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Dickey-Lincoln School Lakes Project Transmission Studies Environmental Impact Statement: Appendix D: Transmission Reconnaissance Study

U.S. Department of the Interior

U.S. Department of Energy

ENVIRONMENTAL IMPACT STATEMENT

TRANSMISSION RECONNAISSANCE STUDY

DICKEY-LINCOLN SCHOOL LAKES PROJECT

TRANSMISSION STUDIES

U. S. Department of Energy
Federal Building
Bangor, Maine 04401
February 1978

APPENDIX **D**

Department of Energy
Washington, D.C. 20585

Dickey-Lincoln School Lakes Project
Transmission EIS Study Team
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Bangor, Maine 04401

TRANSMISSION RECONNAISSANCE STUDY

PREFACE

On October 1, 1977, the responsibility for marketing federally generated power (under provisions of the Flood Control Act of 1944) was transferred from the Department of the Interior to the newly formed Department of Energy. The power transmission portions of the Dickey-Lincoln School Lakes Project were included in that transfer.

The U.S. Departments of the Interior and Energy have conducted system planning, location, and environmental studies for the transmission facilities required for the Dickey-Lincoln School Hydroelectric Project. These studies of many alternate routes have resulted in identification of a proposed transmission line route and an environmental impact statement, as required by the National Environmental Policy Act of 1969. This report is published as an appendix to that statement.

Appendix D, Transmission Reconnaissance Study, documents the field work performed by the Department's reconnaissance team assigned to the Dickey-Lincoln School Project. This team was composed of experienced, highly trained individuals, skilled in recognizing the wide variety of factors influencing a transmission line route. Their knowledge of the relationship between transmission line design, construction, operation and maintenance, and the landscape over which the facilities pass is an important consideration. Having worked in the field of transmission line location and reconnaissance with a widely diverse staff of environmental people, they are also able to view environmental aspects of the activities in a macro way. It remains for the environmental specialists in the several fields to study environmental concerns in more detail.

The location and reconnaissance people began their work in the spring of 1976 with a regional overview, concurrent with the corridor study being performed by VTN Consolidated, documented in Appendix B. The team's major effort, however, focused on delineating half-mile wide routes within the top ranked corridors for System Integrating Plan E.

State-of-the-art field reconnaissance methods were employed. This included detailed and repetitive examination of aerial photography and maps, helicopter flights, and a great deal of driving and walking, as well as a number of contacts with agencies, organizations and individuals in the area.

This report does not address impacts in detail, but instead sets forth the major factors involved in the location of the alternative routes. These routes were assessed and compared by subsequent environmental studies. This reconnaissance study was an important phase of the overall EIS effort.

Harry D. Hurless
Project Manager

TRANSMISSION RECONNAISSANCE STUDY

DICKEY-LINCOLN SCHOOL LAKES PROJECT

U.S. Department of the Interior

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TABLE OF CONTENTS

INTRODUCTION

Two dams are proposed on the St. John River in northern Maine: Dickey, a high earth filled dam immediately above the confluence of the Allagash with the St. John, will have an installed generating capacity of 760 MW; and Lincoln School Dam, 11 miles downstream, a capacity of 70 MW. These dams are scheduled for completion during the mid 1980's.

The U.S. Corps of Engineers, New England Division, has been allocated funds to design the project and prepare their own environmental impact statement. This report (Transmission Reconnaissance Studies) discusses alternative transmission facilities needed to connect the project with the New England grid, and describes the study area involved. It supplements the Transmission System Planning Study prepared by the Department of Interior (DOI) (February 1977) and the Assessment of Alternative Power Transmission Corridors prepared by VTN Consolidated (VTN) of Boston Mass., for the Dickey-Lincoln School Lakes project.

The DOI, under Federal law, is responsible for marketing power from Federal projects. The Southeast Power Administration, an agency of the DOI, is completing the power marketing studies. The Bonneville Power Administration (BPA), also in DOI, is performing transmission system planning and reconnaissance studies and is preparing a draft environmental impact statement for the required transmission facilities. Five plans for transmission are under study. Two 345-kV AC or one 400± DC transmission dircuits are required to connect Dickey Dam with the New England grid. An additional 345-kV transmission is necessary to connect Moore Substation with Granite and Essex Substations. a 138-kV line will connect Lincoln School with the 345-kV circuits. All system plans are discussed in the Transmission System Planning Study These electrical plans identify two levels of developments, authorized and ultimate. The authorized level describes transmission facilities required to accommodate the initial 760 MW of power generated at Dickey Dam and the 70 MW from Lincoln School Dam. The ultimate level provides for additional generation at Dickey and additional transmission lines to integrate that power. At the authorized level, all plans connect Dickey with Moore Substation near Littleton, New Hampshire (Fig. 1).

A prime contractor, VTN Consolidated, established a study method to focus on environmental concerns and resources most threatened by construction, maintenance and operation of transmission facilities. The analysis identifies feasible corridors and rates them from those least acceptable to those most acceptable. Of the five plans studied, two follow a transmission course through eastern and central Maine. Three plans roughly parallel Maine's western border. VTN ratings show the western corridors are most suitable from an environmental point of view (Fig. 2).

A study team headquartered in Portland, Oregon, was dispatched to establish an office at Bangor, Maine. Working with consulting contractors, the DOI team located transmission line alternatives. The reconnaissance team assigned to study the transmission system sought in Department tradition to safeguard natural resources while assessing location factors to assure the best balance between use and protection. It is recognized that locating transmission lines, clearing rights-of-way, and constructing access roads can create adverse impacts and conflict with other land uses. To reduce such impacts, equal

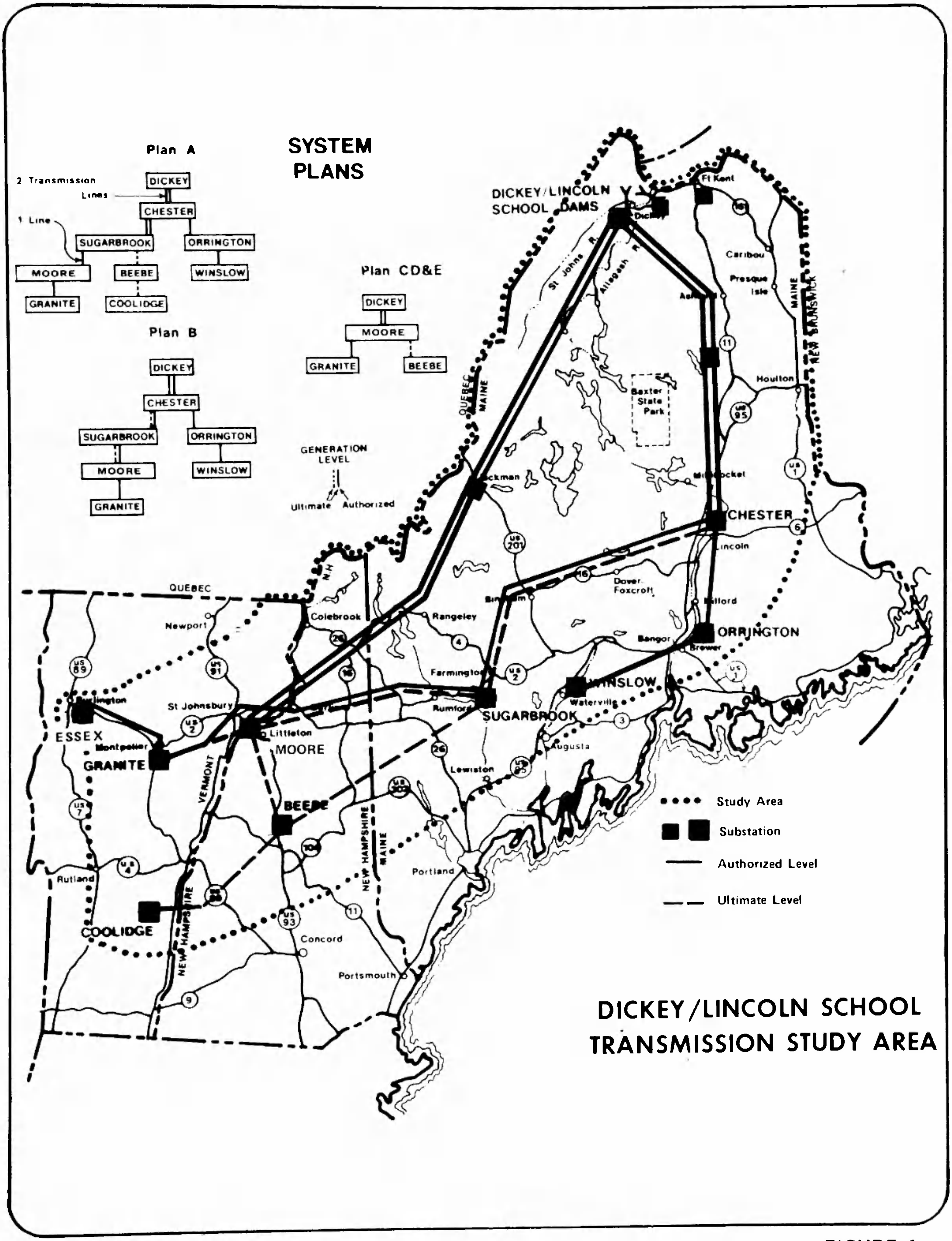

SYSTEM PLANS
Plan A
2 Transmission Lines
1 Line
DICKEY
CHESTER
SUGARBROOK
ORRINGTON
MOORE
BEEBE
WINSLOW
GRANITE
COOLIDGE
Plan B
Plan CD&E
GENERATION LEVEL
Ultimate
Authorized
DICKEY/LINCOLN SCHOOL DAMS
Ft Kent
Caribou
Presque Isle
Houlton
Baxter State Park
St Johns R.
Allagash R.
QUEBEC
MAINE
NEW BRUNSWICK
CHESTER
Lincoln
Dover-Foxcroft
Milford
ORRINGTON
Bangor
Brewer
Rangeley
Farmington
Rumford
SUGARBROOK
Waterville
Augusta
Lewiston
Portland
Colebrook
Newport
St Johnsbury
Littleton
MOORE
ESSEX
Burlington
Montpelier
GRANITE
VERMONT
NEW HAMPSHIRE
BEEBE
Rutland
COOLIDGE
Concord
Portsmouth
Study Area
Substation
Authorized Level
Ultimate Level
DICKEY/LINCOLN SCHOOL
TRANSMISSION STUDY AREA

FIGURE 1

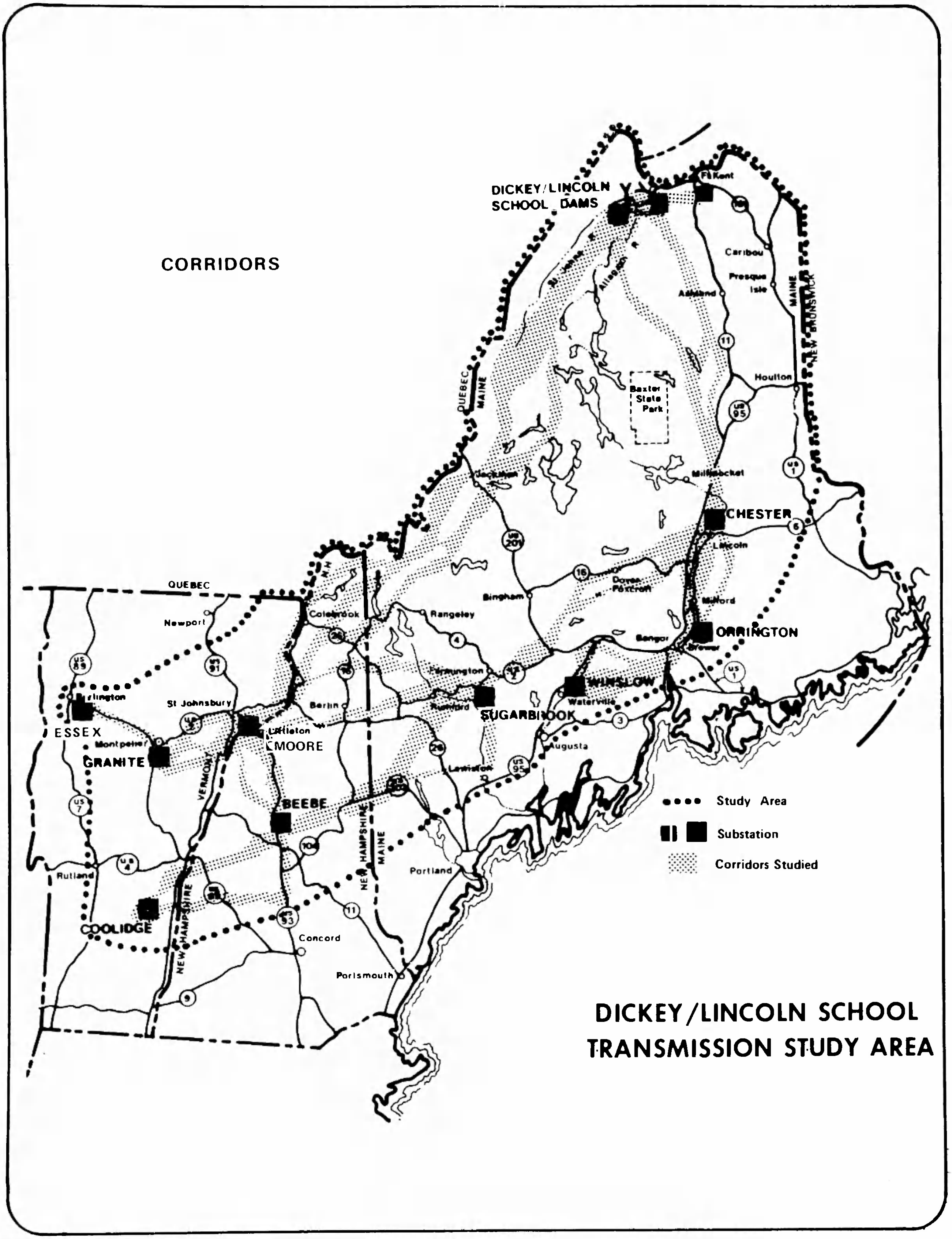

CORRIDORS
DICKEY/LINCOLN SCHOOL DAMS
CHESTER
ORRINGTON
WINSLOW
SUGARBROOK
MOORE
ESSEX
GRANITE
BEEBE
COOLIDGE
QUEBEC
MAINE
NEW BRUNSWICK
VERMONT
NEW HAMPSHIRE
Caribou
Presque Isle
Ashland
Houlton
Baxter State Park
Millinocket
Lincoln
Milford
Bangor
Brewer
Dover-Foxcroft
Bingham
Jackman
Rangeley
Farmington
Rumford
Waterville
Augusta
Lewiston
Portland
Portsmouth
Concord
Berlin
Colebrook
Littleton
St Johnsbury
Montpelier
Burlington
Newport
Rutland
Study Area
Substation
Corridors Studied
DICKEY/LINCOLN SCHOOL
TRANSMISSION STUDY AREA

FIGURE 2

consideration was given environmental concerns and engineering requirements. The field team examined the topography, geography, geology, vegetation, and land use of each system plan and determined the western corridors have fewer overall impacts. Within the western corridors alternative transmission routes, following paths of least sensitivity, were identified for further study. 1/

1/ At this writing each route alternative along the western corridor is under contract study for environmental sensitivity.

DESCRIPTION OF STUDY AREA

Geography

The study area covers approximately 33,000 square miles of northern Maine, New Hampshire, and Vermont. It is bounded on the north by Canada, on the east by Maine's eastern boundary, on the west by Lake Champlain and south by an irregular, arbitrary line separating selected towns and counties.
The area is about 300 miles long and 100 miles wide. 2/ This geographical space is where the Dickey-Lincoln School transmission lines could be built.

The terrain is generally oriented northeast and southwest. It is dotted by countless lakes and drained by several major rivers. The Boundary Mountains extend from New Hanpshire northeast into Maine along the International Boundary. South of the Boundary Mountains, the White Mountains, highest in New England, rise more than 6,000 feet. The Longfellow Mountains form a broken range stretching through north-central Maine.

2/ Identification of the study area boundary is discussed in the Assessment of Alternative Power Transmission Corridors in the VTN report.

The study originally assumed that transmission lines associated with proposed thermal generation in southeastern Maine and Western Vermont would be added to existing grid by the time Dickey-Lincoln School transmission is required. Since the proposed thermal plants are delayed, electrical studies show that stability of the existing system, with Dickey-Lincoln School added, is best served by extending a 345-kV line from Granite to Essex Substations. This line falls outside the original study area. However, reconnaissance studies are expanded to include a line to Essex. Environmental contracts presently in process have also been "scoped" to include this line.

Low, broken mountains lie north of the Longfellows. They lack a definite formation. A long trough, shaped and scoured by glaciers, between the Longfellow and Boundary mountains, contain many large and hundreds of small lakes. The area is called Moosehead-Rangeley Lakes region. Hundreds of other lakes and ponds from one to several thousand acres in size are also scattered among the low mountains in the northern and eastern part of the study area.

The New Hampshire and Vermont portion of the study area are dominated by mountains. Large lakes are less prevalent than in Maine. The northern area is drained by the St. John, Allagash, Fish and Aroostook rivers. Central and southern Maine and western New Hampshire are drained by the Penobscot, Kennebec, Androscoggin, and Saco rivers. The Connecticut River flows between New Hampshire and Vermont.

Geology

Bedrock in the study area varies but is basically composed of sedimentary and igneous associations. Sedimentary deposits have resulted in slates, shists, quartzites, and gneisses. Igneous granite has pushed through these deposits to form rolling, broken, mountainous terrain. High quality granite, suitable for building and decorative stone, is quarried at several sites. Sand and gravel, suitable for concrete aggregate or roads, is abundant. Many semi-precious minerals have been found and prospecting is continuing. Some commerical ores are mined.

