of cordwood convertible into groundwood fiber or chips. Owners have directed minor attention to the present obvious fact that (some) sawtimber class trees can yield higher dollar return per ton of wood material when sawn into advanced lumber products than when converted into fiber. Growth of demand for softwood construction lumber throughout the world, coupled with increasing shortage of quality sawlogs in previously predominant lumber producing regions is compelling this new value outlook by timberland ownerships. Correlated with this, and essentially for the same reasons of demand and supply, the economic viewpoint toward hardwood sawtimber trees has also changed. Whereas in the past timberland ownerships have been inconsiderate of the relative values of cordwood and sawtimber, they now selectively seek best economic return from the total volume of timber under their control.

The allocation of a combined volume of 90 million board feet of softwood and hardwood sawtimber per year to the Ashland area complex has been assured as a result of recognition by ownerships of the 'new economics' briefed above. However, the concept and justification for an integrated complex extends beyond simple selective assignment of timber by quality and form to pulping or lumber manufacture. By interfacing relatively diverse manufacturing facilities the complex will achieve the objective of maximum value added to each ton of wood in sawtimber form to far better advantage than possible by a non-integrated sawmill. The conventional procedure of chipping solid residue left from sawlog lumber, yielding approximately 1400 pounds of oven dry weight wood for every thousand board feet of spruce/fir sawn, leaves an almost equal weight of sawdust, shavings, and bark as a disposal problem that has been solved by a variety of convenient means -- mostly by incineration and increasingly by dumping. The revenue from sale of chips is generally accepted as fair return. But expedient solution of the disposal problem is increasingly subject to strengthening public awareness of the pollution caused, reflecting in legislative reactions at federal, state, and community levels; imposing

capital and operating costs ranging from burdensome to prohibitive for sawmills.

In most sawtimber procurement situations in Maine neither a sawmill nor an integrated sawtimber processing complex can expect to escape sale of their chips to pulp mills, realizing minimal dollar return because of the low value commodity classification of chips. This economic penalty is paid for assured availability of sawtimber under existing patterns of timberland ownership. It is a trade-off concession for sorting harvested timber into cordwood and sawtimber. The "equal quantity of other residues" is not wanted by pulp mills, thus it remains available for internal processing to best economic advantage.

It is economically disadvantageous to continue incinerating residue materials when under existing technology they can be in part manufactured into marketable (basic) products and in part converted into (steam and electric) energy. Thereby, sawmills, with their relative inability to utilize the residual portion of purchased sawlogs, are heavily disadvantaged over an integrated complex. Processing residues into products can result in DOUBLING value added by manufacture over that from processing sawtimber only into lumber. Obviously, this places non-integrated sawmills in a comparatively precarious position in their ability to offer competitive prices for sawlogs, and thus assure their supply of raw material and longevity as businesses.

PROCESSING FACILITIES

Planning an integrated complex must logically include consideration of growth. The reality of purchasing practices at the marketplace applicable to other than commodity wood products makes it unrealistic to project that a business not previously identified as a source of a full gamut of wood products, including, for example, softwood dimension lumber through custom-quality furniture, would be even moderately successful in efforts to rapidly merchandise its full volume output.

Apart from problems normal to placing new machinery systems into operation and cultivating capability and efficiency by new employees, it is relatively impossible for a new producer to quickly register widespread acceptance at the marketplace. Time for development of logistics, proof of products, proof of business reliability, proof of ability to meet service commitments, and numerous similar related identifications of a qualified or favored supplier are mandatory. While these requirements would be appreciably eased if an existing diversified industry-major were to place a fully integrated complex into operation, time consuming and costly delays in achieving full volume sales would nevertheless still be involved. The severity of economic consequence from this would weigh less heavily upon expansion of existing business than upon a new business entity; regardless, compliance with a reasonable schedule of progressive build-up

in product line (and facilities) and sales volume would remain a vital aspect of venture approach.

In recognition of disciplines at the marketplace the complex at Ashland has been planned to evolve over a period of time from a rudimentary Mode-1 configuration into its Mode-2 configuration; this, the ultimate configuration, will enable optimum realization of the Woodchip key objective under conditions in the Ashland area.

MODE-1 CONFIGURATION

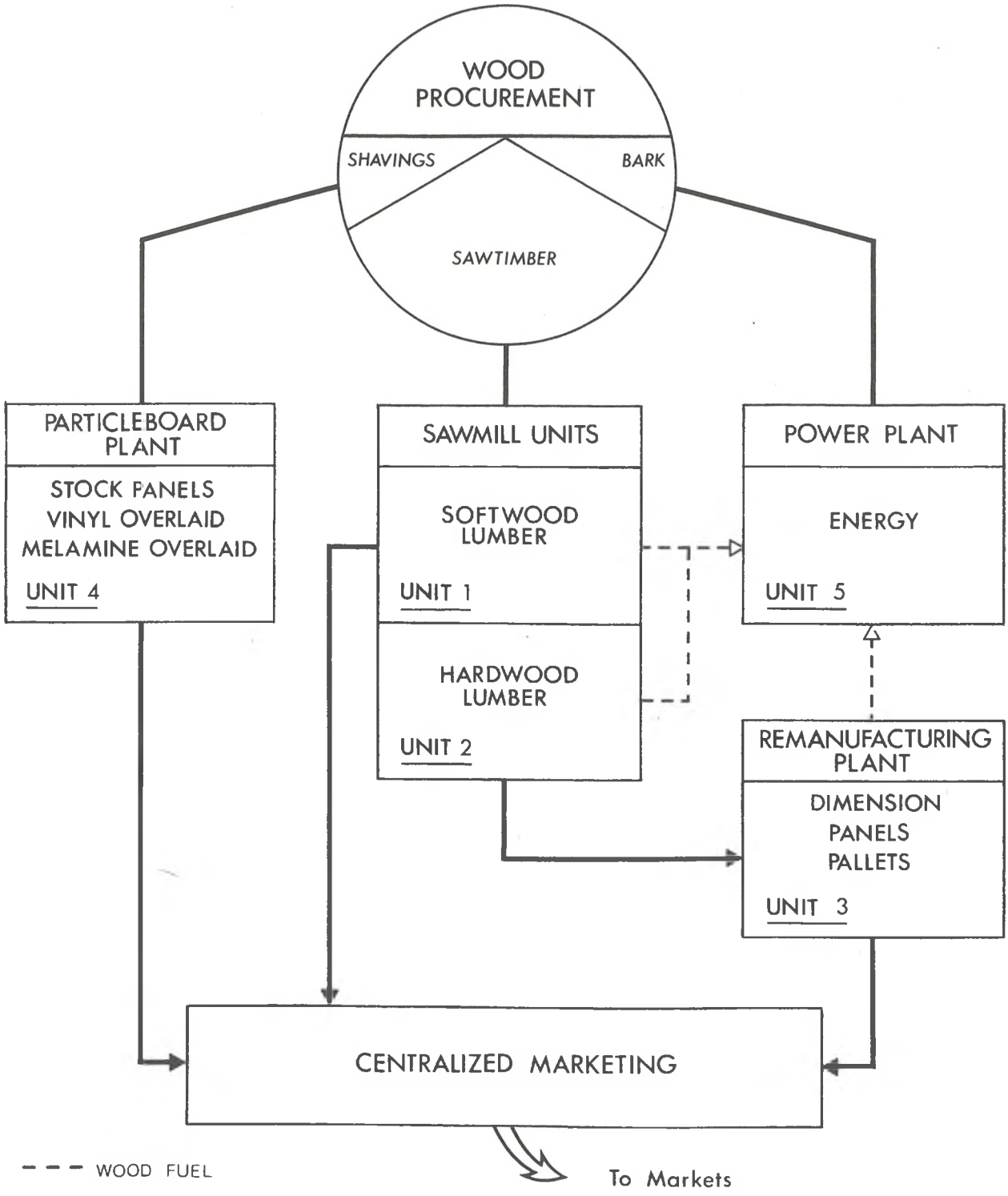
The following diagram identifies the structure of the Mode-1 Ashland area complex. It will comprise five major facilities, each a key in itself to most advantageous and rapid growth into the full scale Mode-2 configuration. Each subsystem would be designed for ultimate processing efficiency and effectiveness in harmony with the assured long-term resource of wood raw material.

TIMBER HARVEST and DELIVERY Tree-length sawlogs will be procured from logging operations within economic limits of delivery -- extending outward to a 100-mile haul, but concentrating on the timber resource within a 50-mile working circle. Harvest will be managed to conform to a long-range cutting plan designed to assure (a) improved sawtimber quality, and (b) sustained yield. Insofar as possible, softwood timber qualified for best utilization as sawtimber will be sorted and loaded at the logging site for delivery to the Complex. This will avoid double handling and a problem with differential species weights, which will occur whenever intermixed loads of sawlogs and pulpwood are hauled. Deliveries will be made on weight basis, rather than by volume measure.

PRIMARY SOFTWOOD PROCESSING Eighty million board feet of softwood sawtimber will be processed into dimension (framing) lumber, boards, and a limited quantity of timber by two 40-million board feet per year sawmills. The specification of two sawmills results from the circumstance that one unit is already operating at the selected site. Supporting facilities will include dry kiln capacity to process 50 percent of the sawn lumber; the remainder to be sold green. Dimension lumber will be surfaced and sized in a high-speed planer mill. 4/4 boards will be processed by a smaller, less automated supplemental planer facility.

Output of lumber is projected at 92 million board feet per year; accounting for projected 15 percent overrun from Holland (Maine) log scale measure. It is reasonable to expect that with new and modified machinery and the most efficient operating procedures overrun could be increased to a theoretical maximum in the 20 to 25 percent range.

MODE-1 COMPLEX CONFIGURATION
Principal Corporation



Processing residues from sawmill operations will be utilized consistent with pollution control and other environmental considerations:

- CHIPS -- 1145 OD pounds produced per thousand board feet of sawlogs -- will be loaded on board rail cars for delivery to pulp mills.
- BARK -- 415 OD pounds produced per thousand board feet of sawlogs -- will be milled and transferred to the power plant for use as boiler fuel.
- CHIP FINES, SAWDUST, SHAVINGS, and HOGGED (DRY) END TRIM -- 850 OD pounds produced per thousand board feet of sawlogs -- will be transferred to the particleboard plant; some green sawdust will be delivered to the power plant for use as fuel.

SOFTWOOD LUMBER DISPOSITION

Softwood lumber products will be merchandized by an internal sales force, part to be routed through conventional distributor/wholesaler channels. It is expected that as sales opportunity justifies, an increasing volume of sawn lumber will be processed on-site, using machinery installed in the hardwood remanufacturing plant -- into softwood cut-stock, sash, stripping, and other value-added dimensioned and machined products. It would be feasible to also manufacture softwood pallets, using automatic pallet assembly machinery in the hardwood remanufacturing plant.

PRIMARY HARDWOOD PROCESSING

10 million board feet of hardwood sawtimber will be processed into lumber, yielding 10.55 million board feet of graded mill-run lumber per year; an average 5.5 percent overrun from Holland (Maine) log scale measure, based on the available supply of maple sawlogs. This compares to -8.6 percent overrun when sawing woods-run grade sawlogs (intermixed No.1, No. 2, and No. 3 Grade in natural proportion), and -13.9 percent when sawing exclusively No. 2 and No. 3 Grade sawlogs in their natural proportion in the Ashland procurement area.

Economic analyses during study confirmed that operating margins are inadequate when sawing a grade-mix of hardwood sawlogs inclusive of more than a minimal percentage of No. 3 Grade sawlogs. Without benefit of associated processing facilities to enable development of consequential value-added, and in spite of the degree of selective hardwood logging that must be tolerated in procuring sawlogs for the complex, return on investment can not meet standards attractive to sources of investment capital.

Mill-run lumber -- average grade distribution 33 percent pallet, 27 percent 2A+, and 40 percent 2A- -- will be further processed in the sawmill to upgrade the 2A- portion; resulting in 18 percent volume loss, reducing total sawmill output to 9.28 MMbf/year. The entire output will be transferred to a remanufacturing facility. Hardwood lumber per se will not be sold by the complex.

HARDWOOD REMANUFACTURING Excluding pallet grade lumber, which will be processed green into pallets, 63 percent of the lumber transferred annually from the hardwood sawmill to the remanufacturing plant will be dried prior to further processing -- 48 percent kiln dried to 6 percent average moisture content; the remainder air dried to 20 percent moisture content, followed by kiln drying as may be allowed considerate of development of degrade. The remanufacturing plant subsystem will include dry kiln facilities to hold 300,000 board feet of hardwood lumber.

A minimum 19 percent loss in wood volume can be expected from yielding procedures (upgrading). Additional losses can be expected as the quality of saleable products made by the remanufacturing plant is improved beyond No. 1 Common and Better average grade -- 40 percent loss will result from processing into dimension products; 40 percent additional loss from subsequent machining operations. However, these losses will be recovered through increased value-added; enabling higher selling price margins.

In its initial Mode-1 configuration the remanufacturing plant will have dry lumber storage space (in balance area-wise with its dry kiln capacity), a rough processing line, an automated pallet assembly line, and a radio frequency energized panel laminating line. Its design will feature planned expansion for future precision machining and limited fabricating operations.