Soils and Agriculture

Soils on the mountain slopes are generally thin rocky phases of sandy loam. In the lakes region, soils are mostly acidic lacustrine silt and clay over glacial till. East and south of the mountains and lakes region, the terrain, dissected by rivers and streams, becomes gently rolling. In these lowlands the sandy clay loams are generally deep enough to farm.

The thin soil mantle of the mountainous area supports stands of timber whose density at maturity varies with the moisture and nutrients available. About 90 percent of the land is timbered. Birch, beech, maple, and oak are mixed with fir, spruce, and white pine. Hardwoods grow on the well drained slopes. The spruce favors low wetlands. Pine and fir are found on slopes and mountain tops. Cedar, hemlock and larch also grow in the area. The region was a strong timber producing area long before harvesting began in the western forests of the United States. Today some forests in the study area are on the fifth rotation, and virgin forest is absent. Much of the land in New Hampshire and Vermont, which once was farmed, is reclaimed by forest. Timber and wood products dominate the use of natural resources in the area.

Deeper soils in eastern and central Maine and the valleys of New Hampshire and Vermont are used to produce potatoes, vegetables, blueberries, and fruits. Dairy and poultry production are also important. Less than 10 percent of the land in the study area is used for farming.

Climate

The climate is more continental than maritime. Warm humid summers are followed by brisk cold fall nights and early frost. The long winters with sub-zero temp-atures and heavy snows are among the coldest in the nation. Hoar-frost is common. Blizzard winds and occasional hurricanes may exceed 75 mph. Spring thaws bring floods or high water to the rivers and low lands. For example, the town of Fort Kent and farms and communities downstream in Maine and New Brunswick are flooded periodically The average temperature is about 45° Average highs are in the 90's and lows fall in the 20's. Large daily temperature fluctuations are common. The average annual precipitation is about 40 inches, spread evenly over the seasons. Snow depths range from 30 to 100 inches between November and April. Hot, humid summers with warm nights and 100 frost-free days make for a fast growing season.

Recreation

Expanding popularity of recreational attributes throughout the area are of a seasonal nature. They are partly man-made and partly natural. Stately resort hotels dating from the 19th century stand in contrast with modern tourist facilities and second homes. The area's natural features, however, provide the basis for recreational activities. Skiing, boating, canoeing, motoring, snowmobiling, hiking, hunting, fishing, and sightseeing are among the growing pursuits. Long, cold winters furnish ample snow for several months of skiing on such notable runs as Squaw Mountain, Sugarloaf, Stowe, and the White Mountains. Mount Katahdin in Baxter State Park marks the northern end of the Appalachian Cordillera and the beginning of the famed Appalachian Hiking Trail. Many less famous but equally popular trails wind through the study area.

Motorists driving a network of highways, may view dense and luxuriant foliage that blankets the landscape around picturesque villages with towering church steeples. Touring New England is popular during all seasons. But the spectacular color of autumn leaves attracts the most tourists.

Boating is mainly confined to the larger lakes and rivers. Canoeing enthusiasts take to the white waters of wild rivers. The Allagash and upper reaches of the St. John, Saco, Kennebec, Penobscot, and Aroostook Rivers, plus many smaller streams provide such inviting waters. Snowmobiling is rapidly gaining in popularity. Riders come from as far away as Boston and Quebec City to enjoy hundreds of miles of groomed snow trails like those of the North Main Woods. One or more snowmobiles in the yards of local residences are a familiar sight.

The area with its forests and water is abundantly populated by wildlife. It provides some of the best hunting and fishing in the east. Game animals and birds include white-tailed deer, black bear, cottontail, and snowshoe rabbits, ruffed grouse, woodcock, ducks, and Canada geese. Lakes and streams are generously stocked with land-locked salmon and trout.

Anglers fish the lakes and rivers in summer and winter. Ice fishing is pursued on both lakes and rivers. The ice is strong enough to support autos and aircraft. Years ago Atlantic Salmon spawned in tributary streams in the area, but dams without fishways and pollution from pulp mills damaged fish. For years the region was without salmon runs. Today. however, rivers are being cleaned up and the salmon runs restored. For example, the Maine State Fish and Game Department is attempting to restore spring salmon runs in the Penobscot.

Transportation

Interstate I-89 crosses Vermont, I-93 crosses Vermont and New Hampshire, and I-95 traverses the eastern part of Maine. Each of these highways carry traffic through the area into Canada. Other federal, state, and local roadways also serve the area. Many connect with Canadian roads. Although parts of northern Maine lack highways, the North Maine Woods may be traversed via a network of private "haul" roads. Many of these roads are open to the public for limited use.

The Bangor-Aroostook Railroad serves eastern and northern Maine. It terminates at St. Francis. Jackman is served by the Canadian Pacific Railroad which crosses north-central Maine. Other railroads cross New Hampshire and Vermont. The railroads mostly carry freight. Passenger service is limited. Light seagoing freighters travel up the Penobscot River to Bangor.

Regularly scheduled airlines serve Bangor and Presque Isle, Maine, and Montpelier and Burlington, Vermont. Air charters serve the smaller communities.

Civil Structure

Each state has county subdivisions as well as towns that abut one another and vary in size from 25 to 100 square miles. In a political system unique to New England, each organized town has its own local government. Town populations range from a few hundred to several thousand persons. Nearly every organized town supports its own elementary school. High schools serve more than one town. The University of Maine has campuses within the study area at Orono, Farmington, Presque Isle, and Fort Kent. New Hampshire University is at

Plymouth. The University of Vermont is at Burlington. Other state and private colleges are scattered through the area.

Major medical facilities are available in most of the cities. Fire, police and ambulance services are provided by the more sizeable towns and are made available to surrounding communities. Water supply and sewage disposal systems are provided only by the more compact urban areas. Rural residents rely on individual wells and private septic tanks.

Much of northern Maine is undeveloped land not organized into cities or towns. The population is sparse. It is concentrated mostly in the organized towns of Fort Kent, St. Francis, Jackman, and Moose River, all of which have their own civic government. The remaining unorganized lands are managed by Maine's Land Use Regulation Commission (LURC) whose jurisdiction extends through northern and western Maine to the New Hampshire border. Residents of these organized towns and unorganized territories are largely of French-Canadian descent and accustomed to a life style dependent upon woods for a living.

Towns in eastern and southern Maine are mostly organized and it is there the vast majority of Maine's population lives and works. Potato farming is important to northern Maine. The southern area is industrially oriented. With few exceptions, New Hampshire and Vermont towns are organized. Timber and wood products contribute strongly to their economy. Most of the farms are in the river valleys. Population densities are greatest in the valleys.

The U.S. census has reflected little fluctuation in the study area's population during this century. Since 1900 the population has increased about 25 percent and the area is weighted heavily with people over 50. The economy is generally below the national average. Economic activity and personal income are below national averages.

RECONNAISSANCE STUDIES

Corridor Studies

Corridors identified by VTN are 1 to 10 miles wide.

The DOI reconnaissance effort has focused on two levels of study: (1) to review potential corridors for all system plans, and (2) to locate alternative transmission line routes, (approx. 150 feet wide) substations and microwave sites for a selected plan.

The study sought to:

--- Identify corridors suitable for the location of transmission lines for each system plan;

--- Provide field-based data and judgments to VTN Consolidated for their consideration;

--- Review the corridors identified by VTN to determine their feasibility on the basis of reconnaissance engineering;

--- Identify tenative microwave control system facility sites for each system plan;

--- Recommend a system plan and corridors within that system plan in which to concentrate route location reconnaissance.

The reconnaissance team studied each corridor and determined the eastern or western plans would accommodate overhead transmission lines. However, it would be necessary to route corridors east or west of the system of lakes extending through north-central Maine. The eastern plans go east of the lakes, and cross wetlands and concentrated drainage systems. A western plan, directed southwesterly between the St. John and Allagash Rivers and along the Canadian border, also avoids the Lakes region as well as the wetlands and drainage system of eastern and southern Maine.

The White Mountains of New Hampshire pose further constraints that limit feasible routes for transmission lines. Only two routes are evident. One follows the Androscoggin River where the valley is congested with linear utilities and population. The other lies north of Berlin, New Hampshire. Corridors for the eastern plans pass through these mountains. Corridors for the western plans pass northwest.

Access serving the eastern alternatives is generally better than in western Maine. However, western plans can be served from a good network of timber management roads in the north Maine woods.

In some cases construction could be hampered by steep terrain or snow in remote sections along the western route. Along the eastern route, construction could be hampered by wetlands, rivers, streams, industrial, residential, and rural development.

Routes for the eastern or western plan cross timberlands. More timber would be removed from the eastern route, but timber quality and production is better along the western routes.

The eastern plans offer more opportunities to parallel existing lines even so more nonparallel right-of-way would be required along the eastern plan than along the western.

Corridors in the eastern plans would be about 1/3 longer than the western corridor. This would make the eastern plans more costly and disrupt more environment. The western plans would go through a remote area where population is sparse.

A summary comparison of the eastern and western route possibilities show a western route imposes fewer overall impacts on the natural and social environment. Information comparing the environment, economic, and engineering merits of the alternate plans and supporting the selection of Plan E as the "proposed" plan is given in the VTN report entitled "Assessment of Alternative Power Transmission Corridors" and the DOI "Transmission Planning Summary" report. System Plan E lies within the Western Corridor as shown in Fig. 1. The following discussion describes alternatives for Plan E.

Route Location Studies

These alternatives must meet certain criteria that are designed to meet these objectives:

--- Identify a suitable transmission route to accommodate two 345-kV circuits between Dickey and Moore substations near Littleton, New Hampshire.

--- Identify a suitable transmission route to accommodate one 345-kV circuit between Moore and Granite and Essex substations.

--- Identify a suitable transmission route to accommodate one 138-kV circuit between Dickey and Lincoln School, and Fish River substation near Ft. Kent, Maine.

--- Identify a suitable site to accommodate a 345/138-kV substation, a braking resistor, and service building near Dickey Dam.

--- Identify suitable sites to accommodate a switching yard at the approximate midpoint between Dickey and Moore.

--- Identify suitable sites to accommodate a microwave control system, for the added transmission facilities to connect with the existing shared microwave control system.

--- Identify transmission route and substation sites, where practical, within the broad corridors identified during the corridor study.

--- Identify alternatives wherever possible or practical.

Reconnaissance efforts are guided in part by the principles set forth by the USDI and the USDA in a joint publication, "Environmental Criteria for Electric Transmission Systems (1970)" Land Use, Access, Reliability, and Environmental Impact are given particular attention for route location in the following discussion.

<u>Land Use</u> - A location that will least interfere with the orderly development of the region.

Transmission lines can alter the pattern of land use over a wide variety of landscapes. To reduce potential impacts, routes are located to conform with developed and planned land uses. If possible, areas of existing or planned development and those designated or zoned for special land uses are avoided.

Access - A location that is accessible from existing roads or where access can be developed without undue environmental disturbance or cost.

An important factor is reasonable access to the line. Access is required to admit men, machinery, and heavy equipment during construction and for maintenance. Existing access is used, where practical, to reduce environmental impacts accompanying new road construction.

Reliability A location to minimize the possibility of transmission line failure from natural causes.

To insure adequate reliability and reduce long term maintenance costs a transmission line is best located where each structure has solid footing. The loss of a tower from natural phenomenon such as a landslide or severe weather can cause serious disruptions in the availability of electric energy.

Generally, the most important factors affecting the cost of a transmission line are the length and number of angle structures required. Variations in topography or land use also can significantly influence cost. For example, 3 miles of line across open landscape may cost less to built than 1 mile with an extremely long span over a river or highway. Stronger, heavier towers with more materials are required at points of sharp changes in direction (angles) A typical 345-kV double circuit steel tower "angle structure" requires approximately four times the quantity of steel needed for a similar tower "tangent structure" on a straight segment. The number and size of angle structures becomes an important factor in reducing cost since steel represents approximately 46 percent of the total cost of the line.

Environmental Impact - A location is sought that will not have undue adverse effects on the natural or human environment.

One important goal of the reconnaissance team is to reduce environmental impacts. The team tried to use existing information as well as field observations to identify, anticipate, and minimize potential impacts. Strong consideration was given to environmental factors, cost, and reliability.

Since size and shape of transmission towers may cause significant visual impacts in areas of high scenic quality, lines are usually located where least visible from highways and viewpoints. Ridges are avoided and lines are located where they seem most compatible with surrounding landscape.

The potential for stream siltation from soil erosion is another important factor in route studies. Building access roads is probably the single most important factor affecting erosion.

Construction on steep slopes adjacent to streams can lead to accelerated erosion. Such slopes cannot always be avoided but efforts are made to confine the lines to the areas with moderate slopes away from streams.

Elevations above 2,500 feet are ecologically sensitive in the study area. They are avoided where possible. Some of the routes exceed this elevation.

Another important resource, wetlands and natural water systems, may restrict the location of transmission lines. Some wetlands can be crossed with little or no impact if construction and maintenance activities are carefully planned and scheduled. However, most wetlands are avoided. Where it is necessary to cross wetlands, efforts are made to avoid critical environmental impacts.

Method Employed

The reconnaissance engineers used detailed maps, aerial photos, helicopters fixed wing aircraft and land vehicles to investigate the various routes. They also walked over the terrain and consulted knowledgeable individuals, groups, and firms. Maps of various types and scales were used. The most widely used were the USGS 7.5 and 15 minute, and the 1=250,000 map series. Both black and white, and color aerial photographs at a scale of approximately 1:24,000 were scanned.

VTN made overlay maps of the resources in the study area. These maps are scaled at 1 inch equals 8 miles. Tentative line locations could be studied and evaluated quickly using these data resource map overlays.

Design Options

The "proposed" plan (Plan E) requires two 345-kV circuits from Dickey Dam to Moore Substation to integrate Dickey-Lincoln School power into the New England power pool grid. Two basic line designs meet the electric system requirements. They are: two parallel 345-kV single-circuit lines using wood or steel structures, or one double-circuit steel-structure line. Both alternatives are discussed in the Transmission Planning Summary Report. Information there demonstrates that a double-circuit, steel-structure line would result in the least environmental impacts and least cost. The route discussion which follows, therefore, assumes that a double-circuit steel-structure transmission line would be built there. However, route location requirements for wood-pole or steel-tower transmission lines are very similar. The use of wood-pole structures through selected sensitive areas is not precluded.

Labeling Scheme

Over 770 miles of routes were studied in this phase of the report. To organize the analysis, a system was needed to describe specific areas easily and precisely. A labeling scheme accomplished this by assigning an identity to each portion of each route. This method is intended to help coordinate the DOI and contract efforts and to enable the reader of this report to systematically follow descriptions of the routes.

The scheme uses link and mile numbers for each route. Link numbers are assigned to each route segment, and mileposts are established to locate specific points along each route. For example, Link 4, Mile 2.2 refers to a point 2.2 miles from the beginning of Link 4. This point is found on Map 1 by measuring south 2.2 miles from Dickey Substation, the beginning of Link 4. Fold out maps which show the routes and identify the links are placed inside the back cover of this report.

Route Discussion

Lincoln School - Fish River

Two alternative routes are shown for the 138-kV transmission line between Lincoln School and Fish River substations. Both routes are south of the St. John River and about 18 miles long. The northern of the two, identified as Link 1, parallels State Route 161 with 1,000 feet to 1 mile separation. It crosses fields and forests along the lower slopes of the hills south of the highway.

Link 2 also parallels Highway 161 but is some 3 miles south of the highway It crosses fields and forests, but the bulk of the forests lie on the western portion of the link. Link 1 follows the north side of a ridge paralleling the St. John River. Link 2 is on the south side of the ridge.

Links 1A and 1B near Lincoln School and 1C near Fish River are common to either route. The Lincoln School-Fish River alternatives are discussed below:

Link 1A - This 1/4-mile link runs southeast from Lincoln School Dam and Substation across farmland. The link would accommodate a line between Dickey and Lincoln School and one between Lincoln School and Fish River. This is the shortest path across the farms from the proposed substation. Two lines sharing a common right-of-way over this location would reduce impacts and land requirements. A transmission line here would impose greater impacts to farms than to forests since farmland is scarce and restricted to the St. John Valley.

Link 1B - Link 1B is 1/4 mile long and crosses forested area. Link 1B is separately identified to distinguish it from Link 1A which contains two lines. It connects Link 1A with Link 1 or 2.

Link 1 - Link 1 begins at the eastern end of Link 1B. This route generally follows the base of the ridge. It was placed there to avoid farms, reduce visual impacts and minimize costs. This location avoids most of the farms. They occupy the flatter areas of the valley and extend to the base of the ridge. A transition area provides a background screen and makes the line less obvious to persons traveling the highway or living in the valley. A line is easily accessible along this link. The cost of acquiring right-of-way is assumed to be less than for farmland, although clearing costs will be higher. The route crosses rolling terrain so construction will disturb the soil moderately.

Link 2 - Link 2 proceeds southeast from the eastern end of Link IB, roughly following Pettie Brook to Bran Lake. As it continues northeast, this route parallels the St. John River Valley about 4 miles south of the river.

Link 2 avoids most of the developed lands for the first 14 miles. The route crosses forested areas and passes adjacent to Hunnewell and Wheelock Lakes. Development in this area is limited to roads parallel by this route. However, the lakes along this route have recreation potential.

About 5 miles west of Fish River Substation, Link 2 crosses lands supporting developments and farms. This location follows the edge of these lands. It uses some of the beneficial edge considerations mentioned above.

Link 1C - Links 1 and 2 merge just east of scenic State Route 11. Link 1C runs for 1/2 mile from this point to Fish River Substation. It provides a good crossing over the highway and Fish River. The crossing avoids homes along State Route 11 and would be inconspicuous to travelers along this highway.

Dickey Lincoln School

Only one route alternative is identified between Dickey and Lincoln School substations. It comprises Links 3 and 1A and is approximately 11 miles long.

Link 3 - This route crosses the Allagash River and closely parallels the St. John River and State Route 161. The location is largely dictated by the topography and a lack of good places to cross the Allagash River.

Dickey Dam is to be built on the St. John River above its confluence with the Allagash River. However, the reservoir formed behind the Lincoln School Dam downstream from Dickey will back water to the tailrace of Dickey Dam, and about 2 miles up the Allagash. The Allagash Wilderness Waterway begins about 5 miles from the mouth of the river and continues upstream to its source.

Link 3 crosses the Allagash 3 miles below the lower end of the wilderness waterway near the backwater from Lincoln School Dam. The topography on both sides of the river is suitable for crossing without high or costly structures. This crossing also minimizes adverse impacts to important scenic and recreational qualities of the river as the line approaches Dickey Substation.

Link 3's location is constrained by topography east of the Allagash River. Steep hills rise to 1,500 feet along the south side of the St. John Valley. The location minimizes changes in elevation by avoiding high points and steep slopes, thus reducing environmental impacts and costs.

Individual angles were placed along this link at miles 1.8, 2.9, 3.5, 4.6, 5.9, 6.8, and 8.2 to conform as much as possible to the topography. For example, the angle point between Casey and Wesley Brooks makes it possible to avoid the steep slopes to the north and the higher elevations north and south of Link 3. The angle placed at Mile 8.2 accomplishes a similar result. At this point the route crosses a small notch between McLean and Wiggins Brooks by passing higher, steeper slopes.

Link 3 crosses forest land. It lies 1,000 feet or more from State Route 161 but is intermittently visible. Frequent spur roads off State Route 161 would permit access to the line between Dickey and Lincoln School.

Dickey Midpoint

Only one route, Link 4, is identified between Dickey Substation and Ross Lake. Near Ross Lake, Link 4 terminates and Links 5 and 9 begin. The area southwest of Dickey is heavily forested. It is an important timber producer and has recreation potential. In general, this part of the route is remote with limited access. Most of the area is owned by private timber companies.

Link 4 - This 46-mile link originates at Dickey Substation. It rises to a bench facing the Allagash River and parallels the river southwest for about 1-1/2 miles.

The route in this area is given special consideration because of its proximity to the Allagash Wilderness Waterway

Locating a route on this bench reduces visual impacts by using the topography and vegetation to screen the line. The hillside behind the bench offers background screening. Trees would furnish foreground screening and hide most of the towers on the sky line.

About 1-1/2 miles from Dickey Substation Link 4 leaves the Allagash River. The river runs north while Link 4 goes southwest. As Link 4 enters the West Twin Brook drainage at Mile 2.2, it is no longer visible from the Allagash. However, detailed visual studies are being done to determine the visibility of the line northwest of the Allagash in the vicinity of West Twin Creek. Link 4 then continues southwest for some 44 miles. Slight variations are made from this general heading to accommodate specific concerns or avoid certain features. The landscape in this area is homogeneous and lends itself to a straight route that would reduce costs and environmental impacts. It also permits the use of existing roads for access.

About 5 miles from Dickey Substation, Link 4 begins to parallel a road along the south branch of West Twin Brook. Link 4 parallels this road for about 1-1/2 miles. The line was located on the side of the ridge east of the road to take advantage of the access and to avoid the wet areas adjacent to the brook. This location also avoids some of the steeper areas near McKinnon and West Twin Brooks.

As Link 4 approaches Farm Brook, the visual impact to users of the Allagash Wilderness Waterway again becomes evident. At Mile 10, Link 4 is within 2 miles of the River. At this distance, the cleared right-of-way and some of the steel towers would be visible. However, the vegetation along the Allagash provides screening at most points.

The location is confined to the slopes above Farm Brook to avoid wet areas near the brook and uses existing roads.

Link 4 between Mile 10 and Mile 20 crosses rolling forests of hardwoods and conifers. Small angles are placed at Mile 11.4 and 15.8 to avoid wet areas and higher elevations.

An angle point at Mile 23.4 takes advantage of the hill south of Blue Pond. By using this point the line can angle to the south without requiring extra towers. It also ties in with the tangents north and south of this angle point.

From the angle point at Mile 23.4, the route runs straight for 7.8 miles crossing Whittaker, Harding, and Cunliffe brooks. Most of the link is on the middle or upper slopes of hills at elevations between 860 and 1,400 feet.

An angle point south of Cunliffe Brook takes advantage of the topography and existing access. It is at Mile 31.2 on a small hill above the surrounding wet area. The tower site located on the hill provides clearance needed to span the surrounding wet areas. Lands near Cunliffe, Whittaker, and Harding Brooks are dominated by spruce and balsam fir. Other parts of this section are along the better drained hardwood forest sites.

Link 4 follows a straight path for 14.5 miles. Beyond Cunliffe Brook, a slight angle is placed at Mile 34.8 to take advantage of local topography and obtain a good crossing of wet areas near Homes Brook. The last 10.9 miles of Link 4 cross flat, poorly drained land that is heavily forested with spruce and fir. In general, drainage is poor east and west of Link 4. Thus, Link 4, which follows the divide between the Allagash and St. John River drainages, offers a sound line location based on engineering and environmental considerations.

Link 4 joins 5 and 9 at Mile 45.7. Advantages of an angle at this point are described under Link 9.

There are a number of alternative routes on this section. However, two major corridors are identified. The routes are modifications within these corridors. One corridor includes Links 4, 6, 7, and 8. It roughly parallels the Canadian border at distances of 6 to 18 miles. This corridor goes east of the many lakes in this area. A switching station is proposed near U.S. Highway 201 about 3 miles north of Moose River. A second corridor further east contains Links 9 and 9A. This corridor passes near a number of large lakes including Seboomook and Moosehead Lakes. It passes east of the village of Jackman. A midpoint switching station site is located between Jackman and Long Pond 1/2 mile south of State Route 14. Links 10 and 10A offer opportunities to select portions of either corridor by connecting them north of Jackman.

<u>Link 5</u> - At the end of Link 4, Link 5 goes southwest for approximately 22.7 miles. In this 22.7 miles only two angle points are located. They are at

Miles 2 and 13.3. The angle point at Mile 2 assures a sound crossing of Fool Brook and adjacent wetlands and uses existing access. The angle at Mile 13.3 accomplishes similar results. This location on the side of the ridge parallel to the Baker Branch makes use of existing access and topographic features. These and other considerations clearly establish this spot as a good place for an angle structure. However, the main reason for an angle at this point was to separate Baker Lake from the route. The small angle in the line placed 9-1/2 miles north of Baker Lake moves the line away from the shore of the lake.

Wetlands with dominant stands of spruce and fir exist near Turner Brook and the Baker Branch. The route goes through this wet area. Alternatives north or south of the route are even less desireable. But it is Baker Lake to the south and the large expanse of wetlands to the north that determine the route location.

The angle point at Mile 22.7 is easily accessible from a major haul road. At this point, Link 5 turns south to an angle at Mile 26.5, which is also near a forest road. From here the line goes southeast again. These two angle points help avoid Baker Lake and neighboring wetlands and take advantage of existing access south of the lake.

Angles placed at Miles 26.5 and 36.4 of Link 5, hold the route close to the forest road. From angle point 36.4, a tangent extends south approximately 2.2 miles to the southern end of Link 5.

The location of the terminal point for Link 5 is controlled by its intersection with Link 7 They meet on a hillside east of the East Branch of Norris Brook.

Link 6 The key element in locating Link 6 is a crossing of the North Branch of the Penobscot River at Mile 2.8. This river is under study for certain uses included in the National Wild and Scenic Rivers Act. Should the river be included under the act, the use of land near the river will be restricted. Treating this river as wild, the route is located to comply with all restrictions under the act. Similar restrictions would apply at Mile 6.3 where this route again crosses the North Branch. At both crossings the line would be near a road adjacent to the river. A bridge exists at Mile 1.4. Heavily forested areas adjacent to the river would provide adequate screening.

Link 6 is close to an existing road for the first 6 miles. Throughout this distance it is within 3,000 feet of the road. It crosses the road at Mile 1.7. This reduces costs for access as well as environmental impacts. To follow the road, angles were placed at Miles 1.4, 3.9, and 6.0.

At Mile 6.0 Link 6 leaves the road. The North Branch is crossed at Mile 6.3. Another angle was placed at Mile 7.2. This angle makes use of a favorable river crossing and provides a good approach to the rugged area of Green Mountain.

Angles placed at Miles 9.5 and 11.3 allow crossing the mountain without locating on steep slopes or high elevations. The route passes through a notch immediately east of the lookout.

The angle at Mile 9.5 determines the southern approach to Green Mountain and avoids wetlands near Lone Brook. Link 6 is about halfway between Little Lone Pond and Lone Brook to minimize impact on them. The straight tangent to the junction of Links 6 and 8 crosses spruce-fir and hardwood forests, but avoids steep slopes and wetlands.

Link 7 - Link 7 is an alternative to Link 6. It is about 1.2 miles longer and closely parallels existing forest roads for 4.5 miles. Link 6 parallels approximately 6 miles of existing roads and passes through the notch. It crosses the Penobscot River twice. Link 7 skirts Green Mountain but does not cross the river.

Only three angles are placed in Link 7 The first angle, at Mile 2.9, is south of the East Branch of Norris Brook. The area on either side of Norris Brook is very wet. This angle holds the first part of Link 7 away from the streams and wetlands.

A second angle at Mile 10.0 moves Link 7 closer to existing forest roads. This angle point is about 100 feet from a road. Link 7 parallels this road for approximately 4 miles providing good access.

The last 5.5 miles of Link 7 are straight except for a slight angle at Mile 7.3. After leaving the Long Pond area, the route roughly parallels Little Penobscot Brook. In this section, Link 7 crosses land forested primarily with spruce and fir. No major roads are encountered until its junction with Link 8. Wetlands and topography do not restrict a line in this area.

Link 8 This 10.3 mile link is used if either Link 6 or 7 is selected. If Link 7 is followed, no angle structure is needed for the first 2.2 miles of Link 8. However, if Link 6 is chosen, an angle is needed at the beginning of Link 10. In either case, the first 2.2 miles of Link 8 traverse the hill east of the Penobscot River. The route is 1,500 to 4,000 feet from the river. In this area, it is near existing roads and away from the river and adjacent wetlands.

An angle at Mile 2.2 takes advantage of a crossing of the South Branch of the Penobscot River. The crossing occurs at Mile 2.7 at a point west of the inlet of Canada Falls Lake. This location avoids the large wetland on the west end of the Lake and is east of the structures along the Penobscot River.

An angle at Mile 3.6 approximately 1,000 feet east of Beaver Pond connects the tangent crossing the river with the 1.9-mile long tangent east of Trickey Ponds. In this segment, the route closely follows an existing road for access. This location on the slopes above Hale and Alder Brooks avoids both the higher hills and the wet areas at lower elevations.

Two additional angles are placed at Miles 5.5 and 8.3 along Link 8. The first angle is small (approximately 5 percent) It avoids hills east of the angle point and a pond to the west. The second angle, on the slope south of Alder Brook, is selected because the site is stable and near a road.

<u>Link 9</u> - Link 9 is an alternative to Links 5 through 8. This 63.6-mile link begins west of Clayton Lake at the southern end of Link 4. It follows a southerly course through the lakes region for about 45 miles to a point north of Moosehead Lake and then goes southwest toward Jackman. Link 9 avoids the steeper slopes and higher elevations near the Canadian border.

Only two angles are placed on the first 9 miles of Link 9. These angles occur at Miles 3.4 and 6.5 to avoid Maple Ridge to the west. Access in this section is generally fair although no through road system parallels the route.

At Mile 9.1 the route angles southeast. The angle enables the route to skirt the hill west of Allagash Pond, and makes use of existing roads. The route begins to parallel existing roads at Mile 10.0. From here through Mile 13.2, the route follows within 600 feet of existing roads. An angle at Mile 10.6 follows the road and avoids wetlands next to Allagash Stream.

The tangent beginning at Mile 10.6 continues to Mile 14.4. At Mile 13.2, Link 9 ascends a ridge east of Wadleigh Pond and leaves the road. Locating the route on the hill avoids Wadleigh Pond by about 1/2 mile.

An angle on the hillside west of Wadleigh Stream at Mile 16.5 is about 1/2 mile northeast of St. Francis Lake. This is well away from the lakeshore and close to forest roads.

From an angle at Mile 19.4, the line crosses the lower slopes south of Cayoomgomoc Mountain and Telephone Hill. These topographic features control the route. Angles at Miles 26.6 and 29.3 send the route over the western side of steep slopes in the area.

Further south, angles at Miles 32.0 and 36.8 hold the route to moderate elevations between steep high hills to the west and low wet areas to the east. The angle at Mile 32.0 places the line between Mucalsea Mountain and wetlands near Bear Pond.

The access from Mile 29.3 to Mile 39.7 is fair to poor. However, the area provides good sites for a line, and access roads can be built across moderately sloping ground. Access improves considerably at Mile 39.7 The route then parallels the major private haul road to Millinocket for 5 miles. This road is well maintained and open to the public. Good access is a controlling factor between Mile 38.0 and 39.0. The route follows the road to avoid wet areas near Russell Stream.

At Mile 45.2, Link 9 angles sharply southwest. This angle directs the route between Seboomook and Moosehead Lakes. It makes use of existing access and a crossing of the West Branch of the Penobscot River at a narrow section between two bends. This, together with the screening along the river, makes this crossing good from a visual standpoint. The West Branch of the Penobscot in this area is being considered for certain uses under the National Wild and Scenic River Act.

At Mile 46.5, an angle is placed near the top of the hill between Seboomook and Moosehead Lakes. The right-of-way will be visible from Seboomook Lake but not from Moosehead Lake. By locating the line on the top of the ridge or slightly to the Seboomook side, it is possible to use gently sloping ground and dense vegetation to limit other views from Moosehead Lake.

After leaving the Seboomook and Moosehead Lakes area, the route follows a series of 3 to 5-mile tangents and intersects with Link 10A. Angles at Miles 54.7 and 58.6 adapt the route to avoid steep slopes and wetlands.

The angle at Mile 54.7 is near an existing forest road that provides access to the area. It also directs the line along the road north of Tomhegan Pond. After passing the pond, the angle at Mile 58.6 turns the route south along the northwestern edge of the wetlands next to Tomhegan Stream. From the angle at Mile 58.6 through Mile 63.6, existing access is fair to poor. No major topographic obstacles restrict a direct routing across the area and the north and south branches of Brassau Brook.

<u>Link 9A</u> - Link 9A continues southwest to Mile 4.7 There the route turns slightly westward to parallel a road. This tangent continues for 4.7 miles, 3 miles of which are near the road.

The last 4 miles of Link 9 run along the north slope of a ridge north of Long Pond. Access is good. The location limits visibility from Long Pond and Highway 15 south of the Pond. The angle at Mile 13.2 near the end of Link 9 controls the crossing at Moose River. This crossing is discussed with Link 12.

Link 10 - Link 10 connects the corridors north of Jackman with the corridors south of Jackman. It is 7.9 miles long. Access is fair to good.

For the first 5 miles, this route traverses the slope east of Upper Churchill Stream. This gently sloping, well-drained area is well suited for a route with a minimal number of angles. This route crosses the stream at Mile 5.3 and angles to the west at Mile 5.7 This crossing was selected because of local topographic conditions and the narrowness of the wetlands in this area. The angle west of the stream directs the route toward Link 12 and the only suitable crossing of Moose River.

Link 10A - This link provides an east-west connection between Links 9 and 11. It crosses rolling terrain and managed forests. At Mile 5 the route crosses a wetland north of Luther Pond at a point which allows a single-span crossing. The route goes south of Muskrat and Fish ponds and north of Mud pond. Slight angles avoid wetlands and steep slopes, providing a buffer between the right-of-way and the ponds. The line is easily accessible most of its length from existing roads.

Link 10A joins Link 11 near the source of Upper Churchill Stream.

Link 11A Link 11A is 1.3 miles long. It begins at the end of Link 8 and joins Links 10A and 11 at the head of Upper Churchill Stream. This link runs southwest and follows Alderbrook Trail. It has no angles.

Midpoint - Moore

Link 11 - Link 11 runs southwesterly for 44.5 miles. It parallels the Canadian border at distances of 4 to 10 miles, avoiding most steep areas and high elevations. One of the switching station alternatives is located at Mile 6 to avoid mountains, wetlands, and developed areas.

The first angle along Link 11 is at Mile 2.9 to direct the route across U.S. Route 201 and holds it approximately 1/2 mile south of Heald Pond. This location also avoids some of the more irregular topography north of Kimball Brook.

The route crosses U.S. Highway 201 approximately 3-1/2 miles north of Jackman within the town limits of Moose River. The highway crossing is also north of Daymond and Coburn Ponds. It avoids existing development along State Highway 201. One of the proposed sites for the Midpoint Switching Station is a few hundred feet west of the crossing. This location near the highway provides good year-round access. Access to the first part of Link 11 is only fair.

Approximately .4 miles west of the Midpoint site another angle is placed on a small hill 1/2 mile from Highway 201. This angle is required to direct the route south of Crocker Pond and numerous wetlands. Some existing forest roads are crossed and in general, access is fair.