REMANUFACTURED PRODUCT OUTPUT 9.28 million board feet of hardwood lumber per year transferred to hardwood remanufacturing will yield 2.12 million board feet of dimension products (e.g., squares, bending stock, furniture dimension), and 3.15 million board feet equivalent of assembled pallets (projecting 10 percent volume loss in pallet assembly from graded pallet stock). It is planned that a portion of the hardwood dimension will be processed further into glued furniture panels; yielding 738 thousand square feet of finished panels; 10 percent loss in volume allowed due to processing falldown. The aggregate loss of wood volume resulting from remanufacturing operations will total slightly over 43 percent. The dimension products and glued panels pro-

duced by the plant, to be sold on the open-market during Mode-1, will become available as basic raw materials for satellite unit operations when Mode-2 is achieved.

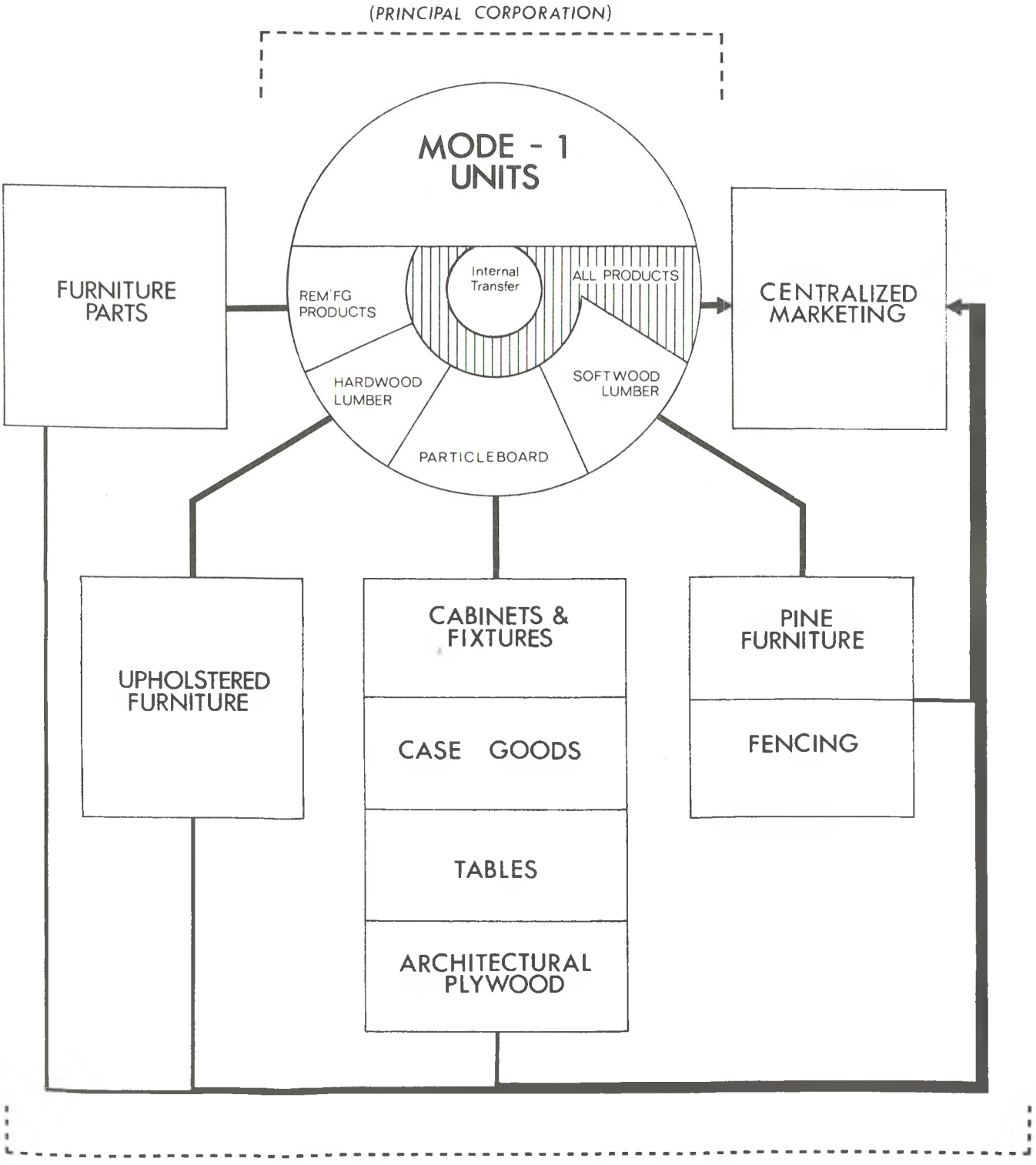
HARDWOOD RESIDUES Residues from hardwood sawmill and remanufacturing operations will be utilized consistent with pollution control regulations and other environmental considerations:

- CHIPS -- 1350 OD pounds produced per thousand board feet of sawlogs -- will be transferred to the particleboard plant.
- BARK -- 415 OD pounds produced per thousand board feet of sawlogs -- will be milled and transferred to the power plant for use as boiler fuel.
- CHIP FINES, GREEN and DRY SAWDUST, and SHAVINGS -- 900 OD pounds produced per thousand board feet of sawlogs -- will be transferred to the particleboard plant.
- HOGGED (DRY) REJECT and GREEN SAWDUST (surplus to particleboard plant requirements) -- 1300 OD pounds produced per thousand board feet of sawlogs -- will be transferred to the power plant for use as fuel.

PARTICLE-BOARD MANU-FACTURE 35,000 tons of wood residue materials resulting from operations of sawmilling and remanufacturing facilities of the complex (selectively proportioned 68% softwood and 32% hardwood) will be manufactured into particleboard by a plant having a design capacity to process 200 tons of wood per day (dry weight basis). On-site residue materials will satisfy 50 percent of the daily wood raw material needs of the plant; projecting 3-shift, 350-day per year operation at peak product output. Outside sources within a 150-mile hauling distance will be drawn upon to supplement with up to 35,000 tons of softwood shavings per year.

Product will be largely restricted to 3-layer industrial particleboard; design capacity at 46.7 million square feet per year (3/4-inch thickness basis, 45-pound density). Production of Underlayment board will be limited due to its commodity (low dollar return) market stature. The manufacture of Underlayment is recommended only on an interim basis to assist more rapid market penetration during the first several months of operation. At full production capacity the planned product mix would include: (1) stock panels and cut-to-size Industrial type board, (2) vinyl film overlaid board, and (3) low

MODE-2 COMPLEX CONFIGURATION



• SATELLITE UNITS MARKET DIRECT OR THRU CENTRALIZED MARKETING

pressure melamine overlaid. These products will be available to satellite units as basic materials of construction; until that time they will be sold on the open-market.

PARTICLE-BOARD MANU-FACTURING RESIDUES The manufacture of particleboard will be free of pollution. Possible visible contamination by exhaust gas from direct-fired rotary wood particle dryers will be avoided by after-burner and filter treatment. Sander dust, developed during the process of finishing board to thickness, will be consumed as fuel by the rotary dryers. Solid edge trim and sawdust resulting from panel sizing operations will be recycled into the construction of new particleboard.

STEAM and ELECTRIC ENERGY PRODUCTION 41.7 thousand tons of residue bark, green sawdust, and hogged (dry) reject hardwood resulting from processing operations of the complex, supplemented with 24.6 thousand tons of bark available from proximity sources, will be burned annually as fuel in a power plant integrated into the System. Steam will be produced and distributed to meet kiln drying, particleboard pressing, and turbine generator demands. 10 megawatts of electric energy generating capacity will be provided; serving Mode-1 facilities, and having sufficient reserve capacity to meet anticipated future demands as satellite operations are added and the complex grows into its full Mode-2 configuration.

It would be feasible to intertie this subsystem with the power distribution network of the public utility serving the Ashland area, thereby enabling sale of surplus electric energy during periods of low demand by the complex. Conversely, energy could be drawn from the network during times of excessive demand, emergencies, and maintenance shutdowns.

MODE-2 CONFIGURATION

The Mode-2 complex will be an outgrowth of operational and marketing successes of the basic product units of the Mode-1 complex. It is expected that addition of satellite units will evolve gradually over a period of time as accomplishments of the initial complex justify expansion by the principal corporation or become attractive to fabricators seeking locations for branch or subsidiary activities. Obviously, one of the least

desirable aspects of the Ashland location is its relative remoteness from trading centers, where consumer market potential is concentrated. The high value products manufactured by satellite units will be mainly, although not exclusively, directed toward consumers. Among the strongest attractants to the location, on the other hand, will be assured supply of basic wood raw materials derived from the Mode-1 facilities, potential cost savings from expected minimal raw material procurement costs due to on-site availability, demonstrated wholesomeness and potential longevity of the concept and its facilities, and management vigor associated with the principal corporation.

At this stage in planning it is impractical to designate specific satellite units. The diagram opposite identifies 'desirable' satellites that have been screened for feasibility and consistency. Each basic product facility of the Mode-1 complex can potentially spawn one or more satellite units; considering that it would not be necessary to the operational plan to process the total product output of any into optimized value-added form. Product(s) not sold on-site to satellites would continue to be sold through centralized marketing. The extent to which this is done will vary with the ownership structure of each satellite. It is probable that a jointly owned or subsidiary satellite will become totally dependent internally for its supply of basic raw material; whereas, an independently owned satellite would plan (protectively) to rely in part on unaffiliated outside sources for a portion of its raw material.

REMANUFACTURED PRODUCT BASED SATELLITE UNITS

The hardwood dimension and glued furniture panels scheduled for production by the remanufacturing facility should prove to be prime attractants to establishment of one or more satellite units -- which would process those raw materials into:

- furniture parts, in accordance with specifications by furniture assembly plants
- fabricated components that would comprise assembled parts of furniture items to be processed into final form at some other location
- completed furniture items such as chairs or speciality pieces of unique design.

Establishment of a larger scale business, such as a new brand name furniture manufacturing entity, featuring solid wood, is unlikely because of the relatively limited supply of suitable hardwood lumber from the complex and from other potential sources in the area.

There may be product overlap or redundancy between installed capabilities of the remanufacturing plant and the furniture parts satellite. The extent will depend upon management attitude and product line limits set by the complex for itself. If management should electively, or due to inability to attract a satellite, equip the remanufacturing plant with fabricating machinery -- to shape, mortis, tenon, turn, or otherwise machine wood parts -- establishment of a similarly engaged satellite unit would be questionable. It is inadvisable and unlikely that management would install machinery in the remanufacturing plant to produce furniture parts or fabricated furniture components of any type.

PARTICLE-BOARD BASED SATELLITES The industrial class particleboard stock panels, vinyl film overlaid panels, and melamine overlaid panels, to be manufactured by the complex, in a complete range of thicknesses and densities, are ideal materials of construction for manufacture of a variety of fabricated products keyed in design and construction to panel material; e.g., modular cabinets for kitchen, utility room, bathroom, and similar applications. A satellite unit to manufacture these products would be highly justifiable and is strongly recommended.

The national trend in cabinet manufacture is toward assembly line production, featuring large size plants that are replacing the relatively numerous small cabinet shops that until the last few years have been conventional to most communities throughout the United States. The trend is advanced in the East, where plants are characteristically large. There is no assumption of responsibility for installation of cabinets. Sales feature packaging and 'finished product' motif, and are directed through wholesale outlets and chain merchandisers (like Sears Roebuck) rather than through construction firms or contractors.

The quantity of particleboard to be produced by the complex will be sufficient to support volume manufacture of proprietary lines of piece goods furniture, or, by another satellite unit, kitchen, dining, and occasional tables. Availability of overlaid panels will advantage the cost of on-site fabricating, relieving the satellite(s) of necessity to install and man expensive overlay machinery. There is good market potential for these items in Maine and throughout the primary marketing area, and there is a shortage of manufacturing capacity indigenous to Maine and northern New England.

Particleboard is available at lower cost than competitive materials (lumber and plywood) and is ideally suited to mass-production methods associated with the products identified

above. Its uninterrupted and defect-free surfaces, homogeneity, and quality-controlled physical properties are important assets that lend to significant material and labor savings during remanufacture.

A satellite unit engaged in manufacture of architectural plywood items, although potentially less dynamic than other product lines, could be justified and would fit will into the scheme of operations at Ashland. Architectural plywood is heavily inclusive of custom items -- matched grain wall paneling, special veneers, special woodwork effects -- fabricated in compliance with architect specifications. It finds application largely in commercial building projects and occasionally in residential construction of planned communities designed to attract middle and upper income buyers. In keeping with the relatively modest market potential for architectural plywood a satellite should be small scale in its volume of product output.

SOFTWOOD LUMBER BASED SATELLITE UNITS

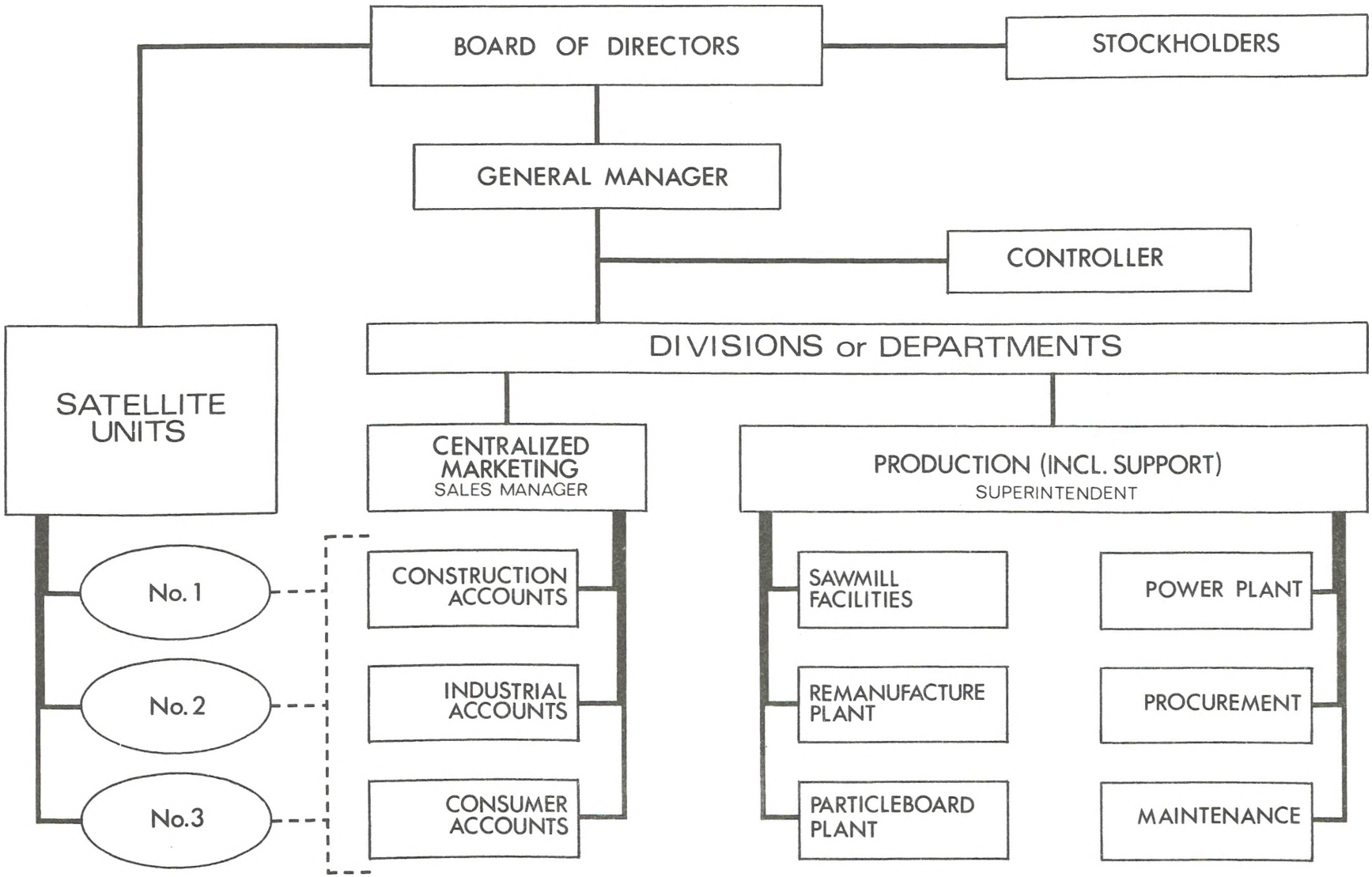
Investment in satellite units using softwood lumber as raw material is expected to be relatively unattractive to existing firms or venture groups, resulting in probability that if one or more units were established they would be wholly owned by the principal corporation. This expectation reflects the present and anticipated continuing strong market for spruce/fir lumber, and the preponderant portion of the softwood sawtimber supply accounted for by the two species. Spruce/fir characteristically in Maine is physically soft and detracted from by numerous small knots, making it comparatively unacceptable at the marketplace as a material of construction for softwood furniture. Upper grades of the species, which are relatively free of knots, are acceptable for certain other products such as molding, stripping, and sash; however, the minimal volume of grade-qualified material would not justify adding other than limited machinery capacity as an addition to the Mode-1 remanufacturing plant.

Projected utilization of remanufacturing facilities to process hardwood will require one operating shift per day. A second daily shift could be added to process softwood into cut-stock and machined items identified above. Additionally, it would be feasible, as marketing capability permits, to operate the pallet line a second shift to produce softwood pallets.

It is expected that as sawlog procurement adjusts to better conformity with forest management objectives, and whenever

'other' softwoods, intermixed with or near spruce/fir stands are harvested, they will be sawn into lumber at the complex. Subject to planned procurement, the valuable 'other species', notably cedar and eastern white pine, could become important resources for speciality satellite units; for example, one manufacturing pine furniture, and one manufacturing cedar fencing and/or shingles.

CORPORATE STRUCTURE (Principal Corporation)



3.03 CORPORATE ORGANIZATION

The following are general, not definitive recommendations for organizing and conducting the business of an integrated complex; subject to adjustment to comply with specifics of varying ownership and business objectives. While the diagram on the opposite page depicts the 'principal' business entity in terms of a corporate structure, it nevertheless holds that a non-corporate structure could be equally attractive. The diagram identifies operating interrelationships of people and functions. It shows lines of authority and division of responsibilities. And it is presented in context with the fundamental, although somewhat academic precept:

> *. . . neither the most modern, costly, proven, and endorsed (physical plant) facilities, nor the most advantageous product line can assure success of carefully planned enterprise unless the caliber of people engaged in its management and operation are equally good. No amount of capital investment or subsequent infusion of corrective capital will be able to effectively counter tolerated deficiencies in this vital area . . .*

Designing and staffing the business structure (of the complex) will be equal in importance to equipping, provisioning, capitalizing, and successfully marketing its products. Compared to these basics, the legal form of structure will impose little if any influence on business success.

OWNERSHIP

The Ashland area complex has been implemented by a subsidiary corporation of a major forest products industry firm. Thereby, it differs in scope of ownership, lines of authority, and organization of its management echelon from the more modestly formulated 'model' corporation structured by the diagram.

PRINCIPAL CORPORATION Relationship between ownership (stockholders) and directorship tends to vary with corporate size. This will range in smaller corporations from board membership by principal owners through representation by assignee members who remain closely responsive to principal owners, to indirect (sometimes incomplete) ownership representation in larger or heavily diversified corporations. Irrespective of these variables,

the membership of a firm's board of directors is exceedingly important in terms of priorities given to personal experience and evidenced capabilities. Ideally, directors, in fulfilling their mandates as representatives of corporate ownership, should provide the board with internal expertise to deal with administrative, tactical, and legal aspects of conducting business.

The modus operandae of directorship usual to smaller corporations, with typically interlocked interests by board members in corporate matters and value appreciation of personal investment in corporate stock, is more likely to evidence the fluidity and purposefulness essential to achieve long-term success of a complex. Personal involvement is particularly important in dealing with timber-based materials procurement and achieving close coordination of product line with changing demand at the marketplace customary to wood products. The remoteness of board members from stockholders usual to larger corporations will work against flexibility and slow down reaction to the typically cyclical business variables of the wood products industry.

Patterns of ownership most likely to be considerate of establishing a Woodchip themed complex are identified and rated (for potential success) as follows:

1. A broadly owned corporation instigated by promotional/speculative capital would probably not be successful.

2. A divisional activity of a major corporation could expect success to be inhibited by divided priorities and slow responsiveness to action demands.

3. A subsidiary firm of a major corporation could expect success to be uninhibited by ownership impositions, provided the subsidiary was not held unusually subordinate in its action prerogatives. The Ashland area complex will be aggressively managed as a subsidiary firm of a major forest products industry corporation, thus it will readily avoid the potential problems of (remote) divisional management.

4. A new venture firm formulated and financed by a small ownership of experienced businessmen or existing business (singly or in combination) would not be limited by its ownership pattern.

5. Coupled horizontal and vertical expansion of an existing (successful) business is perhaps the best initial basis for materialization into the Mode-1

configuration and subsequent growth into the ultimate Mode-2 configuration.

SATELLITE UNITS — Ownership of satellite units involves the same considerations as principal corporation ownership, but with the additional aspect of need for freedom in raw material procurement. Neither the principal corporation nor satellites can afford exclusive buy-sell agreements in this vital area unless the satellite is a corporate division. Otherwise, the success or failure of one, particularly at the marketplace, could strongly influence the welfare of the other.

The concept of satellite units peripheral to and dependent in part on the complex (conceivably including dependence on other satellites for materials of construction) is ideal for small businesses; the nature of their ownerships being more a matter of choice than priority alternatives. It is probable that joint ownership of satellites -- the principal corporation joining in ownership with outside investors -- will best serve to fulfill the Woodchip key objective.

These relatively negative structures should be avoided:

- subsidiaries operated as divisions, tending to be managed to the best interest of the principal corporation; which conceivably could be out of context with the best interests of the overall structure.
- fully independent corporations, tending to be overly protective of their raw material supply situation, as would the principal corporation; resulting in delimiting procurement actions by both parties.

MANAGEMENT AND MANAGERS

The principal corporation will be the nucleus of operation of the complex, discharging these functions:

- Procuring wood raw material; inclusive of hardwood and softwood sawtimber, shavings for particleboard manufacture, and bark for fuel.
- Constructing and maintaining physical plant facilities.
- Operating Mode-1 processing units, and establishing and enforcing operational procedures for the entire complex.

- o Marketing ALL products manufactured by the Mode-1 complex, and assisting in marketing products manufactured by Mode-2 satellite units.

In addition to responsibilities delineated above, the principal corporation should seek to establish and assist in profitable operation of satellite units.

GENERAL MANAGEMENT Conduct of the business and processing activities of the principal corporation, as well as of the entire complex will be under the authority of a General Manager. The individual holding this position should be thoroughly backgrounded in industrial management, augmented by reasonable familiarity with marketing. Desirably, personal qualifications should include working knowledge of wood processing and understanding of production and sales in allied and competitive fields.

The general manager should be the highest paid employee of the principal corporation. In addition to receiving a salary, and commensurate with corporate policies established by the board of directors, there should be entitlement to a bonus, stock option, or other incentive. The type and value of incentive would vary with experience qualifications of the person holding the position. A bonus based on one and one half to two percent of after tax profit of the principal corporation would be fair. These provisions should attract the best available talent.

Discharge of responsibilities by the general manager will require close working relationship with a production superintendent and sales manager. Physical working proximity between individuals holding these positions would be desirable to assure thorough functional interchange. It will also assure production and sales responsiveness and assist coordination of those activities.

To facilitate performance of routine work the general manager should be aided by an administrative assistant; preferably an individual trained and experienced in business administration.

CONTROL Managing the principal corporation to best advantage can be assisted by delegating authority to a Controller, who would function as a member of the management team and be responsible to the general manager. Prerequisite high-level personal skills of the controller should be supplemented by utilization of advanced accounting methods applying computer-assisted production technology.

This application will come into play very consequentially in the softwood and hardwood sawmilling units, which should be equipped with programmed electronic devices to effect precision sawlog inventory control and continuous lumber (output) tally.

Close liaison between the controller and the office of general manager, apart from inventory accounting, is a proven and indispensable means of optimizing business control. When effectually applied it will result in reduction of physical plant and machinery maintenance costs, more advantageous decisions involving purchases of raw materials and supplies, and more complete information as a basis for judgemental decisions by the general manager. The historic pattern suggests that without close liaison an excessive number of decisions influencing cost and profit are made by general management without supporting facts.

The diagram of the structure of the principal corporation shows production and sales activities as division or departmental functions, each under supervision of a qualified manager.

PRODUCTION MANAGEMENT Management of production units owned by the principal corporation will be under the immediate authority of a Production Superintendent, who would direct activities of the four basic manufacturing facilities. Support functions -- raw material procurement and power plant operations -- would be directed out of the general manager's office, coordinating through the production superintendent, under immediate authority of operating supervisiors.

Processing units (and the power plant) would perform their own preventative maintenance, in compliance with schedules issued and enforced by the maintenance superintendent. A limited internal facility would be provided to meet minor and emergency maintenance requirements; major requirements to be serviced by competent outside sources. Provision for diligent attention to machinery and system maintenance by top-qualified employees and service organizations is critically important.

The production superintendent will be a key member of the management group, with the position held by a person having a record of successful management performance in related industry. Direct experience in the wood products field will be helpful, but it is not prerequisite to proper function.

Ordinarily, customer contact by the sales manager would be preceded by groundwork on the part of staff sales representatives. The manager's office would perform clerical processing, respond to customer demands, administer extension of credit, and process other routine business matters.

As a key member of the management staff of the complex the sales manager should be included (to considerable potential advantage) as a member of the board of directors of the principal corporation. The functions of the position should be allowed to (importantly) influence product manufacture by the complex. An individual of the caliber required will command a comparatively high salary, and would probably expect incentive compensation. Accordingly, incentive payment should be made available to the position -- advisedly, in the area of one and one quarter percent of net profit from sales.