A series of small angles placed at Miles 11.9, 14.7, and 17.8. These angles keep the line within well-drained areas and near roads. The route avoids crossing many small hills and stays north of Burnt Jacket Mountain where topography is broken by small hills and lakes. Link 11 avoids most of these features passing north of Little Big Wood and Holeb Ponds and between Long and Mud Ponds.

The route crosses the Canadian Pacific Railroad at Mile 19.2, 2 miles west of the Holeb town site. No major communication or interference problems are expected at this crossing. At Mile 19.5, the route crosses Gulf Stream and nearby wetlands. The route spans this wetland area to provide suitable structure sites. It is several hundred feet wide at the narrowest place.

At Mile 22.3, the next angle turns the line south. The angle point is on the slope of the hill north of Twin Island Pond. From this point to an angle at Mile 27.2, the route crosses slopes above the South Branch of Moose River. In this area of the route heavy deciduous forests grow between the high rocky elevations and low wetlands. Although some moderately steep slopes are crossed, the route generally follows the contour of these slopes and avoids steep grades.

Six angles occur between Mile 27.2 and Mile 39.4. These angles enable the line to follow the Middle Branch of Moose River and Gold Brook drainages. The route generally lies on the eastern slopes of these valleys above a road. The location takes advantage of the stable soil conditions and reduces the need for new access.

At Mile 39.4, Link 11 crosses State Route 27, a designated scenic highway. The crossing is just south of Chain of Ponds near the junction of the Gold Brook road and the highway. An angle placed at Mile 40.0 routes the line through narrow valleys east and west of the highway This shields the transmission line from travelers on State Highway 27

After leaving the valley south of Highway 27, the line continues south toward a junction with Links 13 and 14. The angle at Mile 43.8 routes the link to the notch in Round Mountain. This notch is slightly above 2,500 feet. The areas east and west of the notch are higher and steeper.

Link 12 - Few good crossings of Moose River exist between Jackman and Long Pond. The route is also restricted by the Canadian Pacific Railroad, State Highway 15, and wetlands near the river. Of these, its wetlands offer the greatest restrictions. The shortest distance across the wetlands was selected to approach the river crossing. This tangent extends south from the river to take advantage of the small valley created by Halfway Brook. It also crosses the ridge south of Long Pond at one of the lowest points between Jackman and Parlin Pond.

The angle at Mile 3.9 permits the route to follow the lower elevations near Halfway Brook and avoid the steep, high areas of Catheart Mountain. The angle at Mile 7.7 on the west slope of Catheart Mountain turns the line south to avoid the wetlands near Moose River.

The angle at Mile 11.0 sends the line south and east of the poorly drained area near Attean Pond and Moose River. This area is one of the largest wetland regions in the entire study area. Obstacles created by these wetlands together with the numerous steep mountains to the south and east dictated the routing. Stable tower sites are available along this route. Access is fair.

After leaving the wetland area, the controlling topographic features include Chub Pond, Fish Pond, Spencer Lake, Hardwood Mountain, Baker Pond and Camera Ridge. In each case, angles route Link 12 north and west of these features. An angle at Mile 14.9 between Chub and Fish Ponds changes the direction of the line toward a good stream crossing 1/2 mile north of Fish Pond.

Another angle placed on a small ridge northwest of Hardwood Mountain to good spans in both directions. The tangent south from this angle point continues for several miles skirting the west side of Baker Pond. It follows the valley between Spotted Spruce Mountain and King and Barlett mountains.

The angles at Mile 26.2 and Mile 27.4 route the link around Camera Ridge and along good access between Miles 26.2 and 30.7 Access to the route on either side of this section is fair. Water bodies close to the route include Felker Everett, Chittenden, Little Jim, and Jim Ponds.

After leaving the Jim Pond area, Link 12 crosses the North Branch of Dead River and Highway 27. These crossings are 2 miles north of Eustis and away from recreational and other developments. Highway 27 in this area is a designated scenic highway. Dense vegetation, a mix of conifers and deciduous trees on both sides of the highway, would screen the line year round.

At Mile 34.6 the route angles sharply west and continues for 3.4 miles to follow the road along Tim Brook. The line lies within 1/4 mile of the road from Mile 34.5 to Mile 37.8, providing good access.

Link 12A - Link 12A runs parallel to Tim Pond Road within 1/2 mile. Slight angles at Miles 1.6, 4.1, and 5.3 take advantage of favorable terrain. Some of this area is low and covered primarily with conifers.

The angle at the end of this link falls on the lower slopes of Threemile Ridge for good access and stablility

Link 13 - Link 13 connects Links 11 and 25 and provides a cross-over from the northern to the southern corridors.

This route skirts wetlands for 3 miles near the confluence of the North and South Branches of Alder Stream. At Mile 3.8, the line angles west parallel to the road east of the South Branch of Alder Stream. Access is good from this point past Mile 6.0, where Link 13 ends.

Link 13A This 9.6-mile link also takes advantage of an opportunity to join the northern and southern corridors, and thus provides more flexibility in selecting a final route. Link 13A connects Link 12 with Link 14, running from east to west. The link's three small angles avoid steep terrain and use existing roads that provide good access.

Link 14A - From the end of Link 11, Link 14A goes west for 4 miles through forests toward the Kennebago River. The first significant topographical feature encountered is a ridge between the North and Middle Branches of Alder Stream. The route crosses this ridge on a slope well below the summit. It passes through a saddle, then a basin in the upper end of the West Branch of Alder Stream and terminates on a small ridge. Access is fair.

Link 14 - This route passes between high mountains. It crosses the Kennebago River at Mile 1.5, north of Cow Ridge. This crossing avoids some large wetlands along the river. Both the river and adjacent wetlands are crossed with a single span.

After crossing Kennebago River, the route goes up the slope west of the river Slopes along this ridge are steep in places, but the route follows a diagonal path up the slopes to minimize the impacts usually associated with steep terrain. At the top of the ridge, the route exceeds and elevation of 2,500 feet for 1/4 mile.

As mentioned, areas above 2,500 feet are ecologically sensitive. Much of the route is above 2,500 feet between Mile 6.0 and 9.1. The link, however, never goes above 2,700 feet. The alternatives exceed 2,700 feet. Link 14 passes south of Kennebago Divide (3,645 feet) and north of Snow Mountain (3,755 feet)

Access to this route is poor for the first 4 miles of Link 14. Topography is rugged, and access roads difficult to build. Near the end of Link 14, access and topographic conditions improve.

Link 15 This link begins about 3 miles south of the Canadian border near the Cupsuptic River. It follows a route north of Bottle Mountain and south of the ridges marking the U.S. Canadian boundary. Link 15 avoids those areas above an elevation of 2,500 feet.

Link 15 passes north of Parmachenee Lake. Some wet areas are encountered, especially near a crossing of Magalloway River. The river is crossed near the confluence of the First East Branch and Main branch of the river. An angle is placed at Mile 3.4 to avoid wet areas near Moose Brook. This link does cross some poorly drained areas as indicated by the presence of conifers but sound structure locations are available.

After crossing the Magalloway River, Link 15 runs west to Mile 9.4. There the route turns southwest and crosses the Little Magalloway River. Access in this area is fair and the topography is favorable for a transmission line. By crossing the Little Magalloway near its upper reaches many of the wetlands downstream are avoided.

The route follows Trestle Brook west from the Little Magalloway River for 2 miles. Link 15 leaves the Trestle Brook drainage to run along the slopes southeast of Second Connecticut Lake.

The route across the slope is about 2,300 feet above sea level. This location is more than 1 mile from the lake, but runs below higher, steeper areas. Placing the route at this elevation confines impacts to gentle slopes and views of the right-of-way from Second Connecticut Lake. An existing road provides good access for the last 2.8 miles of the line.

Link 16 Link 16 offers the alternative of going south of Parmachenee Lake. This 15.5-mile route is 0.3 mile shorter than Link 15.

The first 0.6 mile of Link 16 is a continuation of the last tangent of Link 14. An angle at Mile 0.6 turns the line south of Bottle Mountain and avoids the steep slopes east of the Cupsuptic River. The road along the river provides access to this part of Link 16.

South of Bottle Mountain, this route rises above 2,500 feet for .2 mile. The topography is rugged. Existing roads provide fair access.

This link passes within 1/2 mile of Parmachenee Lake south of a ridge southeast of the lakeshore. By placing the route in this location, the ridge provides screening.

West of Parmachenee Lake, the route goes north of Bosebuck Mountain and then along the north slope of Stub Hill. On Stub Hill the route exceeds an elevation of 2,750 feet for about 2 miles.

Most of the region east of Parmachenee Lake is high and mountainous. Alternative routes through this area were not considered they cross steeper and higher slopes. The link ends on the ridge above Second Connecticut Lake.

Link 17 - Link 17 parallels the east shore of First and Second Connecticut Lakes. The route is 1-1/2 miles from the lake on a bench halfway up the slope. The bench along Link 17 is more pronounced than along Link 15. Fewer engineering and environmental problems are expected.

Link 17A - This 9-mile link leaves the Connecticut Lakes and runs south toward Diamond Pond. The topographic features are more restrictive than for Link 17. requiring five angles. Features controlling the route's location include Cedar Mountain, Alder Brook, Diamond Ridge, and Diamond Pond. This link ends on the north slope of Sugar Hill about 1/2 mile from Little Diamond Pond. Access is fair to poor in this section.

The topography and vegetation between the two Diamond Ponds and Link 17 would partially obscure the transmission line. However, Little Diamond Pond falls within Coleman State Park where the natural environment is sensitive.

Diamond Pond is larger and more heavily developed. Link 17A goes within 1,000 feet of the pond and the terrain does not screen the line well. Most of the development, however, is along the southwest shore of Diamond Pond. This influenced the route location. This, together with the aspect of the slope make this route more acceptable. Wood pole structures and selected clearing should be considered in the area near these ponds.

Link 17B - Link 17B avoids Coleman State Park and Diamond and Little Diamond Ponds, which are popular recreation spots. It passes west of Roundtop Mountain and Dead Water Ridge, angles left at Mile 7 near Hedgehog Hill, and follows the Ferguson Brook drainage for 2 miles to another angle point. There the route turns south, leaves the timber and enters an area of scattered farms.

The primary considerations in locating the last 5 miles of Link 17B are to avoid skylines, open farmland, and dwellings. The route goes along the west side of Holden Hill and Harvey Swell, avoiding as many farms and roads as possible.

Access is fair for the first 9 and good for the last 5 miles. This link joins Link 18 about 0.7 mile northwest of Kidderville.

Link 18 - Links 18 and 19 mark a transition from forest to farmland. Topography and access become less significant. Potential conflicts with land use and human activities assume greater importance.

Link 18 begins on the ridge north of Sugar Hill within Coleman State Park. The first angle is placed at Mile 0.8 on the west side of the road to Diamond Pond. The angle is midway between the road and East Branch of Hix Brook.

This angle directs the route south, skirting the farmland adjacent to the road. The angle at Mile 3.5 turns the line west so it crosses the east and west branches of Hix Brook, 1/4 mile upstream from where they join. A cultivated field is crossed at Mile 3.8, but the other fields along East Branch of Hix Brook are avoided. Link 18 ends on high ground 0.7 mile northwest of Kidderville.

Link 18A This link assumes a southerly heading and ends at Mile 6. The Mohawk River and Highway 26, identified as a scenic highway through Dixville Notch, are crossed in the first mile. Some farmland is crossed here and at Miles 1.3, 2.8, and 3.8. At other places the route crosses forest land and abandoned fields. Access on this link is fair to good.

Link 19 Link 19 begins in Coleman State Park and follows the east slopes of Sugar Hill and Van Dyck Mountain where it is visible from roads and residences in the area. Farmland is crossed at Mile 1.9 and at Mile 3.5. An angle at Mile 4.1 directs the route toward the base of Baldhead Mountain, and away from steep slopes. This angle minimized the amount of farmland crossed on the approach from the north.

At Mile 4.7. Link 19 crosses Highway 26 and the Mohawk River. Farms lie on both sides of the crossing. No location is available in this area that does not cross some farmland or interfere with recreational development east of the crossing.

Most of the last 5 miles of Link 19 cross forest land of mixed species. Some farms through this area are abandoned and reverting to forest. No major topographic obstacles exist to prevent a 6-mile tangent. Access to all of Link 19 is fair.

Link 20 - From its beginning on the slope east of Bog Brook, Link 20 goes almost due south for 0.6 mile. An angle is placed on a level area of the ridge 1/4 mile northeast of Cranberry Bog Notch.

At Mile 2.8, a second angle directs the line away from Nash Bog Pond. The tangent approaching this angle follows an existing road across the lower slopes of Whatcomb Mountain. South of the angle, the line parallels the east side of Nash Bog Pond at a distance of 1/2 mile. At Mile 4.2, Link 20 crosses a ridge and follows the East Branch of Nash Stream.

Several small angles allow the line to follow the Nash Stream Valley well below the rugged upper slopes. At Mile 6.5, the route nears the road, linking Highway 110 and Nash Bog Pond. Prior to this point, access is fair, but from Mile 6.5 to the end of Link 20 access is good.

Link 21 - Link 21 crosses Nash Stream and an adjacent road at Mile 0.1. It crosses the lower slopes of Bog Hill. The terrain is rolling and well suited to a transmission line. Access exists, but it is not continuous.

The topography along the first 3 miles of Link 21 offers few problems. Two angles are needed to approach the Upper Ammonoosuc River and Groveton. An angle at Mile 4.1 establishes a river crossing about 100 feet downstream from the dam. An angle south of the river turns the line from Moore Mountain toward an existing transmission line and Link 34.

Link 22 This 2.4-mile link offers one alternative to connect Link 21 with Link 33 which parallels the existing transmission line into Groveton. The major advantages of this route are length and low cost. Disadvantages include potential interference with an airstrip, steep topography, and visual exposure on a hill east of Groveton. Access is fair to good, and not much different than that of the other alternatives.

Link 23 - Link 23 connects Link 20 with Link 22 or 24 This portion of the route is common to the routes over or around Beech Hill. Link 23 is 1.4 miles long and has no angles. The link runs along the slope east of Nash Stream where no access exists, but conditions are suitable for roads. The southern end of this link allows Link 24 to follow the slopes below Jimmy Cole Ledge.

Link 24 - Link 24, along the slope below Jimmy Cole and Potter Ledges, is partially screened from viewpoints along the road. Construction is possible without removing now existing dwellings. This link crosses the Upper Ammonoosuc River parallel to an existing line and joins Link 32.

Link 25 - The first mile of Link 25 parallels an existing road across the south branch of Black Brook. This is not a major stream and the road provides good access through the wetlands. The angle at Mile 1.0 directs the route around the wetlands between Threemile Ridge and Kennebago Lake and follows the road to Little Kennebago Lake.

At Mile 4.8, the route crosses the Kennebago River 1/4 mile south of Little Kennebago Lake. The river crossing avoids as much recreational development around Kennebago and Little Kennebago Lakes and along Kennebago River as possible. Tops of structures may be visible from camps along the lakes. This tangent continues through Mile 8.0 where the direction of the line changes. At Mile 6.4, Link 25 crosses the West Kennebago Mountain Trail. This trail would lose some of its wilderness quality

Access is good from Mile 9.6 to Mile 13.0. In this segment, Link 25 closely parallels an existing road along the north slope of Daddy's Ridge. The route crosses the Cupsuptic River near the mouth of Beaver Brook. Good access to the river at both sides of this crossing is expected to alleviate any problems.

Another angle at Mile 12.6 turns the line south. This angle begins the tangent which extends onto Link 26. Link 25 ends at Mile 14.1 on the small ridge southwest of Cold Brook. Access to the last 1/2 mile of Link 25 is fair.

Link 26 - The last tangent of Link 25 extends 2.6 miles into Link 26. Three small angles along Link 26 are required at Miles 4.0, 6.2, and 7.1 so the route can follow the ridge but bypass its highest points.

Although this link is below an elevation of 2,500 feet for its entire length, it crosses sensitive areas. The upper steep slopes of the ridge southeast of Aziscohos Lake are important for esthetic and ecological reasons.

One particularly important physiographic feature is Observatory Mountain. Link 26 passes between the two peaks of this mountain and down the steep southwest side. The right-of-way would be very visible to travelers on Highway 16.

From the angle on Observatory Mountain a 2.7-mile tangent extends to the end of Link 26 southeast of the Aziscohos Mountain summit. Access to the last portion of Link 26 is fair to poor.

<u>Link 27</u> - While Link 26 straddles the ridge between Aziscohos Lake and Richard Pond, Link 27 follows a low route between Richardson Pond and Mooselookmeguntic Lake. This route roughly follows Route 16, crossing it once at Mile 3.2.

Link 27 is low in elevation and close to State Highway 16. It is 2.2 miles longer than Link 26. The added length results from angles inserted to bypass Richardson Pond and the high elevations west of Cupsuptic Lake.

At Mile 3.6, the first angle is controlled by the notch at Mile 3. The tangent continues .6 mile beyond this notch. The approach to the next angle is good. Access through this area is fair to good. The better access is between Miles 3.0 and 7.0.

Two important concerns in the last section, Miles 7.7 to 11.8 of Link 27, are to avoid wetlands and to minimize visual impacts. Upper Richardson Lake, Richardson, East Richardson, and Little Beaver Ponds, are engineering and environmental obstacles. The area is poorly drained and visible from Highway 16. These concerns suggest that the line should be somewhere between the shorelines and Highway 16. Access to the last 4.8 miles is limited and fair.

Link 28 - Locating a transmission line on Aziscohos Mountain would be unacceptable from environmental and engineering viewpoints. Thus, Link 28 goes around Azischohos Mountain and Pond. The first three angles accomplish this objective. A fourth and fifth are needed to cross the Magalloway River and adjacent wetlands. The river is crossed at Mile 3.2, but the wetlands, which are over a mile wide in places, are crossed between Miles 4.1 and 4.6.