SATELLITE MANAGEMENT The potential for satellite operations will be attractive to businesses of varying scale, ranging from single entrepreneurships in which management and ownership are one and the same to larger structured units (e.g., case goods furniture manufacture) involving departmental supervision. Rather than to present various structures to cover imaginable variances, a keynote theme is recommended as universally applicable in formulation, qualification, and management of satellite enterprises:

> *. . . management of satellites should be restricted to individuals experienced in the technical and business aspects of product-line engagement. Staff and line functions by promotional individuals should be considered negative and inhibiting to potential success; organizations so structured should be screened out of participation in the complex. . .*

The principal corporation should be particularly (protectively) concerned about management capacities of satellite units; disqualifying candidate businesses having apparent or potential deficiencies.

OPERATIONS

The Mode-1 complex should be implemented as a complete package, with the five recommended units programmed for construction in an orderly sequence that will enable start-up operations to commence almost simultaneously. There is an almost inseparable interfacing of facilities. All

require electric energy from the power plant; which will also be the source of process steam for dry kilns and particleboard press heating, utility steam for building heating during wintertime, and means of disposing of processing wastes not usable for product manufacture. Temporary means of providing for these services would be impractical and costly. Disposal of waste (principally bark; some hardwood not desirable for particleboard manufacture) is a problem that can be expected to rapidly intensify and for which solutions must be increasingly sophisticated, promising added capital costs in an order of magnitude that will appreciably suppress return on investment (ROI).

It is inadvisable to place satellite units into operation until Mode-1 facilities have been in production for a period of time, and matters of procurement, production, marketing, and customer acceptance have been advanced well toward optimum expectations. Without the basic soundness of enterprise resulting from those advancements, the ability to attract, as well as the feasibility of attracting satellite operations will be questionable.

The various planned units will conduct routine production operations in accordance with different schedules:

- SAWMILLS -- will operate two shifts per day, 250 days per year. Time to perform (rigidly) required routine daily maintenance, normal to sawmill operation, does not permit three-shift or weekend production. Attempts to saw lumber during times when maintenance should be performed invariably result in non-linear increase in the severity of need for maintenance; a situation of diminishing returns in terms of lumber productivity.
- REMANUFACTURING PLANT -- initially scheduled one shift per day, 250 days per year; premised on acceptable ROI. Activity would be increased to two-shift daily operation, possibly up to 300 days per year, as marketing success enables. By expanding to include softwood as well as originally scheduled hardwood processing, operations could be intensified up to three shifts per day for 350 days per year. It is expected that the maximum level of operations will be reached after the complex is expanded into its ultimate Mode-2 configuration.
- PARTICLEBOARD PLANT -- planned for rapid build-up of product output through one, two, and three-shift operation following a 250-day year schedule to design capacity (60,000 tons per year) operating 300 days per year. There would be no preventative to running the plant continuously, provided sufficient wood raw material was available and sales volume was developed to its ultimate

potential. Although maintenance is important and demanding in a particleboard plant, it is not a delimiting factor to maximized utilization of machine capacity as it is in sawmilling.

- POWER PLANT -- planned for initial and continued operation on a three-shift, 350-day year schedule, allowing major preventative maintenance during annual two-week scheduled shutdown of the entire complex. If the electric energy distribution system is inter-tied with a commercial power system shutdown of all facilities of the complex will not be necessary during maintenance closure of the power plant. Otherwise, all facilities would suspend operations simultaneously -- resulting in a fixed vacation period for employees of both the principal corporation and on-premise satellite facilities.

SATELLITE UNIT LOCATION Although depicted in a manner interpretable as need for physical proximity between satellite units and Mode-1 facilities, the concept of an integrated complex is not that rigidly limited. It is fully conceivable that a satellite might be located a considerable distance away -- to enable marketing advantage, to take advantage of established physical plants at other locations, or for various other (economically feasible) reasons. The criterion is comparative economic or functional advantage, not gratification of a scheme.

Acquisition of existing operations or construction of new satellite facilities in Central or Southern Maine is likely by the principal corporation of the Ashland area complex. Inducement for these actions evolves from potential savings through milling in-transit transportation cost advantages, warehousing advantages to customers through closer proximity of sources of supply, and availability of experienced labor (a derivitive of acquisition).

3.04 SUBSYSTEM EVALUATIONS

Estimated capital investment in Mode-1 facilities constructed at a new industrial site, complete with utilities and combined rail and highway access will total $ 17.0 million; with additional requirement for $ 2.0 million in working capital to 'prime' operations until a positive cash flow position is reached. In operating the complex the principal corporation would employ 215 persons; of which 145 would be production employees, the balance supervisors, service, and sales personnel. These data are based on System design in compliance with the operational profile detailed under topical heading 3.02 in this report section, except primary softwood processing would be reduced from 80 million to 50 million board feet of sawtimber per year. This reduction, made in recognition of special conditions of sawtimber availability applicable under ownership of the Ashland area complex, will enable 'evaluation data' to apply more realistically as a model for establishing a complex at other locations in Maine.

Reduced sawtimber volume will impose proportionate decrease in the tonnage of shavings and sawdust available from sawmill operations for conversion into particleboard products. However, presuming that sawtimber will not be coupled in total in its availability to commitment to sell by-product chips to pulping operations, unsold chips (desirably) could be used to manufacture particleboard; maximum availability reaching 35,000 tons (oven dry) per year, or 58 percent of the raw material requirement of a 200-ton board plant. The quantity of shavings and sawdust from sawing 50 million board feet of softwoods, plus 10 million board feet of hardwoods will conservatively reach 20,000 tons per year, thus the complex could conceivably approach self-sufficiency in its supply of particleboard furnish. Whatever shortfall there may be as a result of exchanging chips for the privilage of assured timber availability could probably be made up (in most candidate locations for a complex in Northern Maine) by open-market procurement of uncommitted shavings and sawdust from sawmills within an (economic) radius of procurement extending 150 miles from the complex. Survey work conducted during mid spring 1973 evidenced adequate availability should extend well into the future; conservatively estimated at 100 tons per day.

SOFTWOOD SAWMILL SUBSYSTEM

Programmed to saw 50 million board feet of sawtimber per year, producing 57,500,000 board feet of lumber based on 15 percent overrun from Holland (Maine) log scale measure, the softwood sawmill subsystem would be of advanced concept emphasizing accuracy of cut, facilitating maximum over-

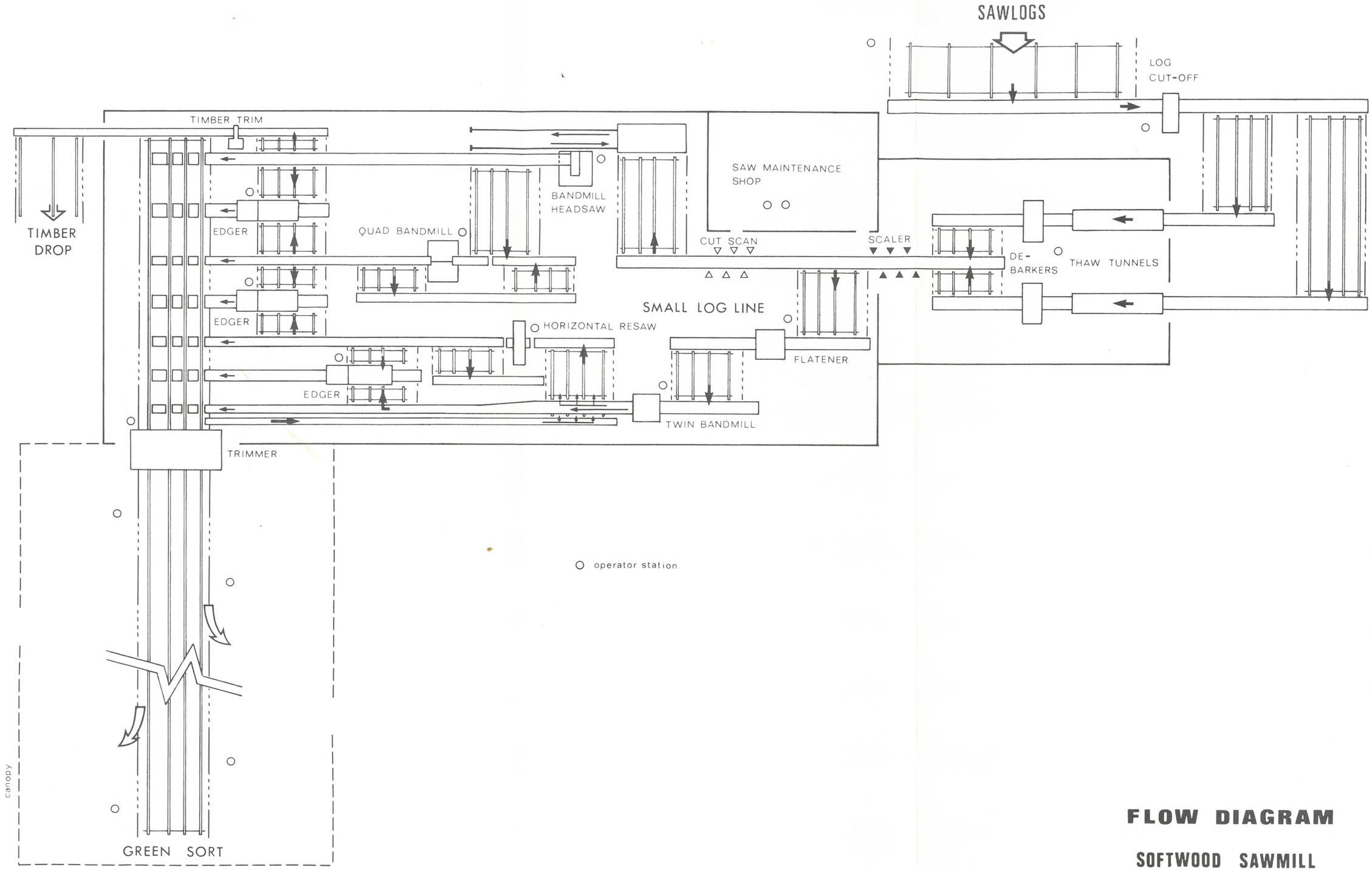
run, and requiring fewer production employees than a more conventionally designed sawmill.

Processing will be premised on tree-length sawlogs, with facilities provided to thaw frozen logs during wintertime and to control inventory by means of computerized log scaling. The flow of logs through sequential operations in the mill will be divided according to log size; small diameter (6.5-inch average in northern Maine) routed through a computer controlled twin bandmill, large diameter (13.6-inch average) through a single-cut bandmill headsaw. Advanced automation throughout the sawmill will avoid most manual lumber handling, substituting push button controlled mechanical devices.

Supporting facilities will include kiln capacity to dry 50 percent of lumber output, the remainder to be shipped green; a high speed planer mill to surface the entire output of dimension and lumber; bark recovery and milling machinery; chipping, chip handling, and chip car loading machinery; and maintenance equipment.

ECONOMIC PROFILE (Softwood Sawmill)

SUBSYSTEM INCLUSIONS	Improved Site Buildings Fire Protection Utility Connections Yard Vehicles Sawlog Handling Mill Machinery Residue Rocovery Chip Preparation Dry Kilns Planer Mill Mill Supplies Maintenance Equipment		
MILL SPECIFI-CATIONS	Building Area	60,000 sq. ft.	
	Site Area	10 acres	
	Electric Energy Usage	1700 KWH	
CAPITAL INVESTMENT	Installed Cost	$ 4.75 million	
	Working Capital	$ .60 million	
PERSONNEL REQUIREMENTS	Production Employees	38	
	Support Employees	8	
	Supervisory Employees	3	49



FLOW DIAGRAM

SOFTWOOD SAWMILL

PRODUCT OUTPUT	57.5 million board feet (annually) of KD and green dimension -- 2 x 4's, 6's, 8's, 10's, and 12's, and 4/4 to 7/4 lumber, limited timbers.	
SALES REVENUE 1/	Average Net f.o.b. Mill	$ 135/Mbf
	Estimated Gross Sales -- 12-Month Period	$ 7.76 million
12-MONTH PROFORMA RESULTS	Cost of Production	$ 5.75 million
	Gross Profit	$ 2.01 million
	After Tax Profit	$ .98 million
	ROI	18.3 percent

1/ Immediate and long-term demand for softwood lumber and dimension are sufficiently strong to justify projecting sale of 100 percent of product output during any 12-month period, including the first 12 months of sawmill operation.

HARDWOOD SAWMILL SUBSYSTEM

Programmed to saw 10 million board feet of sawtimber per year, producing 10,550,000 board feet of lumber based on 5.5 percent overrun from Holland (Maine) log scale measure, the hardwood sawmill subsystem patterns identically to performance objectives of the softwood subsystem; inclusive of tree-length sawlog processing, wintertime thawing (to improve bark removal), and computerized scaling. Flow through sequential operations divides into sawlog and bolter log lines, thereby enabling development of maximum lumber volume (and quality) from input sawtimber, which, intentionally, will run heavy to No. 2 Grade logs.

The bolter facility will permit recovery of lumber (to very best advantage) from short logs developed by removal of defective sections from tree-length sawlogs; simultaneously saving headsaw time and maintenance. It is reasonable to expect, too, that bolter saw-bolts will be delivered from woods operations along with tree-length sawlogs. Nominal bolt length is six feet; lumber yield will average 50 percent of log scale volume.