The point at which the line crosses the river is also controlled by the location of Highway 16 and the ridges to the west. Specifically, a route along the steep eastern slopes of Mt. Dustan and Diamond Peak is not feasible because of the route's high visibility, a lack of a good crossing of Magalloway wetlands, and the engineering difficulties that would be encountered on the steep slopes. For these reasons, Link 28 is placed west of these mountains.

At Miles 5.1 and 6.1, the Dead Diamond River and the Swift Diamond Rivers are crossed. The end of Link 28 at Mile 7.7 is on the west side of Mount Dustan. Access to this area, like the rest of Link 28 is fair.

Link 29 - This 5.2-mile link begins on the east slope of Mount Dustan. An angle at Mile 1.7 turns the line to the south along the west shore of Little Greenough Pond. The route is confined to the flat area at the base of the ridge west of the lake. It is several hundred feet from the lake. Ample vegetation should be retained to screen the route from viewers on the lake.

At Mile 2.2, Link 29 runs roughly parallel to a road along Greenough Pond and Greenough Brook. This road provides good access along the base of Black Mountain. The road also separates the route from Greenough Lake and minimizes impacts to the scenic and recreational qualities of the lake.

Link 30 Link 30 is slightly longer than its alternative Link 29, but it has two fewer angles. In addition, Link 30 crosses high undeveloped areas where access is only fair. At Mile 2.3, the only angle on the route is 1/4 mile west of Little Bear Brook Pond.

Although Link 30 is not as close to Greenough Pond as Link 29, the visual impact to users of the pond may be as great. The route lies on a slope above the southern shore of the lake. Both the right-of-way and individual towers would be visible. However, Link 30 is well screened from Little Greenough Pond.

Link 31 - Link 31 parallels the road leading to Greenough Pond for the first mile. At Mile 0.9, an angle turns the line toward the west away from a residence on Highway 26. Angles are placed on both sides of Highway 26 at Miles 1.4 and 1.6 to avoid residences and shorten the tangent crossing the highway.

Clear Stream is crossed at Miles 1.6, 2.2, and 2.7. These multiple crossings are required to avoid farms and residences along Highway 26. This location keeps the route from being next to the highway. An angle at Mile 2.6 turns the line to the southwest parallel to Millsfield Pond Brook and an adjacent road. This valley provides the only path from Clear Stream to Groveton which does not cross high mountains.

The route angles south at Mile 5.0 and passes about 700 feet east of Long Pond. The route is confined to the valley between Signal Mountain and Mount Patience before crossing Newell Brook. The topography is rugged throughout this region, but Link 31 avoids the extreme areas. Angles at Miles 9.3 and 11.3 are needed to bypass Dummer Ponds and the wetlands near Phillips Brook. Access to this section of Link 31 is limited, but conditions for constructing new roads are fair.

An angle at Mile 13.3 directs the line toward the Ammonoosuc River and an existing transmission line north of it. Link 31 joins the line at Mile 17.2. Access improves from fair to good because existing facilities can be used. The route continues along the less developed north side of the existing line until Mile 19.5. There the route crosses over the existing line to the south side. A crossing at this point eliminates the need for special "cross over" structures and places the proposed route on the least sensitive side of the existing line.

Link 32 - This 1.8-mile link is independently identified so that Link 33 can be used in conjunction with Links 24 to 31. The route parallels an existing line on the south side and includes one small angle at Mile 1.5. This route crosses the Upper Ammonoosuc River east of Beech Hill. A line on this route should not interfere with air traffic using the airstrip east of Groveton.

Link 33 - Link 33 parallels an existing line on the line's south side for 2 miles, beginning at the junction of Links 22 and 32. It connects these links with Link 34. Existing access to this route is fair.

Link 34 - This short link, south of the existing line, connects Links 21 or 33 with Links 35 or 38. It extends Link 33 an additional 0.4 mile to Link 38. Link 34 ends at the intersection with the existing line running south from Groveton toward Whitefield. Link 38 begins at this point on the west side of the existing line.

Link 35 - Southwest of Groveton, Link 35 traverses the lower slopes west of Cape Horn. It is visible from various points along the Connecticut River. Topographic and vegetative screening are used where possible.

The Connecticut River is crossed at Mile 5.1, .7 mile west of U.S. Highway 3. The topography is favorable and there are no developments along the highway or river, but some fields are crossed on both sides of the river. Dwellings are avoided. This link ends south of Duran Mountain at Mile 6.3.

Access along Link 35 is fair for the first 4.6 miles. Near the river, on both the New Hampshire and Vermont sides, access is good.

Link 36 - A heavy angle structure is required between Link 35 and Link 36. This angle turns the line northwest from the Connecticut River Valley. The route leaves the valley at Mile 2.4 and passes through the notch between Halibut and Sheridan Mountains.

At Mile 3.6, the Link crosses Catbow Brook 1/2 mile south of Adden Mountain near the western end of the wetlands southwest of Sheridan Mountain.

From the angle at Mile 5.9, only small angles are required to Mile 13.9. Topography is rolling and land use constraints do not limit location. As the line approaches its terminus at Mile 18.7, it comes closer to the Connecticut River. The angle at Mile 13.9 turns the route slightly to the south toward Moore Reservoir. At Mile 14.4, a small transmission line right-of-way is crossed. This link ends at Mile 18.8 where it intersects the existing line along Moore Reservoir. Access is fair to all of Link 36.

Link 37 Link 37 is an alternative to Link 36. This 11.8-mile link runs along the Connecticut River toward Luneburg and beyond. Small angles placed along this route avoid populated areas. Topographic features do not impose serious restrictions.

This route is much closer to the Connecticut River than Link 36. Consequently, visual concerns are more dominant. However, local topographic features such as the hill west of South Luneburg provide screening.

The other major concern in this area is land use. By locating Link 37, 1 to 2 miles from the river, most potential conflicts were averted. Access to this area is fair.

Link 38 The last angle on Link 39 is on the west side of the existing transmission line running from Groveton to Whitefield. Link 38 begins at this point and follows this line for 5.1 miles through Lancaster, N.H., to the junction with the transmission line running west from Gorham. This link remains on the west side of the line from Groveton to Whitefield. The angle at Mile 15.1 is north and west of the junction and the Gorham line.

Link 38 runs along the north side of the existing line through Whitefield to the end of Link 38 at Mile 25.8. This terminus is on the west side of Moore Reservoir. Suitable crossing conditions exist on both sides of the river.

Access to this route is excellent for its entire length. Several buildings adjacent to the existing line near Lancaster and Whitefield would have to be removed. This disadvantage is at least partially offset by the advantages of paralleling existing facilities. This route is substantially longer than other alternatives.

Link 39 - From the junction of Links 37 and 39, Link 39 continues in a south-westerly direction for 5.5 miles. It follows the existing line on the north side to Moore Substation, passing through the junction with Link 36. The section continuing to Moore is identified as Link 40.

This route crosses rugged topography west of Moore Reservoir. Access is excellent in this area but rugged topography may increase the line's construction cost.

Link 40 This 2-mile link follows the existing line toward Moore Substation, crossing the Connecticut River 1/4 mile west of the dam. The crossing is not adjacent to the existing crossing. New lines would be compatible with the functional appearance of the dam complex. The topography at this river crossing is favorable for transmission lines and access is excellent on both sides of the river. This link crosses the existing line north of Moore Substation.

Link 41 - This .3-mile loop into Moore Substation would connect the lines from Dickey and Granite Substations with Moore Substation. This connection requires additional development at Moore Substation (see Appendix A for an illustration). Access is excellent. One or two towers would be needed.

Moore Granite

Link 42 Link 42 follows the existing line from Moore to Comerford, paralleling it on the south side. No 345-kV connection is made with Comerford. The route passes the south side of the substation. Link 42 continues toward Granite, paralleling the existing line on the east side. The link ends on the west side of the river where Link 43 and 44 begin. The route follows a vacant transmission line right-of-way through this area. Access is excellent.

Link 43 - Link 43 crosses over and leaves the existing line 1/2 mile northwest of Barnet. Scattered farms in the area cannot be avoided.

The rolling topography does not impose major constraints. Land use patterns have the greatest influence on route location. An example of this is the angle placed at Mile 4.4 which turns the line south of Peacham.

Farther west certain physiographic features - Martins Pond, Devils Hill, Morse Mountain, and Peacham Pond - determine the route's location. The angles at Miles 12.3 and 14.4 avoid upper slopes of Black Hill, Burnt, Kettle and Hardwood mountains. Other local topographic features also influence the route's location.

The dense hardwood vegetation in this region generally helps minimize visual impacts. However, the line would be highly visible from Peacham and Martins Pond. The lack of vegetative screening together with the location of the line on the slopes above these ponds could result in significant visual exposure.

Southwest toward East Barre, more farmland is encountered. Link 43 avoids much of this land, but some fields are crossed. At Mile 24.6, this link comes within 500 feet of upper Orange Reservoir. From this point south to the junction with Link 45, only one angle is needed.

In general, this route avoids the most developed areas between Barnet and East Barre but does cross through Groton State Forest. Access is fair for almost the entire length. However, for .7 mile beginning at Mile 11.9, existing roads provide good access.

Link 44 - Link 44 follows the vacant right-of-way on the south side of the existing 230-kV transmission line between Comerford and Granite. The vacant right-of-way was acquired by Vermont Public Service. Some buildings have been constructed near the edge of the vacant right-of-way.

Link 45 - This 1.5-mile link is used for either Link 43 or 44. Link 45, like Link 43, follows the vacant right-of-way south of the existing line. Two angles are needed on this line and additional development will be required at Granite Substation. A sketch of this development is included in Appendix A.

Granite - Essex

Vermont Electric Company (VELCO) is involved in planning and constructing a 345-kV transmission grid in Vermont. Plans include a link between the greater Burlington area and central Vermont, referred to as the Granite-Essex 345-kV line. Engineering and environmental studies have been initiated by VELCO. Their need for this connection follows the scheduled completion of the Dickey-Lincoln School project. This line is essential for electrical stability for all system plans associated with the Dickey-Lincoln School transmission. The VELCO information identifying alternative route locations for this link was made available to the DOI for continued study if this line becomes part of the Dickey-Lincoln transmission system. Using DOI criteria, the routes were carefully reviewed and accepted for this study. The VELCO locations reflect an intensive professional effort with no feasible alternatives omitted.

Granite Substation is in the upper central Winooski River Basin which includes the densely populated Barre-Montpelier complex. The site of the proposed Essex Substation lies in another basin draining into Lake Champlain. These two regions are separated by the Green Mountains, a north-south range, broken only by the Winooski Water Gap. All route alternatives pass through this gap, which now contains two highways, a railroad, and two transmission lines. Most alternatives take advantage of parallel opportunities.

Link 45A This 1-1/2-mile link parallels a 115-kV line northeast through woodland and farmland.

Link 45B Link 45B parallels the existing line across State Highway 14 and Stevens Branch, midway between Williamstown and South Barre. Several buildings and a service station are immediately south of the existing line at the crossing.

The problem can be handled with a double crossover on the 115-kV line, or by moving the 115-kV line north and occupying its right-of-way, or by selecting Link 45C. Link 45B is 1 mile long. It crosses farmland and a wooded area.

Link 45C Link 45C avoids the congestion at Highway 14 but is nearly one mile longer than 45B. It proceeds west, mostly through woodlands, across Highway 14 and Stevens Branch, then north to join the existing line. Link 45C is nearly 2 miles long.

Link 46 - Link 46 runs north toward Barre for 3 miles, then northeast across rolling terrain south of Stevens Branch. This 7-mile link parallels the existing 115-kV line, except in Mile 5. There it passes immediately north of the Montpelier-Barre Airport and the Central Vermont Hospital. The alignment is shifted north 500 feet to avoid these facilities. It seems reasonable to move the existing line 500 feet north also.

Link 46 crosses an interchange on Highway 62 near the hospital.

Link 47 - Link 47 is 4 miles long. It parallels the 115-kV line and crosses mostly woodland and farmland with some rural homes. The line passes about 1-1/2 miles south of downtown Montpelier, and would have little visual impact on that area. However, the line will be visible as it crosses Interstate 89 and will be intermittently visible from this highway and from Montpelier. An alignment adjustment is advised in Mile 2 to minimize the impact on a mobile home court at Dog River.

The major advantage of Link 47 is its parallel location to the VELCO 115-kV line.

Link 47A - This 4-mile long link continues parallel to the 115-kV line above the valley floor south of the Winooski River. The advantage of a parallel location is diminished because the rights-of-way, for both lines, will be highly visible from the valley and to motorists on Interstate 89. Link 47A ends near Middlesex.

<u>Link 50</u> - This 6-mile link avoids the congestion and visual problems encountered along Links 47 and 47A. Link 50 takes off from Link 46, proceeds southwest 1 mile crossing Interstate 89 then northwest for 5 miles. It roughly parallels about 1 mile south of the existing line and out of sight of the valley. This link crosses rolling wood terrain.

<u>Link 51</u> This 2-mile link connects the end of Link 47 to the end of Link 50. It takes advantage of a parallel location offered by Link 47, yet avoids the steep terrain and visual exposure associated with Link 47A. Except for two small fields, Link 51 is located entirely in forest land.

<u>Link 52</u> Link 52 also runs through forest land south of the Winooski River Valley. It joins an existing 33-kV steel line owned by Green Mountain Power Company. This 2-mile link takes advantage of favorable terrain.

<u>Link 53</u> - Less than a mile long, Link 53 connects Link 47A with Link 52 in the vicinity of Middlesex. This connection allows the new line to parallel the 115-kV line to Middlesex, then follows the 33-kV line across rolling, forested terrain.

<u>Link 48</u> - Link 48 is 8 miles long and parallels the VELCO 115-kV line. It crosses to the north side of the Winooski River at Middlesex to avoid development along Highway 100 near the mouth of the Mad River, then immediately crosses back as the river curves north. The remainder of the link traverses fairly steep, wooded terrain sloping toward the river It can

be seen from Interstate 89 and the village of Waterbury.

Link 54 The existing line paralleled by this link is a double-circuit 69-kV construction, strung on one side only and energized at 33-kV. To parallel it for its entire length would require removing one or more homes. Portions of the existing 33-kV line could be removed and the right-of-way occupied by the proposed 345-kV line. The 33-kV service could be rebuilt on single wood poles, and the overall right-of-way width minimized. Link 54 lies 1/2 to 1 mile south of Link 48. It crosses rolling to moderately steep timbered terrain.

At Mile 6 the existing line crosses a high ridge and drops down a slope toward the river and Interstate Highway. The cleared right-of-way is highly visible. Link 54 alleviates visual exposure by deviating from a parallel route and passes through a saddle to the southwest. Consideration should be given to moving the old line adjacent to the new.

Link 49 - Link 49 crosses to the north side of the Winooski River and Interstate 89. It runs near the top of the slope parallel to both the 115-kV and 33-kV line. This location is constrained by the highway and developments on the south and by steep rocky terrain on the north. Considerable detailed centerline location studies will be required to fit a 345-kV line in this area, but no alternative route is available. The most satisfactory plan may be to rebuild all or part of the 33-kV line on single poles to reduce total right-of-way required. Since much of this 12-mile link is within view from valley residences and the highway, visual considerations must be weighed heavily in locating and designing this section.

Link 55 - This link is 5 miles long. The first 4 miles are parallel to the 115-kV line. In the first mile it crosses the Winooski River and low farmland. It then runs westerly through flat to rolling terrain that is partially wooded. Most of it is farmed. At Mile 4, it leaves the 115-kV line and turns abruptly north to the proposed site referred to by VELCO as the "Redmond Farm Site"

Link 56 The existing 115-kV and 33-kV lines separate at the beginning of this link. Link 56 follows the 33-kV line northwest for a mile, then turns west across the river and follows a new route west to Essex. This 5-mile link crosses broken terrain which is less suitable for farming than the land along Link 55. It also avoids rural residences. It would require a new right-of-way, although an existing right-of-way lies 1/2 mile south.

APPENDIX A

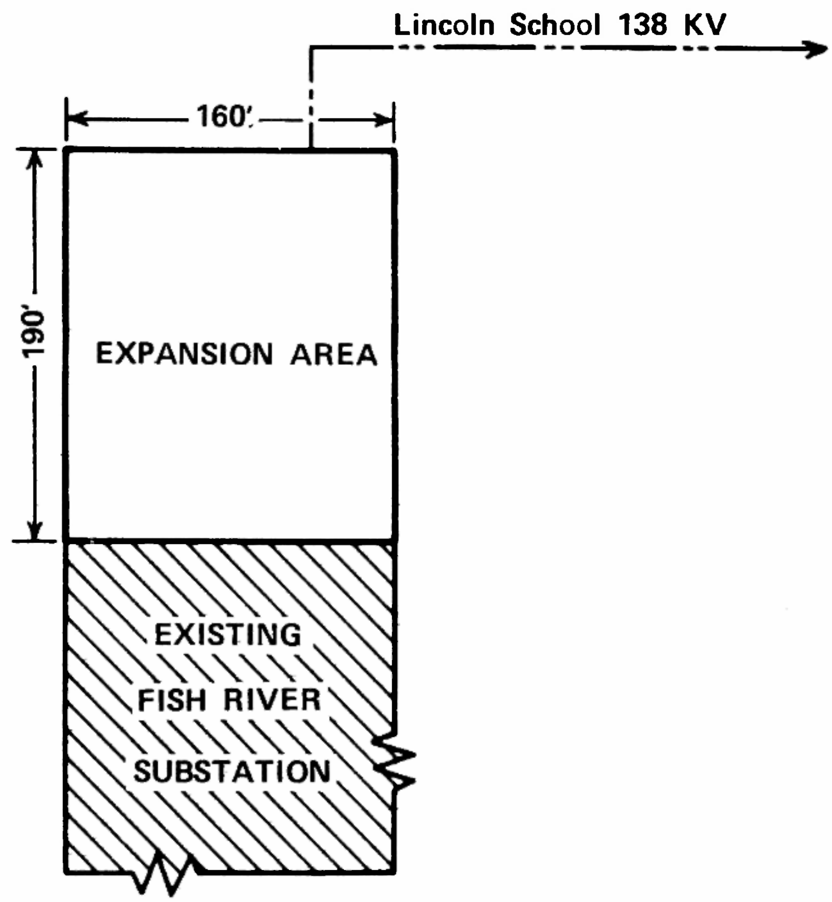
APPENDIX A - SUBSTATIONS

A substation is an electrical facility without generation used to transform power from one voltage to another or to switch power from one line to another.