Sawlogs, cut to 16-foot maximum length after computer scaling (12.6-inch average diameter in northern Maine) will be routed through a wide saw single-cut high strain bandmill headsaw. Headsaw cants will be broken down by a horizontal band resaw; edging by a top arbor edger. Limited piece count, compared to the volume of in-process lumber in the softwood sawmill, coupled with relatively low footage

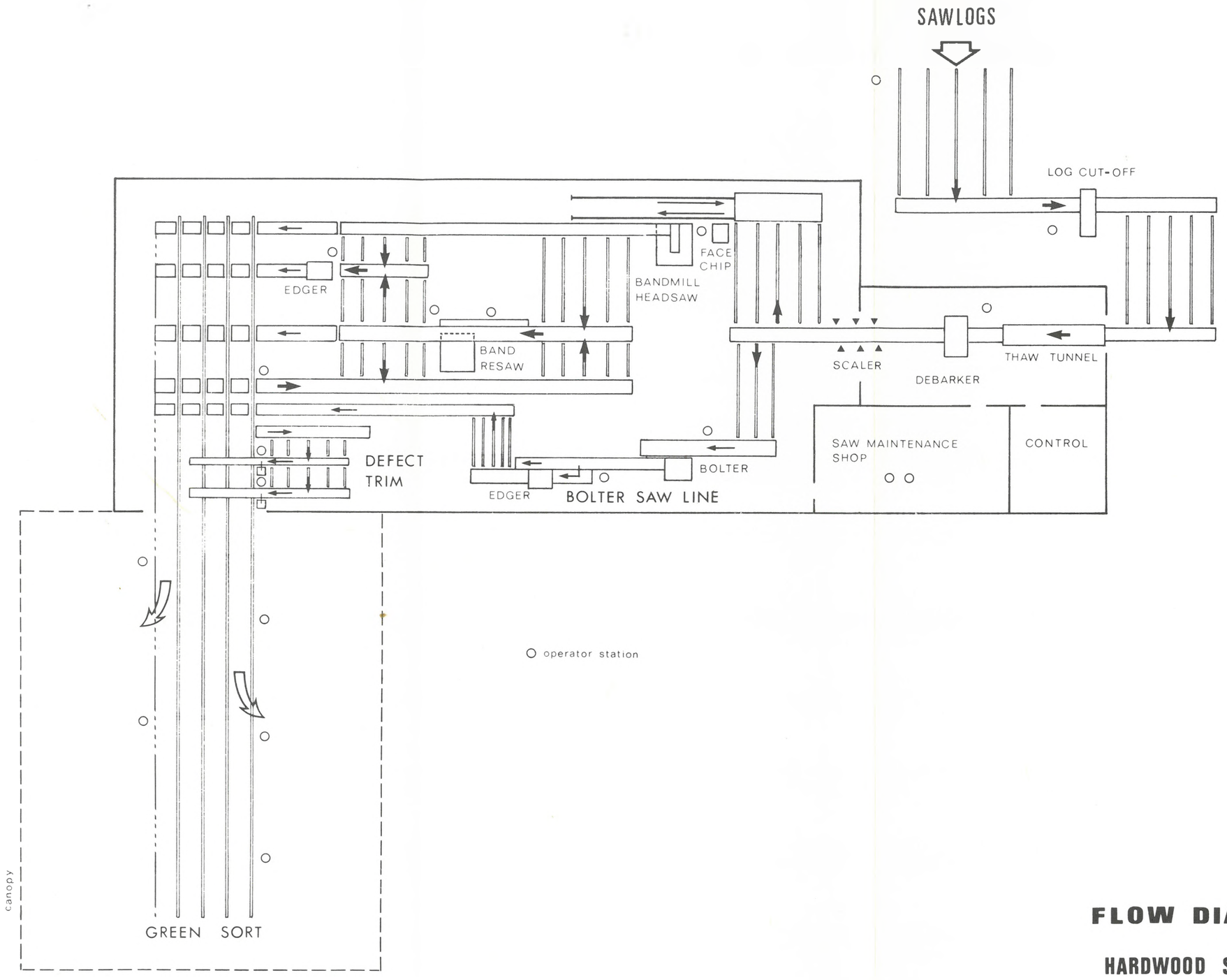
(2800 board feet per hour) restricts the feasibility of automation and mechanization. However, no concession can be made to specify other than proven machinery that will perform at high levels of precision, efficiency and reliability. These needs are given emphasis by the fact that projected ROI for the subsystem (3.9 percent) is marginally above break-even. Expected marginality correlates with value analysis data and information in Section I of this report, pages 31-33.

Lumber sawn by both the bandmill headsaw and the bolter mill, exclusive of pallet grade stock, will be processed through cross-cut defecting saws, to result in upgrading one hundred percent of lumber output to 2A+ grade. The combined effect of (a) 50 percent yield from bolter sawing, and (b) 12 percent falldown in volume from defect cutting of 2A- grade lumber will be to reduce (expected) 5.5 percent overrun attainable by conventional hardwood sawmilling to 3.0 percent UNDERRUN. Actual transfer of lumber from the sawmill to the remanufacturing subsystem, therefore, will total 9.7 million board feet per year, of which 3.5 million board feet will be pallet grade and the balance (6.2 million board feet) 2A+ grade lumber.

Supporting facilities will be limited in scope due to transfer of 68 percent of the daily output of lumber to the remanufacturing plant in rough, green condition. The balance will be air dried before transfer. Yield from the anticipated grade-mix of sawlogs is projected at 34 percent pallet lumber and 66 percent graded mill-run. All of the pallet lumber and 48 percent of the graded (mill yielded) lumber will be transferred daily. Facilities will include bark recovery and milling machinery; chipping, chip handling, and chip car loading machinery; and maintenance equipment.

ECONOMIC PROFILE (Hardwood Sawmill)

SUBSYSTEM INCLUSIONS	Improved Site	
	Building	
	Fire Protection	
	Utility Connections	
	Yard Vehicles	
	Sawlog Handling	
	Mill Machinery	
	Residue Receivery	
	Chip Preparation	
	Mill Supplies	
	Maintenance Equipment	
MILL SPECIFI-CATIONS	Building Area	23,000 sq. ft.
	Site Area	8 acres
	Electric Energy Usage	935 KWH



FLOW DIAGRAM

HARDWOOD SAWMILL

CAPITAL INVESTMENT	Installed Cost	$ 1.63 million
	Working Capital	$ .29 million
PERSONNEL REQUIREMENTS	Production Employees	26
	Support Employees	6
	Supervisory Employees	2 — 34
PRODUCT OUTPUT	9.28 million board feet (annually); 34% pallet grade, 66% rough green graded mill-run; 68% of total transferred green to the remanufacturing plant (unit #3), transferred air dried.	
SALES REVENUE	Net Mill From Transfers	$ 158/Mbf
	Projected Gross Revenue -- 12-Month Period	$ 1.48 million
12-MONTH PROFORMA RESULTS	Cost of Production	$ 1.27 million
	Gross Profit	$ .21 million
	After Tax Profit	$ .11 million
	ROI	5.7 percent

REMANUFACTURING SUBSYSTEM

6.32 million board feet of green lumber, 55 percent pallet grade and 45 percent graded mill-run, will be transferred annually from the hardwood sawmill to the remanufacturing plant for further processing. The balance -- 2.96 million board feet from a scheduled total of 9.28 million -- will be transferred in air dried condition. Both the mill-run green and air dried stock will be kiln dried immediately following delivery. 1/ 2/ For this purpose the plant will be equipped with 300,000 board feet of kiln capacity. Efficient control of transfers, scheduling, and inventories will require functional and management interfacing of the sawmill and remanufacturing plant.

Following kiln drying, lumber will be warehoused in a dry shed by size, species, and thickness in sufficient quantity -- one million board feet -- to meet the multiple processing demands of the remanufacturing

1/ Graded mill-run lumber should average 40 percent 2A- grade, 60 percent 2A+ grade; considerate of the fact that 33 percent of total hardwood lumber output by the sawmill will be pallet grade.

2/ All lumber will be kiln dried to six percent moisture content; 12 to 15 days drying time for green lumber; 5 to 8 days for air dried lumber, commencing at 20 percent moisture content.

plant. The requirement for a substantial inventory of dry material results from need for close responsiveness to market demand.

Apart from machinery and facilities for kiln drying, the plant will be equipped (initially) with a rough processing line, and automatic pallet line, and a radio frequency equipped panel gluing line. This, the Mode-1 configuration of the complex, will enable producing (1) assembled pallets, (2) hardwood dimension products, and (3) glued furniture panels. 3/ Without appreciable increase in initial capital investment the quantities of input raw materials could be increased by as much as 50 percent in hardwood, to 15.8 million board feet of lumber per year, and scope of processing could be extended to manufacture products from at least 10 million board feet of softwood lumber per year, resulting in much improved system utilization.

Inclusion of remanufacturing facilities is fundamental to achieving a fully syntactic relationship with the timber resource and procurement objective defined for the Aroostook area, and to optimize profit results. Much of the ability to attract satellite manufacturing activities will derive from intrinsic values of the planned basic products and their utility as materials of construction for the satellite units.

These processing activities will take place each day:

1. 23,120 board feet of kiln dried stock (the total daily volume) will be processed through a 'rough dimension line' to surface, remove defect, and standardize piece widths and lengths. Machining will be accomplished by two cross cut saws for defect removal, followed by surfacing, then stripping through glue-line rip saws -- feeding into a sorting and packaging line. A rework (cut-back) line will serve to salvage and upgrade pieces that might not have been yielded to best advantage during initial pass-through. Loss of wood volume through this operation is projected at 40 percent. The resulting product is identified as HARDWOOD DIMENSION STOCK.

2. 3,280 board feet of hardwood dimension stock manufactured during the day shift will be selected and accumulated for manufacture into 2,950 board feet of glued furniture panels; 10 percent processing loss projected. Processing during a second shift

3/ Hardwood dimension products in the context of reference are inclusive of furniture dimension (rectilinear pieces, squares and bending stock), and semi-manufactured parts (fabricated to customer specifications).

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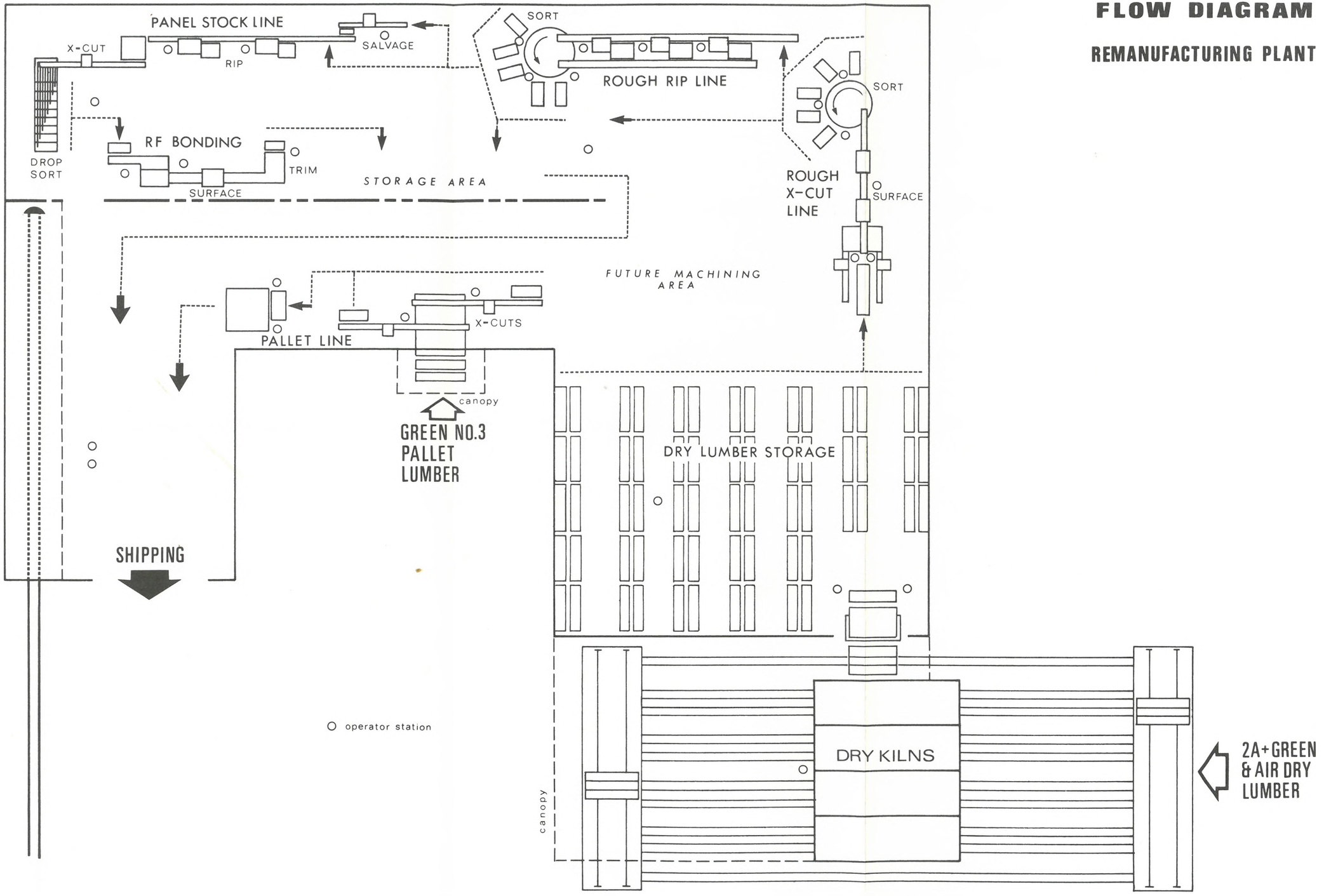
FLOW DIAGRAM

REMANUFACTURING PLANT



○ operator station

will result in most efficient utilization of machinery and avoidance of the machine duplication that would be required by limitation to a single-shift operating schedule.

3. 5,300 board feet additional of hardwood dimension stock will be selected and manufactured into furniture dimension (finished to thickness, length, and width measurements) and semi-manufactured parts, in accordance with customer specifications. Processing will yield 3,180 board feet of finished products, involving another 40 percent wood volume loss. Future expansion could include facilities for molding, boring, routing, bandsawing, and other machining operations, with relatively little increase in wood volume lost by machining. Whatever volume is lost will be more than compensated by increased worth at the marketplace.

4. The balance of the hardwood dimension stock manufactured each day, another 5,300 board feet (38 percent of the total) will be sold without further rework.

Lumber Volume Changes During Remanufacturing Operations

Summary Data

START PRODUCT	GRADE	GROSS ANNUAL VOLUME (mbf)	PER-CENT YIELD	NET VOLUME ANNUAL (mbf)	NET VOLUME DAILY (bf)	END PRODUCT
Rough Green Lumber 1/	2A+	2820	100%			
	2A-	4230	70%	5780	23,120	2A+ lumber
Kiln Dried 2A+ Stock	2A+	5780	60%	3470	13,870	hardwood dimension
Hardwood Dimension Stock	- -	1325	100%	1325	5,300	Furn. dimension
	- -	1325	60%	795	3,180	semi-mfg. parts
	- -	820	90%	738	2,950	glued panels
Rough Green Lumber	pallet	3500	90%	3150	12,600	nailed pallets
NET YIELD OF SALEABLE PRODUCTS			59.9%	6008	24,030	

1/ Rough 2A- lumber will be yielded in the hardwood sawmill as a first remanufacturing step.

With exception of glued furniture panels, projected utilization of remanufacturing facilities will require one operating shift per day. A (full) second daily shift would be applied to process softwood into cut-stock, stripping, sash, and a variety of other dimensioned and machined products (including salvage of 'shorts' by finger jointing) for which there are ready market opportunities. Machinery and floor space to accomodate these activities would entail only modest additional capital investment, with good profit potential attainable. Additionally, it would be feasible to operate the pallet line a second shift daily to produce softwood pallets. These options are not included in the estimates of personnel, investment, and economic potential below.

Yield factors applied in proforma analysis of operating results have been interpolated for species and grade characteristics from current industry-standard data, which relate to specific end-product possibilities and objectives. Considerate of technical advances in machining and methods, their validity may be short term, with expected improvement in percent of falldown -- more saleable product per thousand board feet of rough lumber -- and greater value added during manufacture.

Application of computer technology to yielding, in the past mostly experimental, promises in particular to erase the 'fail safe' proneness of manual rough line operators, who almost characteristically (although stringently) remove excessive good wood during defect cutting. Other factors, e.g., length of cuts, can be benefited by computer delineation replacing (variable) human judgement. The motivation is twofold; to benefit production cost economics, and to relieve intensifying worldwide shortage of wood. The following excerpt from a recent publication by the Northeast Forest Experiment Station succinctly states the case, and evidences that projections in this report may prove overly conservative as soon as experimental procedures evolve into machine-function reality. 1/

> ". . . The present method of converting lumber to dimension parts is to process a board through a series of crosscuts and rips to conform to a particular cutting bill. In other words, once a board is brought into the system it is processed through to completion. The computer simulation program we used functions in the same way, but the speed, accuracy, and analytical capabilities of the computer are infinitely greater than those of the saw operator. The yields were high for No. 2 Common because we used 100 different cutting sizes. However, we cannot expect the yields in a production plant to equal them; a crosscut operator cannot carry 100

1/ U.S.D.A. Forest Service Research Paper NE-248 Long Length Cuttings From No. 2 Common Hardwood Lumber. Edwin L. Lucas, 1973.

different cutting sizes in his head and at the same time keep his rate of production and yield at a satisfactory level.

No manufacturing system can change the yield potential of a board, but one can affect the probablity of attaining that potential. To realize the maximum potential of long cuttings from No. 2 Common lumber, changes must be made in the present manufacturing process. . . "

". . . Although the quality of the lumber determines what cuttings you can get, the saw operator determines what you will get. Therefore, whatever decision rules are developed must be easily translatable into instructions that can be put into practice by the saw operator. . . "

ECOMONIC PROFILE (Remanufacturing Plant)

SUBSYSTEM INCLUSIONS	Improved Site Buildings Fire Protection Utility Connections Yard Vehicles Fork Lift Carriers Dry Kilns Rough Dimension Line Pallet Line Glue-up Line Support Equipment Mill Supplies		
MILL SPECIFI-CATIONS	Building Area	55,000 sq. ft.	
	Site Area	5 acres	
	Electric Energy	500 KWH	
CAPITAL INVESTMENT	Installed Cost	$ 1.44 million	
	Working Capital	$ .26 million	
PERSONNEL REQUIREMENTS	Production Employees	26	
	Support Employees	5	
	Supervisory Employees	3	34
PRODUCT OUTPUT	3.15 million board feet equivalent of assembled green pallets; 2.32 million board feet of dimension products (62% furniture dimension, 38% semi-manufactured parts); .735 million board feet of glued furniture panels.		

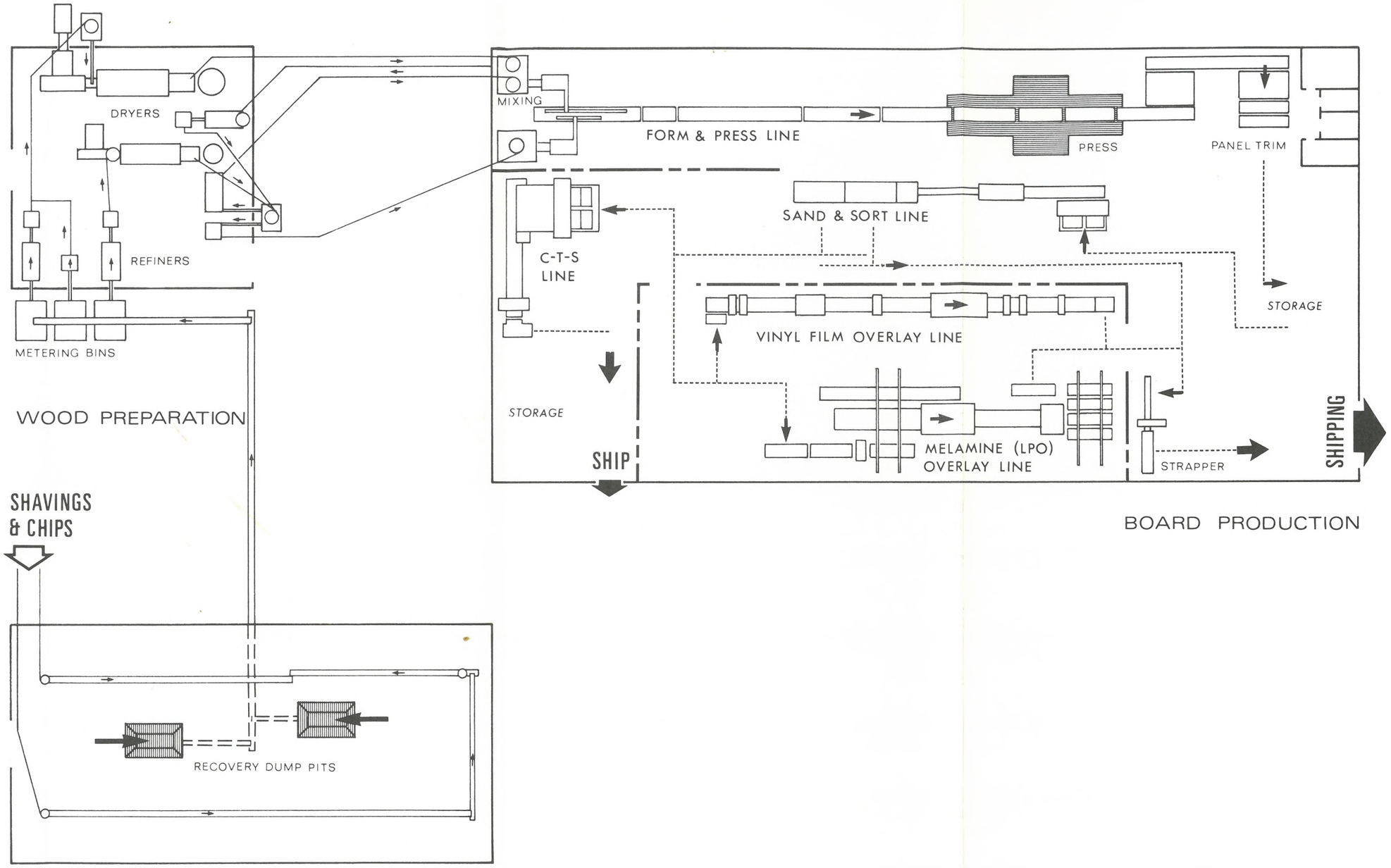
SALES REVENUE	Item Values:	
	- Pallets	$ 215/Mbf
	- Furniture Dimension & Semi-Manufactured Parts	$ 450-750/Mbf
	- Glued Furniture Panels	$ 436/Mbf
	Average Net f.o.b. Mill (for expected product mix)	$ 450/Mbf
	Estimated Gross Sales -- 12-Month Period	$ 2.71 million
12-MONTH PROFORMA RESULTS	Cost of Production	$ 1.98 million
	Gross Profit	$ .73 million
	After Tax Profit	$ .36 million
	ROI	21.2 percent

PARTICLEBOARD SUBSYSTEM

Theoretically, the 'model' complex, sawing 50 million board feet of softwood and 10 million board feet of hardwood sawtimer per year, will be self-sufficient in supplying wood raw material to operate a 200-ton daily capacity particleboard plant 300 days per year -- provided spruce/fir pulp chips are used for that purpose. Realistically, availability of sawtimber will likely be conditional to selling a portion or ALL of the chips generated from slab, edging, and cull portions of sawlogs to a pulp mill. Regardless, it is both economically and functionally feasible to plan on assured availability of 60,000 tons of wood residue raw material per year; with reasonable security in estimating around-the-clock 350-day year operations. In light of these circumstances planning for particleboard should be premised on some degree of reliance on outside procurement of shavings; ranging up to 35,000 OD tons per year, depending on 'imposed' deficiency in pulp chip availability.

Data from recent study identifying availability of spruce-fir shavings within a 150-mile radius of procurement about the Ashland area complex -- extending into Quebec -- evidence reasonable long-term potential for delivering 35,000 tons per year of supplemental-source material that may be required. There is every likelihood that availability will remain secure for at least the 10-year amortization life of the subsystem unit, and it should be possible to purchase and transport the material economically. 1/

1/ Shavings are increasingly in demand in Quebec as raw material for fiberboard and particleboard manufacture; however, this fact is not expected to seriously restrict availability to an Ashland location -- provided competitive contract and pricing practices are met.



FLOW DIAGRAM

PARTICLEBOARD PLANT

Alternative to (preferred) usage of spruce/fir pulp chips, combining supplemental-source shavings with the various (qualified) residue materials from operations of the complex will result in excellent 'furnish' that will contribute to manufacture of the prerequisite HIGH QUALITY INDUSTRIAL TYPE PARTICLEBOARD that must be produced to correlate with demand and economic factors at the marketplace. Spruce and balsam fir have species superiority as raw material for particleboard manufacture over predominant species in major centers of particleboard production; i.e.,- southern yellow pine in the Southeast, douglas fir in the West. The occurance of limited dilution by (the less desirable) hardwood species resulting from hardwood sawmill and remanufacturing activities of the complex, amounting to only 15.7 percent of the total furnish, will not effectively negate the intrinsic property advantage of spruce/fir.

Types and Quantities of Wood Residues Available for Particleboard

Tons per Year -- Oven Dry Weight Basis

	HARDWOOD	SOFTWOOD	TOTAL RESIDUE
Internal Sources:			
Chips	6,750	35,000	41,750
Chip Fines	630	3,075	3,705
Green Sawdust	840	715	1,555
Planer Shavings	2,780	9,250	12,030
Hogged Solid	- -	960	960
Supplemental Sources:			
Spruce/Fir Shavings	- -	35,000	35,000
COMBINED AVAILABILITY	11,000	84,000	95,000

Particleboard is a 'production controlled' material that regardless of species is manufactured to predetermined density considered most appropriate for use requirements; normally 45 pounds per cubic foot for the industrial market, 42 pounds for Underlayment. Southern yellow pine, used in approximately 53 percent of the board manufactured during 1971, occurs in four species. Shortleaf and loblolly, the lowest density of the four, weigh 32 pounds per cubic foot. This means that 45-pound industrial particleboard made from those species contains 40 percent more wood than occurs in a piece of pine lumber; one square foot one-inch thick will weigh 3.75 pounds, compared to 2.7 pounds per square foot for southern pine lumber. In contrast, douglas fir wood, used to manufacture about 35 percent of the particleboard produced during 1971, is lighter than southern pine. An equivalent cross section of douglas fir particleboard would have 50 percent more wood than douglas fir lumber. The fact that douglas fir particleboard contains more wood at the same density than otherwise identical board made from southern pine mitigates to its

selling advantage. More wood material connotes to better physical properties. This seemingly minor point has been accountable for much of the presently intensifying ability by West Coast producers to sell their particleboard in the 'backyards' of board plants in the Southeast.