Six substations or additions are required for the proposed transmission facilities. New substations would be built at Dickey Dam, Lincoln School Dam, and near Moose River or Jackman. Additional facilities are needed at the Fish River, Moore, and Granite Substations. A new 345-kV substation is planned by the Vermont Electric Company in the vicinity of Essex Junction Vermont. It is assumed this substation will be large enough to accommodate the Dickey power without any need for expansion.

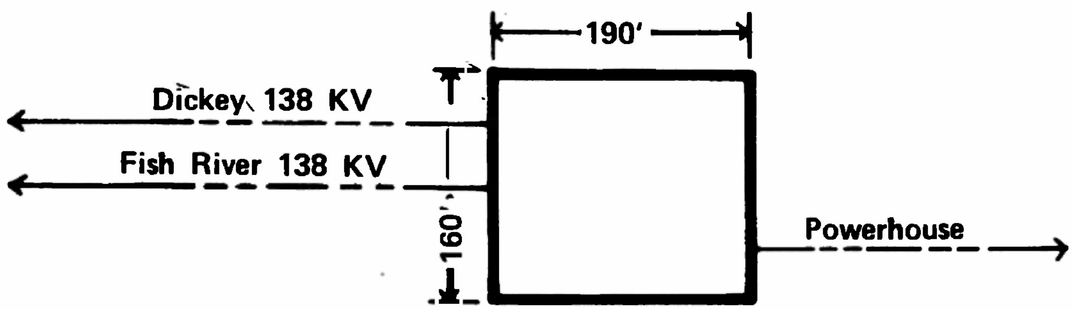
The following sketches show the approximate size and shape required for substation additions. This project is still being planned, and larger parcels may be desirable for buffer strips or future expansion. No contacts with property owners have been made nor any commitments from utility companies for expansion of substations received.

FISH RIVER ADDITION



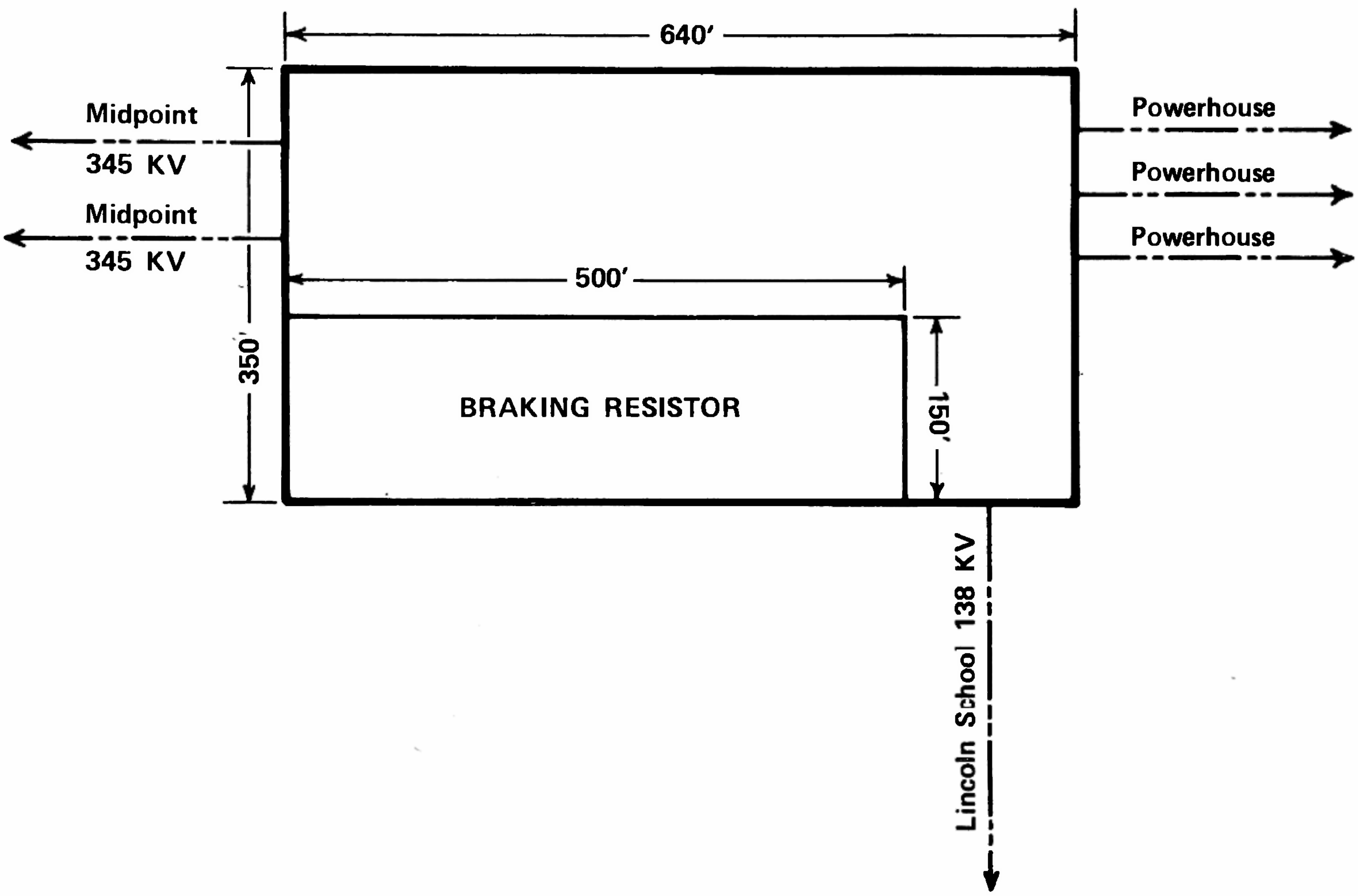
This addition would be located next to the existing Fish River 69-kV Substation. It will include step-down transformers from 138-kV to 69-kV.

LINCOLN SCHOOL SUBSTATION



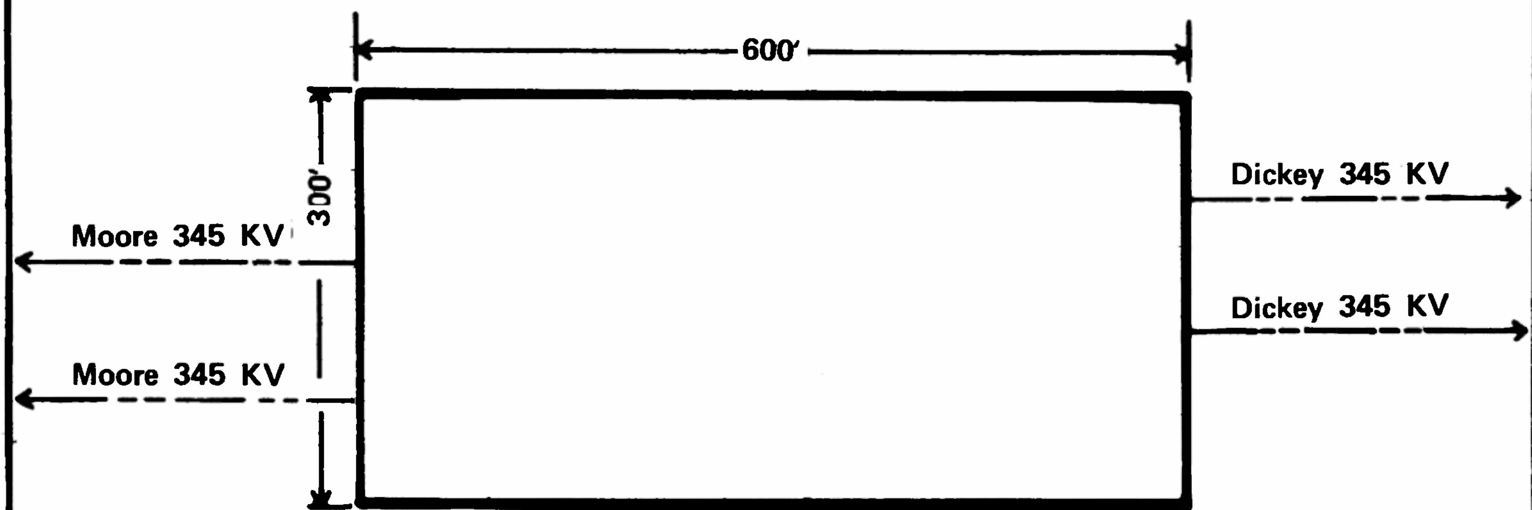
Lincoln School Substation would have a switching arrangement to send the power generated at Lincoln School Dam to Fish River or to Dickey at 138-kV. It would be located near the Lincoln School Powerhouse.

DICKEY SUBSTATION



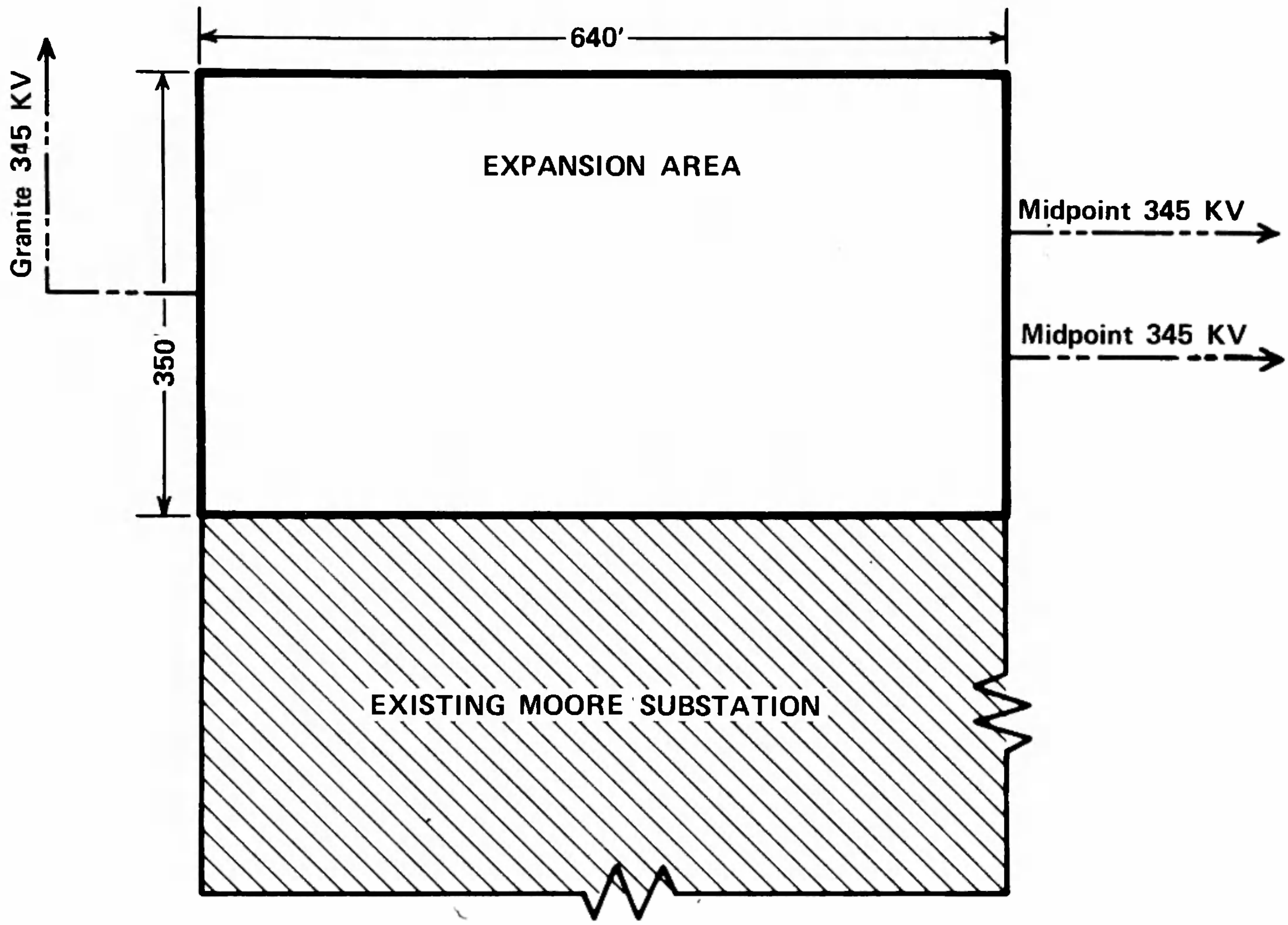
Dickey Substation would provide transformation between 345-kV and 138-kV and would include necessary equipment for switching and controlling the Dickey power. It would also include a "braking resistor" to help preserve the stability of the system in the event of a line fault.

MIDPOINT SWITCHING STATION



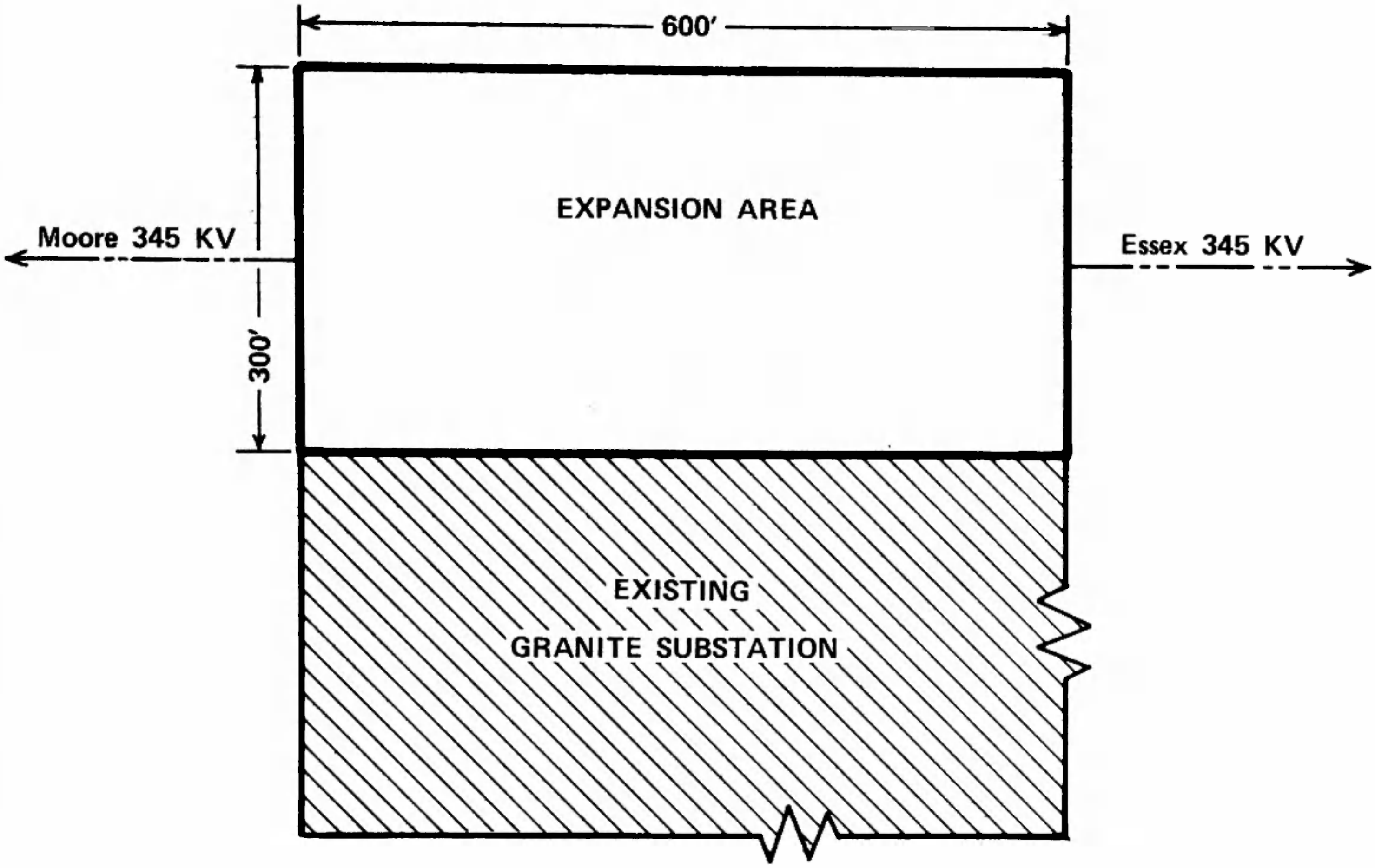
This switching station has two alternative sites located near Jackman or Moose River, would not be equipped with transformers. Its purpose would be to assist in maintaining electrical stability by providing a means to switch the power from one Dickey-Moore circuit to the other should a fault occur in either circuit.