Spruce/fir combination in the mix ratio expected at the Ashland area complex will have an average (solid wood) density of 24.59 pounds for douglas fir. All other factors being equal (glueability, fiber characteristics, workability, etc.) spruce/fir, in particleboard form, being 18 percent lighter weight than douglas fir, will hold the same advantages over douglas fir in physical properties and at the marketplace that douglas fir holds over southern pine.

The type of particleboard to be manufactured should be restricted to 3-layer industrial board, allowing limited production of Underlayment during the first year of plant operation to assist market development and reduce overhead costs. Since the plant will have considerable production flexibility, able to make stock panels and film/paper-impreg overlaid panels, the mix of products would vary as sales volume and product acceptance gradually reach optimum levels. Economic projections below are based on changing ratios, reaching the proportion of 56 percent stock panels and 44 percent overlaid product by the time full capacity output is reached; which is not projected until the fourth year of plant operations. By that time the production of Underlayment board would be phased out completely.

There is growing receptivity toward particleboard by the construction sector of the market, including an adjusted viewpoint toward particleboard by the Federal Housing Authority (FHA) which allows its use in conformity with 'tentative' Commercial Standards in homes qualifying for mortgage guarantee. This is regarded by leaders in the industry as the first sign of large scale infiltration by particleboard into residential and commercial construction. New high-strength particleboard products are presently in an advanced stage of development. These products and the recognition afforded by new Standards could result in a down-stream change in the product line of the proposed particleboard plant. The recommended production system and associated capital cost estimate in this report are considerate of this possibility. Should such a change occur, there would probably be associated opportunity to economically process low grade hardwood in roundwood form; this being a situation that is not economic under the present (intensely) competitive character of the industry.

The proposed plant would be equipped at the onset with rudimentary cut-to-size facilities, to be increased in capacity and sophistication, including computer programming, as allowed by success at the marketplace. Growth in this direction will ideally benefit Mode-2 satellite units premised upon usage of particleboard as their basic material of construction.

ECONOMIC PROFILE (Particleboard Plant)

SUBSYSTEM INCLUSIONS	Improved Site Buildings Fire Protection Utility Connections Wood Delivery, Storage, & Recovery Machinery Wood Refining & Drying Machinery Blending, Forming, Pressing & Panel Sizing Machinery Low Pressure Overlay (LPO) Line Film Laminating Line Support Equipment Mill Supplies Maintenance Equipment	
MILL SPECIFI-CATIONS	Building Area	94,000 sq. ft.
	Site Area	7 acres
	Electric Energy	3,400 KWH
CAPITAL INVESTMENT	Installed Cost	$ 7.94 million
	Working Capital	$ .51 million
PERSONNEL REQUIREMENTS	Production Employees	49
	Support Employees	13
	Supervisory Employees	16 — 78
PRODUCT OUTPUT	40.0 million square feet per 300-day year, increasing to 46.7 million square feet when operating at 350-day maximum capacity (3/4-inch basis); dividing 56% stock panels and cut-to-size Industrial board, 25% film overlaid, and 19% LPO with melamine paper-impreg.	
SALES REVENUE	300-Day Year:	
	Average Net f.o.b. Mill	$ 152.50 per ton
	Estimated Gross Sales	$ 9.15 million
	350-Day Year:	
	Average Net f.o.b. Mill	$ 166.40 per ton
	Estimated Gross Sales	$ 11.64 million

PROFORMA RESULTS
Years 1-4 and 11

YEAR	1		2	3	4	11
Operating Months	1-4	5-12	13-24	25-36	37-48	subs.
Shift Capacity	26%	54%	80%	100%	100%	100%
Manufacturing Costs	850	2,400	4,550	5,390	6,300	5,395
Net Sales Revenue	620	2,615	6,775	9,040	11,635	11,635
Gross Profit (Loss)	(230)	215	2,225	4,490	5,335	6,240
After Tax Profit		(15)	1,036	2,171	2,548	3,233
ROI			12.4%	26.9%	30.5%	38.7%

POWER PLANT SUBSYSTEM

Although it is unlikely that construction of a power plant to supply both processing steam and electric energy to meet needs of a Mode-1 complex patterned to the 'model'; will be feasible, the possibility of inclusion in the face of intensifying nationwide shortage of energy and strengthening restrictions against disposal of processing wastes must be considered if the purpose of this report is to be fully met. 1/ In contrast, the Ashland area complex, which is a reality from the impetus of Woodchip, has been programmed to include full capability to produce requisite quantities of processing steam and to generate up to 10,000 kilowatts of electric energy. Feasibility in that case is based on surplus residues from a total sawtimber input of 90 to 95 million board feet per year, compared to 60 million for the 'model', and assured availability of an adequate make-up tonnage of bark residue fuel from operations of the chipping plant at Portage, Maine, enabling the power plant to be self sufficient in fuel supply.

26,000 tons of mixed bark and solid wood residue generated by programmed processing activities of the 'model' complex (all surplus to particleboard plant requirements) will be available for use as fuel to generate processing steam and electric energy. The combined requirements of Mode-1 facilities will approach 6,500 kilowatts per hour, inclusive of utility demand. Estimating an additional 3,000 KWH demand by Mode-2 satellite units, a power plant integrated into the complex should be designed to generate 10,000 kilowatts of electric energy. In addition, heat must be supplied for dry kiln and particleboard plant operations. Combined needs, allowing for conventional boiler and turbine efficiencies will require the heat energy from burning 53,400 tons of residue fuel.

1/ A capital investment of at least $6 million will be required to provide process steam and electric energy in compliance with demands of the 'model' complex.

To justify installation of a 10,000 kilowatt electric energy generating plant and boiler capacity to produce (the prerequisite) 120,000 pounds of steam per hour, it will be necessary to procure 27,400 tons of residue fuel per year (acceptably 100 percent bark) from outside sources; increasing to 42,000 tons per year at full rated output of electric energy when the ultimate Mode-2 complex configuration is reached. 1/ There should be guarantee of outside procurement of not less than 42,000 tons of mixed bark/solid wood residues per year to assure feasibility.

Steam demand at maximum production activity by the several facilities of the complex would be approximately 95,000 pounds per hour; 35 percent process steam for lumber drying and particleboard manufacture, 65 percent turbine steam for generation of electric energy -- rate of fuel consumption about ten tons per hour dry weight. At 'average' production steam demand will decrease about 45 percent, to 40 million kilowatts per year when all facilities are operating at peak output; this level of usage about 48 percent of turbine capacity.

Although not used for development of the foregoing calculations, rule of thumb estimating allows consumption of 300 kilowatts of electric energy for each thousand board feet of sawtimber processed into lumber and consumption of 2.5 pounds of steam for each pound of water evaporated during kiln drying. Consumption of energy for particleboard manufacture will average 570 kilowatts of electric energy and 985 pounds of process steam for each thousand board feet of 45-pound industrial board, 3/4-inch thick. These indexes, when associated with the facts that one ton of bark/wood residue materials (at Ashland) will produce 9,460 pounds of steam and 10 pounds of steam are required to generate one kilowatt hour of electric energy, can be applied as determinants of the heat balance of an integrated wood processing complex at most locations in northern Maine.

Predicated on the foregoing, data in this report are developed on the thesis that surplus residues will be used as fuel only to generate process steam; electric energy to be purchased from a commercial source. Thus, steam and electric energy will be cost items, not products of a profit center operation as is the case of the Ashland area complex.

Facilities to generate steam will require capability to produce 34,000 pounds per hour at periods of peak demand, corresponding to consumption of 3.6 tons of residue fuel per hour; in good balance with projected availability of 26,000 tons of residue fuel per year. However, because cumulative demand will average significantly less than indicated by the peak

1/ Average calorific value for the admixture of residue materials available as fuel will be 9,295 Btu's per pound -- based on an average calorific value of 9,370 Btu's per pound of bark and 9000 Btu's per pound of residue wood material.

consumption value it will be necessary to have means to dispose of probable surplus fuel. To provide for this it would be practical to install an oversize boiler -- in the range of 40,000 pounds per hour rated capacity -- with intent to exhaust surplus steam into the atmosphere. This will enable economic and functionally practical solution of residue disposal, in compliance with existing and anticipated sterner future pollution control ordinances.

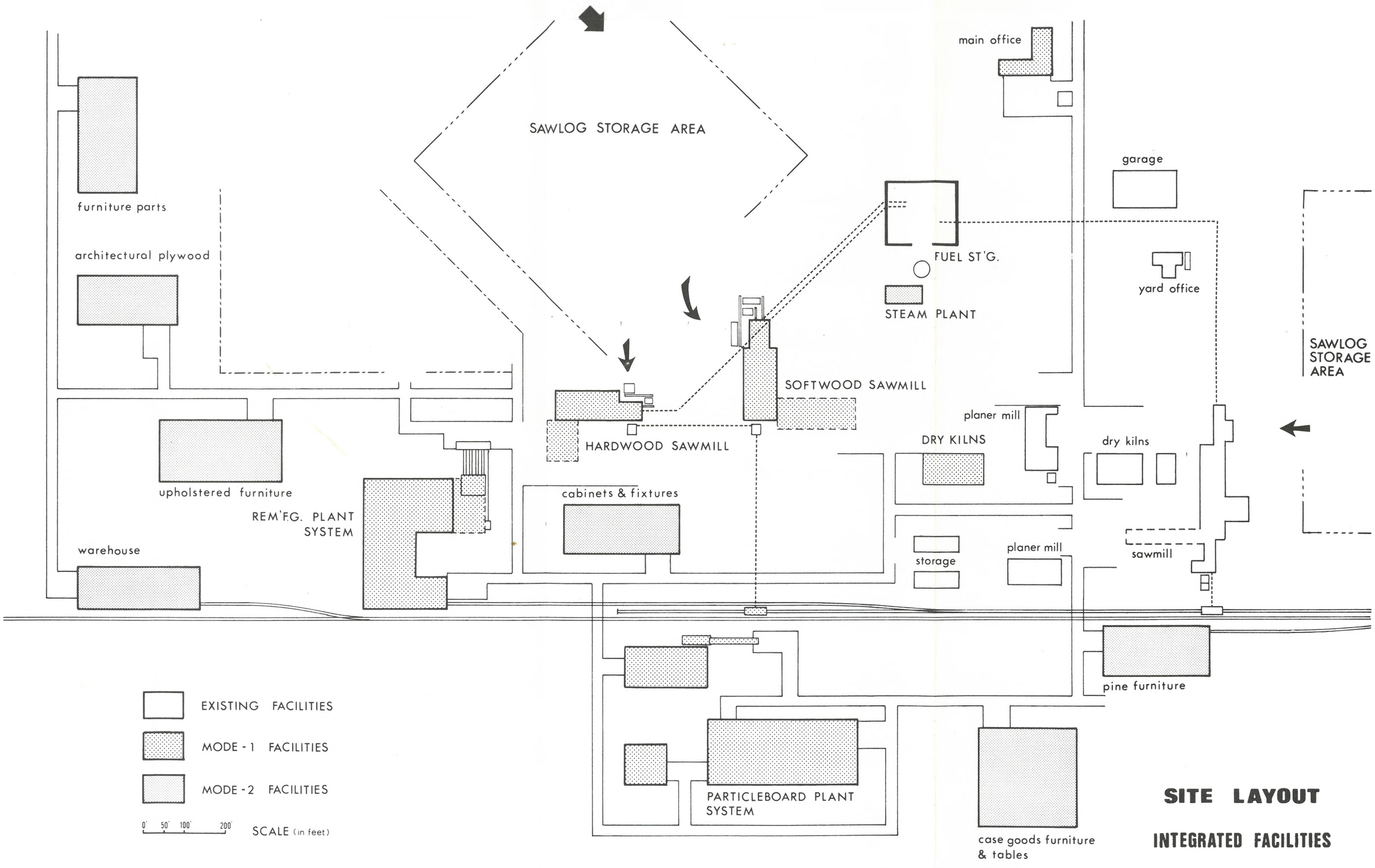
An estimated capital expenditure of $1.0 million will be required to install a fully integrated steam generating plant, premised on burning a heavy percentage of bark and complete with fuel collection, preparation, and storage facilities. Manning would require six workmen, operating on a 24-hour per day schedule, 350 days per year.