MOORE SUBSTATION ADDITION



This substation addition would be located next to the existing Moore Substation. It would include transformation from 345-kV to 230-kV to integrate a portion of the Dickey power into the existing New England grid.

GRANITE ADDITION



This addition would be located next to the Granite 230-kV Substation. It will provide transformation from 345-kV to 230-kV and switching equipment to send power at 345-kV to Essex.

APPENDIX B

APPENDIX "B" - MICROWAVE SYSTEM

DICKEY-LINCOLN SCHOOL DAM PROJECT - Communications System Report

OUTLINE

I. Introduction

II. Definitions

III. Communications System Requirements

IV. Site Selection Parameters

V Proposed Plan of Service

VI. Description of Proposed Microwave Sites and Their Development and Impact

VII. Conclusion

VIII. References

IX. Attachments

Communications Section
July 19, 1977

I. Introduction: This report is the result of map study and path profile study of potential microwave sites and microwave system routing tentatively selected on the ground by personnel of the Dickey-Lincoln School Project Office. Actual channel density is not being considered in this study. The general routing is per Western Plan #2 shown on Figure C-3 of the "Transmission Planning Summary" dated November 1976.

II. Definitions: The following defines terms used to describe the planned radio system and its parameters.

A. Active Repeater Station An active repeater station is one requiring a road for construction and maintenance access, a powerline backed up by a self-contained emergency engine generator, a radio building, an antenna tower and a fuel storage tank. The radio buildings are normally single story with from 200 to 300 square feet of floor space.

B. Passive Repeater Station - A passive repeater station is a billboard type structure on a self-supporting tower. The repeater can be constructed and maintained without access roads by use of helicopters. Power is not required. Maintenance access after construction is infrequent such as once every year and can be accomplished on foot or by helicopter.

C. Line-of-Sight - For this report a criteria of $0.6F_1$, K = 1 plus 70 feet was used for path clearance over and above optical line-of-sight, i.e.,

$$0.6F_1 + 70 = 43.2 \frac{d_1 d_2}{F_{GHz} D} + 70$$

$d_1+d_2= D$ Total path length miles

F = Radio frequency in GHz

d_1 = Distance to critical point in miles

$0.6F_1$ = 1st Fresnel zone clearance

D. Microwave As used in this report is a term used to describe line-of-sight point-to-point radio systems which operate on discrete frequencies in the Government 1710 to 1850 MHz and 7125 to 8400 MHz bands. These systems are capable of carrying multiple audio channels to serve the power system control communications requirements.

E. VHF Mobile Repeater Station - These are radio stations which operate on discrete frequencies in the Government 162 174 MHz band. Stations are located so as to provide VHF mobile repeater capability in the vicinity of power stations and along transmission rights-of-way. Equipment is usually collocated with microwave equipment. In some cases small radio buildings are used to extend VHF coverage to areas remote from the microwave system.

F. Power System Control - As used in this report means hardware and software for: acquisition of power system operating data including sensing, telemetering, indicating, recording, storing, and logging; providing an accurate data base (electrical and hydrometeorological). sensing and recording remote events, interfacing users and data systems, transmission and annunciation of alarms; remote switching and monitoring; regulating real and reactive generation; regulating bus voltage levels; protecting transmission lines and substations components; protecting system stability; locating and identifying faults; monitoring system security; providing communication systems for data, control signals, relaying, voice, televisions, teletype, etc.; on-line analysis and diagnosis of system abnormal conditions; providing computer direction of these functions; and providing systems for operating and maintaining the facilities which perform them.

III. Communications System Requirements: A. Initial. This proposed system will provide communications for power system control of the proposed 345 kV AC main grid transmission system originating at Dickey-Lincoln School Lakes Project, Maine, and terminating at Comerford, New Hampshire. This includes providing VHF mobile radio coverage in the vicinity of (1) Dickey-Lincoln School Lakes Project, (2) Jackman switching terminal, and (3) Comerford terminal.

B. Future. The initial requirements should provide for future expansion of the VHF system to almost 100% coverage of the transmission line rights-of-way. This expansion could be by VHF coverage "gap filler" stations spurred out from a high elevation microwave station in the vicinity of the 345 kV power terminal stations.

IV Site Selection Parameters: Sites are selected in accordance with the following parameters with the primary parameters being essential to a working system. The remaining parameters are considered in a trade-off exercise aimed at an ultimate best operable and maintainable system at the least cost and impact.

A. Primary design parameters.

1. Radio terminals at Moore, New Hampshire, Jackman, Maine

2. Line-of-sight beam paths between adjacent radio stations and any additional path clearance criteria.

B. Secondary design parameters.

1. The fewest possible sites.
2. Utilization of already developed sites where possible.
3. Minimum site development with respect to tree clearance.
4. Locating higher elevation sites so as to minimize skyline silhouetting of structures.

C. Operational and Maintenance parameters. The following are some operational considerations relating to microwave repeater site selection. Since the sites may be either a passive repeater, consisting only of a clearing and a metallic "billboard," or an active repeater with a building, possibly a steel tower, power line, etc., operational considerations differ considerably.

1. General operational considerations consist of beam path, terrain in site vicinity and along beam path, and unusual or severe climatic or sub-surface conditions.

2. Additional active repeater considerations are:

   a. Access roads and central station power availability

   b. Periodic service personnel visits for fuel replacement and equipment maintenance.

c. Infrequent maintenance personnel visits to inspect site and installation for appearance and to perform appropriate site maintenance.

V. Proposed Plan of Service: A. The proposed microwave system would provide communications between Dickey-Lincoln School (dams/substations) and Jackman Substation via eight or nine active repeaters and one passive reflector. The system as shown on drawing EPIC-866 is 244 miles in route miles (without the tie to Black Cap). A link connecting this system to the New England Shared Microwave System (SMS) would be between Black Cap and Ferry.

B. Configuration alternatives are:

1. Oakfield Hill to Bagley Mtn. (Direct)

   or

   Oakfield Hill to Hot Brook to Bagley Mtn.

2. Parlin MW to Jackman Substation

   or

   Parlin MW to Moose River Substation

Ground survey and environmental impact considerations may alter the proposed configuration. Tower heights are given based on map profiling, local obstructions and actual path variations may reduce tower heights.

C. Path data indicates that 2 or 8 GHz bands could be utilized. The electronic configuration could be frequency diversity, non-diversity, or non-diversity hot standby, all solid state equipment. The overall system reliability would therefore be a function of path length equipment redundancy and system gain. Under the planning concept that this system will be interconnected to the SMS system, a non-diversity/non-standby system; actual system reliability from Dickey-Lincoln School (dams/substations) to Moore Substation will be a major function of the SMS System reliability.

D. VHF service would be provided by repeaters at McLean Mtn., Oakfield Hill, Parlin, and Ferry. Coverage along the line route could be extended from Parlin and McLean Mtn., to VHF "gap-filler" repeaters at Little Russell Mtn. and Priestly Mtn.

VI. Proposed Microwave Sites and Development:

A. Dickey Dam/Substation. At this-facility an 80-foot self-supporting tower would be required. Electronic equipment would be housed inside the "control house." AC station service would most likely be provided via the Dam. Existing state highways and construction roads would provide site access.

B. Lincoln School Dam/Substation. At this facility an 80-foot self-supporting tower would be required. Electronic equipment would be housed inside the "control house." AC station service would most likely be provided via the dam. Existing state highways and construction roads would provide site access.

C. Lincoln School Passive Repeater At this station a passive reflector would be constructed. No other structures would be required. Site access could be via helicopter for both construction and maintenance. Selective beam path clearings may be required to allow line-of-sight. Local obstructions will determine the overall impact of the site. As a maximum the site clearing would be limited to approximately a 50 x 50-foot clear area.

D. McLean Mtn. (Microwave). At this station an active repeater would be constructed. The site development would include station service power, 100 x 100-foot selective cleared plot, and site access road. From 1:250,000 mapping there appears some dirt unimproved roads in the area. A dirt unimproved road approximately 5.4 miles long would be required to allow site access from Maine Hwy. 161. The power cable may be able to parallel the access road. The area is wooded with 50-60 foot trees.

E. Pennington Mtn. (Microwave) At this station an active repeater would be constructed. The site development would include station service, 100 x 100-foot selective cleared plot, and site access road. From 1:250,000 mapping there does not appear any existing roads to the site. A dirt unimproved road approximately 6.9 miles long would be required to allow site access from Maine Hwy. No. 11. The power cable may be able to parallel the access road. The area is wooded with 50-60 foot trees.

F. Ashland (Microwave) At this station an active repeater would be constructed. The site development would include station service power, 100 x 100-foot plot, and site access road. From 1:250,000 mapping the access road would be very short (a driveway). There is existing overhead powerline along the highway adjacent to the site (Hwy 11). The station would be located north of the highway (Maine No. 11) in cleared farmland.

G. Oakfield (Microwave). At this station an active repeater would be constructed. The site development would include station service power, 100 x 100-foot selective cleared plot, and site access road. From 1:250,000 mapping there appears a dirt road approximately 1.5 miles from the road into Red Bridge (approximately 6.5 miles). The powerline may be able to follow this road route. The area is wooded with 50-60 foot trees.

H. Hot Brook (Microwave). This station is considered in an alternative to the direct path from Oakfield to Bagley. This station would be located near a New England Bell Telephone Co. microwave station. (100-200 feet southeast from Telco site). Access road, and overhead power are developed. The site development would consist of a short driveway and 100 x 100-foot selective cleared plot. The area is wooded with 50-60-foot trees.

I. Bagley (Microwave). At this station an active repeater would be constructed. This station would be located near a New England Bell Telephone Co. microwave station. (100-200 feet southeast from Telco site). Access road and overhead power are developed. The site development would consist of a short driveway and 100 x 100-foot selective cleared plot. The area is wooded with 30-40-foot trees.

J. Ferry (Microwave). At this station an active repeater would be constructed. This station would be located near a New England Bell Telephone

Co. microwave station. (100-200 feet west from Telco Site). Access road and overhead power are developed. The site development would consist of a short driveway and 100 x 100-foot selective cleared plot. The area is wooded with 40-60 foot trees.

K. Black Cap (Microwave). At this station an active repeater would be constructed. This station would be located near the SMS microwave site or perhaps within their facility. Access road and overhead power are developed. If a new site would be required, it could be located about 50 feet southwest of SMS microwave station.

L. Oak Ridge (Microwave) At this station an active repeater would be constructed. The site development would include station service power, 100 x 100-foot selective cleared plot, and site access road. From 1:250,000 mapping there does not appear any existing roads to the site. A dirt unimproved road approximately 3 miles long would be required to allow access from Maine Hwy. No. 15. The power line may be able to parallel the access road. The area is wooded with 50-70 foot trees.

M. Parlin (Microwave). At this station an active repeater would be constructed. The site development would include station service power, 100 x 100-foot selective cleared plot, and site access road. From 1:250,000 mapping there does not appear to be any existing roads to the site. A dirt unimproved road approximately 2 miles long would be required to allow access roam Maine Hwy No. 201. The powerline may be able to parallel the access road. The area is wooded with 50-70 foot trees.

N. <u>Jackman Substation</u>. At this facility an 80-foot self-supporting tower would be required. Electronic equipment would be housed inside the control house. AC station service would be provided by the substation equipment. Existing state highway No. 15 and construction roads would provide site access.

VII. <u>Conclusion</u>: The foregoing is based on map study and the preliminary investigative work performed by the Dickey-Lincoln School Dam Project Office. Final site selection and routing adjustments pend on-site radio survey work. Actual site layouts and radio survey activities will determine required access, beam path, and site clearing. Soil conditions and topography will determine to what extent unimproved dirt access roads can be used.

VIII. <u>References</u>:

A. Montana Microwave Loop Closure System - Facility Supplement dated August 5, 1975.

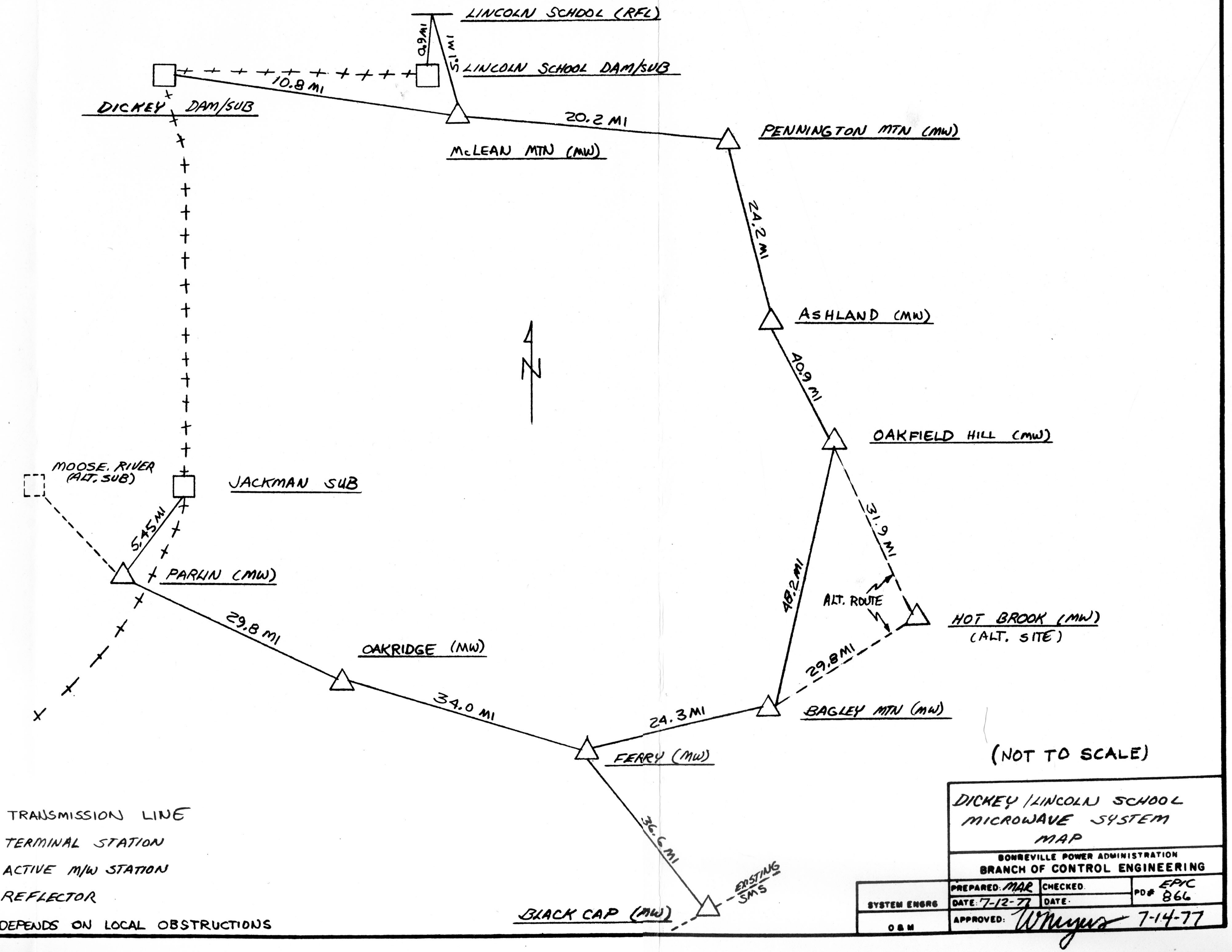
B. Dickey-Lincoln Project - Proposed Communications Plans dated October 22, 1976.