CORPORATE OPERATIONS

Capital expenditure for site acquisition and construction of corporate headquarters facilities is estimated at $250,000 additional to the $16.76 million projected for processing units. Associated working capital requirements are estimated at another $300,000; covering salaries, materials, supplies, and sales/management overhead cost items. An administrative and management staff of ten persons, in keeping with the chart of corporate structure on page 126, and a sales staff of five employees would be sufficient to man the Mode-1 complex and carry it into the Mode-2 configuration. At that time addition of more sales and clerical personnel would be expected.

Aggregate after tax profit of the softwood sawmill, hardwood sawmill, and remanufacturing plant, and the particleboard plant when it reaches full capacity output the third year after commencement of production, is projected at $3.65 million. 1/ Allowing for operating costs of the central corporate facility, after tax profit will drop to $3.35 million. Therefore, return on $17.1 million invested capital will conservatively reach 19.7 percent; or 17.6 percent projected on the basis of total capital (inclusive of working capital).

1/ Proforma projections of individual processing units of the complex, and projection of aggregate proforma operating results have been carefully developed. They are considered sufficiently finite for reasonable purposes of application of this report. ROI during the years preceeding maximum projected return from particleboard operations will be satisfactory, but the percentage rate will be subject to considerable variation depending upon the finesse of scheduling applied to advance the complex to its optimum Mode-1 operational capacity.



SITE LAYOUT

INTEGRATED FACILITIES

Section 4

Development Plan & System Implementation Approach

4.01 DEVELOPMENT PLAN

Both the Ashland area complex and the complex offered by this report as a 'model' approach have been conceptualized in essential particulars in Section 3. At this point attention is given to means of managing advancement of the concept into operating reality. There is little difference between the recommendations below and the course of action already taken that has resulted in implementation of the Ashland area complex, or, in a sense any other industrial venture of consequence.

SOUND BASIS

Implementation of the Mode-1 complex will involve procurement of $17 million capital investment, inclusive of working capital. Eventual expansion into the (ultimate) Mode-2 configuration will involve a total investment approaching $30 million. It is readily apparent that full realization of the forest management, timber utilization, employment, and economic objectives backgrounding the Woodchip project will not materialize until Mode-2 is a reality. Thus, in awareness, the investment community will be insistent upon a sound, composite development plan before it will be attracted to serious consideration of participation in any proposed venture themed to Woodchip. Planning can borrow from this report, using it as a documenting and guiding reference to correlate with other data and the specific objectives of a venture principal. The report is by no means an investment document in itself.

SCOPE

A plan of venture must encompass details of the entire spectrum of engagement. For Woodchip themed venture in Aroostook County, or elsewhere in Northern Maine, first emphasis should be placed on the long-term AVAILABLE timber resource. Next in importance is the coincidence of that resource with the plan of manufacturing venture, and its extension and processing into products for which there is viable, durable, profit-making potential at the marketplace. With these aspects of venture in context, focus of attention can then direct to organization and management, and economic qualifications of the proposed business.

RISK

There is risk in any new venture; however, it is a strong purpose of investors to minimize risk in all practical ways. In recognition of this, recommendations should be excluded from planning, and they have been excluded from the 'model' complex approach, that would (at the onset) involve new or untried products and utilization of species that are not in favor at the marketplace.

OBJECTIVITY

Interjection of idealism into venture planning is difficult to avoid, particularly in consideration of some of the good intents and motivations behind Woodchip that have emanated from forest management and wood products research sources. It would be ideal to program usage of abundant but comparatively unused species, No. 4 Grade hardwood sawlogs, forest debris and cull material, and an array of technically new and imaginative products. There is a tendency, too, to look toward old, proven, but no longer wanted products as a panacea for using materials and creating industrial activity and jobs. Objectivity must predominate; however, once a complex has been established and has made a record of its ability to prosper and grow, it can turn its attention in part to pioneering new products and using more of the materials that will result in better fulfillment of forest management and utilization goals.

SEQUENCING

It has been established in Section 3 that the Mode-1 configuration of the complex should be made operational and given opportunity to demonstrate profitability and long-term potential before effort is made to attract satellite operations and initiate transition into the Mode-2 configuration. This does not imply that the Mode-1 configuration must be set in motion as a complete system at the onset of business, although that would be highly desirable. It is probable, in consideration of the relatively high dollar investment, that commitment of sufficient capital to enable implementation of the full package will be difficult.

The softwood sawmill, secondly the particleboard plant, and lastly the hardwood sawmill and remanufacturing plant together could be organized, financed, and made operational in phased sequence, but in strict compliance with a plan that would result in final installation of a completely interfaced Mode-1 complex without sacrifice over simultaneous installation. The least separable units are the softwood sawmill and the particleboard plant, which, if not installed at the same time, would impose temporary residue disposal problems and cause loss of dynamacism important to attracting labor

and engendering wholehearted community support in the locational area.

INVESTMENT PROSPECTUS

Regardless if venture into a Mode-1 complex is by one-step, two-step, or three-step approach, preparation of a detailed investment prospectus is a fundamental requirement. First action preparatory to its preparation, assuming project sponsorship by a venture group, should be to establish a business entity, designate officers, and delineate areas of performance responsibility to key individuals. An expanding business should provide for the same considerations, stressing a well planned and organized venture strategy. Other initial provisions would include identification and liason with potential sources of financing, and retention of legal counsel. Interim funding should be obtained, which should be commited in sufficient amount to enable employment of a full-time program (general) manager, and to pay for professional services in connection with preparation of the requisite investment prospectus.

FOCUS

The prospectus should be addressed to the entire gamut of considerations important to equity participants and sources of financial assistance. Equity investors are, as a rule, attracted to the business which offers best potential return along with a modicum of control -- as would be available through issue of common (voting) stock. Alternatives to issue of common (i.e., preferred stock, debentures, and their variables) have considerable merit, and should be evaluated and selected with twofold intent to serve the best interests of the business entity while performing the companion function of attracting investor participation. Qualified professional advice resulting in best technical structuring is available and should be applied. However, there is proneness to loose sight of local considerations important to development of community support and vitally important to establishing and operating a complex as envisioned. The financial structure should seek to attract local participation; with intent, insofar as possible, to maximize cash distributions from earnings back into the local area.

PEOPLE

Management (the people aspect of venture) is vitally important to procurement of capital. Eminently qualified persons should be selected in advance to fill top staff and line positions, and they should be identified.

Here, again, the relationship of the business to the local community should be considered, and reflected as feasible by recruiting on an area basis. In this instance, however, no concession should be made to recruiting the very best talent in favor of creating the best local impression. In end analysis this will be respected by all critics; it is obvious that management talent will be paramount in the success of the planned manufacturing enterprise.

SYSTEM

Other disclosures in the prospectus, which will require thorough groundwork and application of planning effort, will include verification of (long-term) sawtimber availability, industrial site chacterization, product line delineation, investment and cash flow projections, and a schedule of implementation and growth. These can be premised on the content of this report, but they must be supportive to the exact plan of enterprise to be followed.

COMMUNITY CONSIDERATIONS

The complex, as a new enterprise, must identify with the community from which it will draw support and employees, and upon which its employees must depend for their living essentials, health, education, and enjoyment. Consistent with this it will be imperative to establish dialogue with community officials as soon as site location has been decided. Liason before that time could prove highly advantageous by inducing extension of local assistance in matters of tax relief, zoning regulations, site availability, industrial buildings, housing, fire and police protection, and financial assistance.

ACCOMODATION

The more than 200 employees required for the Mode-1 complex, expanding to at least 500 employees when the Mode-2 configuration reaches its full potential -- representing a family population of at least 1500 persons -- will impose a sizeable addition to any community in Northern Maine. Development planning must assure that requisite new housing, schools, shopping centers, and other essentials are properly provided for on a controlled basis. Exploitation by means of speculative land dealing, erection of substandard housing developments, and other methodologies must be guarded against to the selfish interest of the complex. The well-being of employees stands as a critical factor able to influence success of the complex; attentiveness to their circumstances is absolutely essential. It has been reported

in Section 2 of this report that 'returnees' to Northern Maine are viewed as an excellent potential resource of labor and management. That resource will be unavailable if costs, housing, services, and community amenities are not comparable to urban and suburban locations from which persons might be drawn by hopes for fresh, interesting employment and a vigorous community attitude.

EQUITY INVESTMENT

Financing a complex involving either formulation of a new business entity or expansion of an existing (small) business, assuming a corporate structure, would be advantaged by participation of equity investors acquired through public subscription. Without reasonably large scale public subscription, and in the absence of alternative equity cash, it is unlikely that private sources of financial assistance would be interested in the venture. Federal sources, notably the Economic Development Administration, which was revitalized during June 1973 for a one year period, are unable to loan in excess of 65 percent of project cost (usually not over 50 percent). State of Maine assistance programs are the most liberal, with the Maine Industrial Building Authority empowered to insure mortgage loans made by banks and other financial institutions up to 90 percent on real estate cost plus 75 percent of equipment cost.

Intrastate solicitation of investors is favored over extension to interstate; to maximize in-state support and to avoid the time consuming requirements of Security and Exchange Commission (SEC) registration and approval. Whatever the selling field, solicitation should be pursued vigorously through media advertising on a state-wide basis. The theme of ecological improvement through operations of the complex, increased employment, and improved economic contribution within Maine from internal value-added utilization of the timber resource is real and properly exploitable as an attractant to sound investment.

FINANCIAL ASSISTANCE

A variety of State and Federal assistance programs and sources of private financial assistance are available that could be utilized to minimize and augment equity capital and accomplish financing of a complex.

STATE

The Maine Industrial Building Authority (MIBA) empowerment described above provides loan insurance with maturity up to 25 years on real estate and 10 years on equipment. Municipalities in Maine are empowered by the State to issue bonds for financing construction projects of interest to the municipality; including in the bond issue purchase price of land or building, construction costs, labor, materials, machinery and equipment, financing charges, plans and specifications, engineering and legal fees, hiring of specialists, and other necessary services. Securities are retired entirely from lease income paid by the lessee. Voter approval of the bond issue is required. This program is administered by the Municipal Securities Approval Board (MMSAB).

FEDERAL

Federal programs are offered by the U.S. Department of Commerce under two Agencies; the Economic Development Administration (EDA) and the Small Business Administration (SBA). Assistance through EDA is available under a one-year continuance of the Agency effective through June 1974, providing low interest, long-term loans to businesses in locations classified as redevelopment areas -- Ashland area is eligible for qualification as a redevelopment area under Title IV of the Public Works & Redevelopment Act of 1965. Assistance through SBA, which guarantees bank loans up to $350,000, participates with banks on loans up to $150,000, and makes direct loans up to $100,000, would become applicable in meeting requirements of satellite operations when the complex advances into the Mode-2 configuration.

PRIVATE

Private financial assistance may be obtained from banks, insurance companies, commercial finance companies, and, specifically in Maine, the Development Credit Corporation of Maine (DCCM). Banks and insurance companies are the two most likely sources of assistance to meeting needs of the complex. Direct placement loans on a long-term basis are available from major insurance companies to provide funds for purchase of new equipment and facilities, expansion, and other industrial purposes. Several of these companies habitually extend loans to substantial wood products industry firms; suggesting good approachability based on need and intents of financing requirements for a Mode-1 complex. There are 21 State chartered commercial banks, and 32 savings banks in Maine. Industrial loans are available from most, supported by healthy interest in meeting requirements of timber based industry. DCCM is a private development corporation that has been organized by Maine banks for the purpose of promoting economic development; however, its loans are held to $100,000, with some exceptions over that limit. As with SBA, it could come into play as a source of

ASHLAND AREA COMPLEX IMPLEMENTATION

Actions leading to implementation of the Ashland area complex were in general compliance with development plan recommendations carried out parallel with Woodchip study advancement, but involving separate study formatted to exact objectives of the investing corporation. Results of that study work, which treated the timber resource, markets, production system, and economic potential were reported in prospectus form. The prospectus, in turn, served as a basis for decision and procurement of financing. Soundness of the scheme was evaluated in detail by corporate headquarters, and a plan of construction sequencing was evolved that provided the basis for financing. Importantly, the process of evaluation, planning, and reaching implementation decision involved continued close liason between corporate headquarters, line management of the operating facility, and sources of professional assistance that participated in the planning and evaluation work.

RECOMMENDED APPROACH

Considerate of existing wood products manufacturing industry in Maine, there is justifiable opportunity for establishing one or more integrated complexes in Northern Maine additional to the Ashland area facility now under construction. It is anticipated that a degree of inertia will impose against formalization of implementation efforts in other logical and qualified locations; anticipating a wait-and-see attitiude. This can and should be avoided by continuing aggressive action by the Maine Department of Commerce and Industry directing effort to stimulate development planning; preferably with industry sponsorship, alternatively by community action groups. The specific lines of action should be considerate of and in compliance with patterns of timber ownership and control as they will condition the critical first need of ASSURED LONG-TERM SAWTIMBER AVAILABILITY.

IMPLEMENTATION OF INVESTMENT

Implementation actions culminating in decision to invest in facilities construction should result in a product (investment prospectus) inclusive of capital cost determination, preliminary design of facilities installation, and schedules for construction, cash flow, start-up, and capacity build-up. The prospectus should delineate these items, as well as identifying the site location, planned phasing to achieve the full Mode-1 and ultimate Mode-2 configurations, and designation of the selected source of engineering design.