C. Transmission Planning Summary dated November 1976.

IX. <u>Attachments</u>.

A. Dickey-Lincoln School Microwave System Map Drawing EPIC-866

B. Nine map sections marked to show proposed sites



STATION	LAT (N)	LON (W)	ELV. (FT)	TOWER	PROFILE #
DICKEY DAM/SUB	47° 04' 39"	69° 04' 23"	600	80 FT *	1
LINCOLN DAM/SUB	47° 09' 23"	68° 55' 22"	600	80 FT *	2
LINCOLN RFL	47° 10' 12"	68° 55' 24"	1000	15 FT. *	2
McLEAN	47° 06' 56"	68° 51' 05"	1954	80 FT *	1,2
PENNINGTON	46° 58' 08"	68° 28' 57"	1500	80 FT *	3,4
ASHLAND	46° 37' 08"	68° 27' 01"	827	100 FT	4,5
OAKFIELD	46° 04' 30"	68° 06' 39"	1510	100 FT	5,6
HOT BROOK	45° 37' 55"	67° 55' 01"	700	100 FT *	5
BAGLEY	45° 25' 09"	68° 27' 05"	840	100 FT *	6
FERRY	45° 14' 09"	68° 52' 42"	500	100 FT *	7,8
BLACK GAP	44° 45' 12"	68° 34' 02"	1022	80 FT *	8
OAKRIDGE	45° 22' 38"	69° 33' 58"	1300	80 FT *	9,7
PARLIN	45° 33' 54"	70° 07' 04"	2593	80 FT	9,10
JACKMAN SUB	45° 37' 23"	70° 11' 38"	1300	80 FT *	10

+ TRANSMISSION LINE
□ TERMINAL STATION
△ ACTIVE M/W STATION
\ REFLECTOR
* DEPENDS ON LOCAL OBSTRUCTIONS

DICKEY / LINCOLN SCHOOL MICROWAVE SYSTEM MAP

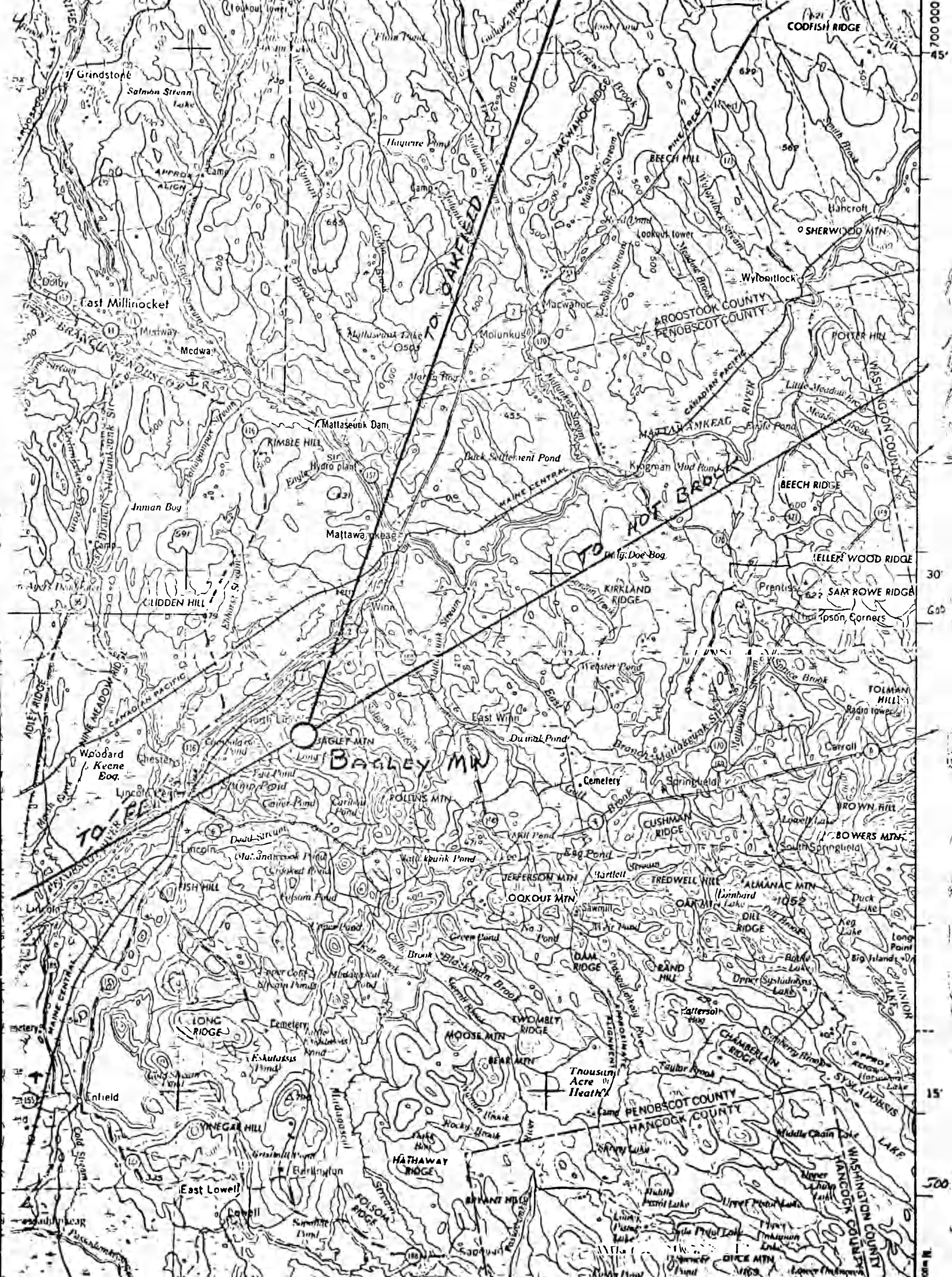
BONNEVILLE POWER ADMINISTRATION
BRANCH OF CONTROL ENGINEERING

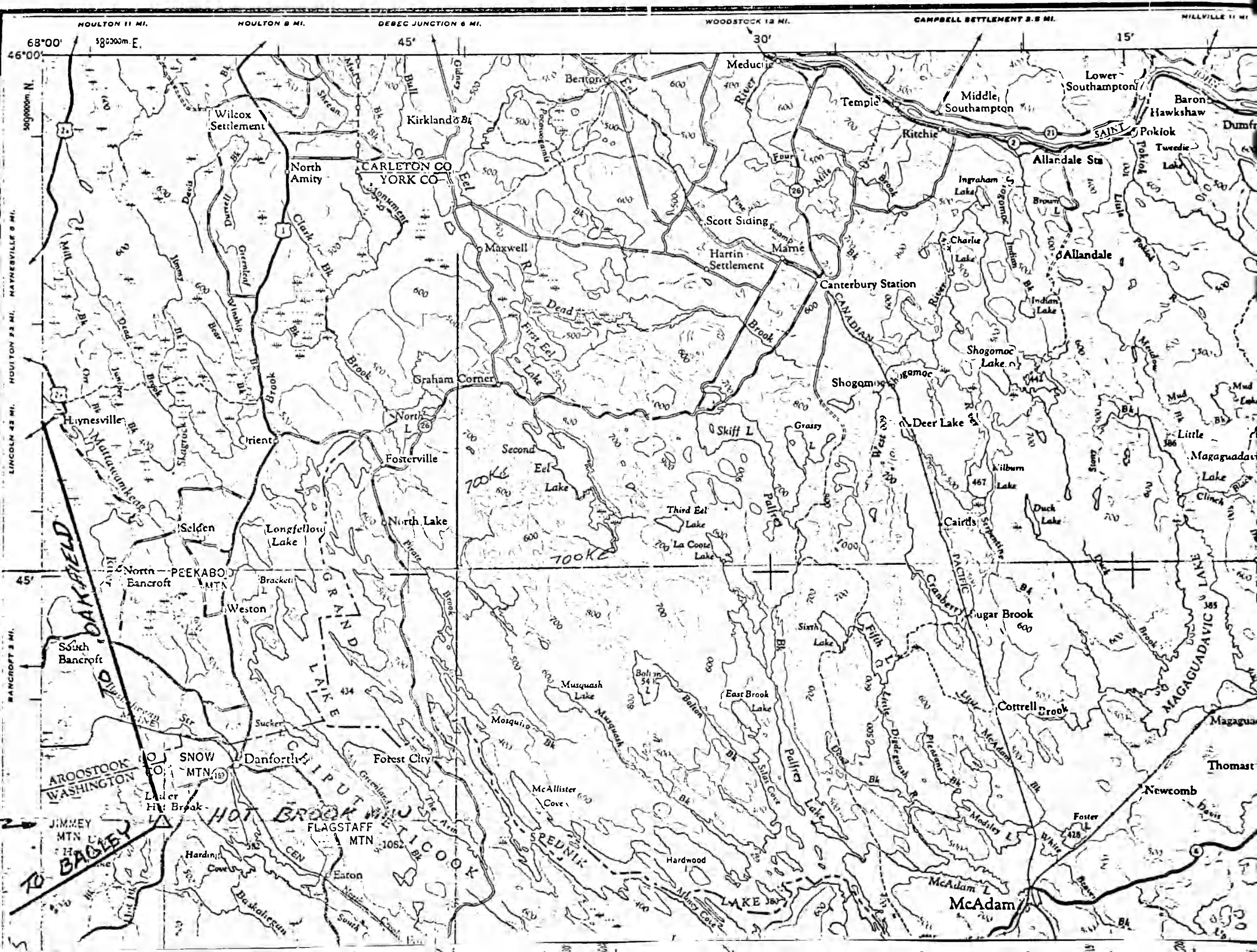
SYSTEM ENGRG	PREPARED: MAR	CHECKED:	PD# EPIC 866
	DATE: 7-12-77	DATE:	
O & M	APPROVED: W Myers 7-14-77		


LINCOLN SCHL
RFL
LINCOLN SCHOOL
DAM
McLEAN MW
DICKEY DAM
TO PENNINGTON
La Résurrection
Rivière-Creuse
St-Eusèbe
Ste-Rose-du-Dégelé
Otterburn
Rivière-Cabano
St-Eusèbe-Ouest
Packington
Pied-du-Lac
Sully
England
Aubut
Fatima-de-Témiscouata
St-Joseph-de-la-Rivière-Bleue
Landry
Les Étroits-Nord
St-Jean-de-la-Lande
Rang-St-David
Glendyne
Les Étroits
Lac-Thibeault
Bélanger
Courchesne
Lac-Baker-Nord
St-Castin
Collin
Lac-Baker
Portage-du-Lac
QUEBEC
NEW BRUNSWICK
TEMISCOUATA CO
MADAWASKA CO
AROOSTOOK CO
ST FRANCIS
Baker Brook
Caron Brook
Lac-Unique
Lang Settlement
HAFEY MOUNTAIN
Rocky Brook
Fort Kent
Clair
Little River Mills
Pelletier Mills
Crockett
Fort Kent Village
Fort Kent Mills
Bradburys
Val Oakes
Pierre
Wheelock
BANGOR AND AROOSTOOK
BOSSY MOUNTAIN
Violette Settlement
PINETTE HILL
Connors
St John
Bradbury
Glazier Lake
Mouth of St Francis
Belanger Settlement
Fort Kent Pit
Labby
Michaud Siding
JOHNSON BROOK
Back Settlement
Soldier Pond
MICHAUD HILL
Wallagrass
Dickey
Wallagrass Station
Plaisted
Allagash
Austin Dam
ASHLAND 38 MI.
69°00'
45'
49
50
51
52
53

600 000 FEET (EAST)
PENNINGTON MW
HEDGEHOG
HOG
Lookout tower
Hanford
Mud Lake
Salmon Brook Lake
Bog Lake
Spaulding
Cemetery
Radio tower
Perham
North Wade
Caribou
Jacobs
Caribou Lake
Lookout tower
Washburn
New Sweden
Station
Sweden
Cemetery
Fish River
Portage Lake
PORTAGE
Little Machias River
Little Machias Lake
Sterling Brook
Beaver Brook
RIVER
AROOSTOOK
Frenchville
Mapleton
Presque Isle
Smith
Radio tower
Airway beacon
Sheridan
Sawmills
Ashland
ASHLAND
MW
West Branch
BANGOR AND AROOSTOOK
Causeway
Alder Lake
Airway beacon
Squa Pan
Causeway
Ford
SQUA PAN KNOB
Shields
Squa Pan Lake
Blackwater River
West Branch Presque Isle Stream
AROOSTOOK RIVER
Otter Brook Bog
Cranberry Pond
OAKFIELD
HEDGEHOG MTN
Lookout tower
Camp

Causeway
SQUA PAN KNOB
Lookout tower
Shields
Brook
Cemetery
River
Blackwater
West Branch Presque Isle Stream
East Branch
Otter Brook Bog
AROOSTOOK RIVER
Oxbow
Cranberry Pond
Trout Brook
ASHLAND
Griswold
Beaver Brook
HEDGEHOG MTN
Camp
Lookout tower
Number Nine Lake
MAPLE MTN
HOVEY MTN
Matherson Pond
Otter Pond
Lookout tower
APPROXIMATE ALIGN
Carry Lake
Cranberry Pond
Beaver Pond
BANGOR AND AROOSTOOK
St Croix Lake
Howe Brook
Lookout tower
LAKE SEBOEIS
Black Cat Pond
Cut Lake
Umcolcus Lake
PENOBSCOT CO
AROOSTOOK CO
Cut Brook
Butch Brook
SNOWSHOE MOUNTAIN
Tracy Brook
Weeksboro
Smith Brook
Cut Pond
BULL RIDGE
Camp
White Horse Lake
Weeks Brook
Lane Brook
Hay Brook
Brandy Pond
Dudley Brook
GREEN MTN
Knowles Corner
Radio tower
Rockabema Lake
ROBERTS MOUNTAIN
HAY BROOK MOUNTAIN
Mud Lake
Hot Pond
Duck Pond
Mill Brook
Cemetery
Pleasant Lake
Pickett Mtn Pond
Upper Shin Pond
Cemetery
Smyrna Mills
Cochrane L
Lutts Corner
Batesville
SUGARLOAF MOUNTAIN
2440 MOUNT CHASE
Lookout tower
Mill
Augustine Shin Pond
DE LETTE RIDGE
Oakfield
Cemetery
Dyer Brook
OAKFIELD
OAKFIELD MTN
BATES RIDGE
Crystal Lake
Cemetery
Twin Ponds
Cameron
BEAR MOUNTAIN
Mud Lake
ROBINSON MTN
Lookout tower
Upper Mattawamkeag Lake
Crystal
Island Falls
Belvedere
1 200 000 FEET (WEST)
1 000 000 FEET (WEST)
68°00'
516
515
30'
514
513
15'
512
511
55
56
57


TO OAKFIELD
TO HOT BROOK
BAGLEY MTN
TO
CODFISH RIDGE
Grindstone
Salmon Stream Lake
East Millinocket
Medway
Lookout tower
Haynes Pond
Camp
MACWAHOC RIDGE Brook
BEECH HILL
Bancroft
SHERWOOD MTN
Wytopitlock
AROOSTOOK COUNTY
PENOBSCOT COUNTY
Macwahoc
Molunkus
Mattaseunk Lake
Mattaseunk Dam
KIMBLE HILL
Hydro plant
Buck Settlement Pond
MAINE CENTRAL
CANADIAN PACIFIC
MATTAWAMKEAG
RIVER
Kingman
Mud Pond
Eagle Pond
BEECH RIDGE
POTTER HILL
WASHINGTON COUNTY
Inman Bog
Mattawamkeag
Winn
GLIDDEN HILL
KIRKLAND RIDGE
Prentiss
SAM ROWE RIDGE
Thompson Corners
Webster Pond
TOLMAN HILLS
Radio tower
East Winn
Dunnak Pond
Carroll
ADLEY RIDGE
Woodard
Keene Bog
Chester
Lincoln Center
BAGLEY MTN
Cemetery
Springfield
POLLINS MTN
Caribou Pond
BROWN HILL
CUSHMAN RIDGE
BOWERS MTN
South Springfield
Lincoln
Egg Pond
Mill Pond
Folsom Pond
FISH HILL
JEFFERSON MTN
LOOKOUT MTN
Sawmill
TREDWELL HILL
ALMANAC MTN
1052
DILL RIDGE
Duck Lake
Keg Lake
Long Point
Big Island
Green Pond
No 3 Pond
DAM RIDGE
Blackman Brook
RAND HILL
Upper Sysladobsis Lake
LONG RIDGE
Cemetery
TWOMBLY RIDGE
MOOSE MTN
BEAR MTN
CHAMBERLAIN RIDGE
Taylor Brook
Thousand Acre Heath
Enfield
PENOBSCOT COUNTY
HANCOCK COUNTY
VINEGAR HILL
HATHAWAY RIDGE
Middle Chain Lake
Burlington
East Lowell
Lowell
FOLSOM RIDGE
BRYANT HILL
DUCK MTN
WASHINGTON COUNTY
HANCOCK COUNTY
JUNIOR LAKE
SYSLADOBSIS LAKE
45'
30'
15'
700 000
600
500


HOULTON 11 MI.
HOULTON 8 MI.
DEBEC JUNCTION 6 MI.
WOODSTOCK 12 MI.
CAMPBELL SETTLEMENT 2.5 MI.
MILLVILLE 11 MI.
68°00'
45'
30'
15'
46°00'
45'
HAYNESVILLE 6 MI.
HOULTON 22 MI.
LINCOLN 42 MI.
BANCROFT 3 MI.
Wilcox Settlement
North Amity
CARLETON CO
YORK CO
Kirkland
Benton
Meductic
Temple
Middle Southampton
Lower Southampton
Baron Hawkshaw
Pokiok
Ritchie
Allandale Sta
Scott Siding
Hartin Settlement
Marne
Canterbury Station
Maxwell
Allandale
Graham Corner
North L
Orient
Haynesville
Fosterville
Second Eel Lake
Third Eel Lake
La Coote Lake
Skiff L
Grassy L
Deer Lake
Shogomoc
Shogomoc Lake
Kilburn Lake
Duck Lake
Cairds
Selden
Longfellow Lake
North Lake
North Bancroft
PEEKABOO MTN
Weston
Brackett
GRAND LAKE
South Bancroft
Sugar Brook
Sixth Lake
Fifth L
MAGAGUADAVIC LAKE
Musquash Lake
Bolton L
East Brook Lake
Cottrell Brook
Danforth
SNOW MTN
Forest City
AROOSTOOK
WASHINGTON
CHIPUTNETICOOK
HOT BROOK
FLAGSTAFF MTN
JIMMEY MTN
McAllister Cove
SPEDNIK
LAKE
Hardwood
Eaton
Newcomb
Foster L
Thomast
McAdam L
McAdam
TO OAKFIELD
TO BAGLEY
CANADIAN PACIFIC

RAGGED MTN
BIG WILKIE MTN
West Seboois
CEDAR MTN
BANGOR AND AROOSTOOK
Inman Bog
GLIDDEN HILL
EBEEMEE MOUNTAIN
Packards
SCHOODIC MTN
MATTAMISCONTIS MOUNTAIN
Lookout tower
Schoodic
Turtle Pond
APPROXIMATE ALIGNMENT
East Branch
ADLEY RIDGE
NINE MEADOW RIDGE
CANADIAN PACIFIC
Woodard
Keene Bog
Chester
Lincoln Center
BULL HILL
SCHOODIC LAKE
BALD HILL
South Branch Lake
SEARLES HILL
Knights Landing
Brownville Junction
Seboeis
CARPENTER RIDGE
Lincoln
FISH HILL
Sawtelle Bog
South Lincoln
Adams
Hardy
PENOBSCOT COUNTY
PISCATAQUIS COUNTY
RANDALL RIDGE
BROWN HILL
Brownville
MAINE CENTRAL
VARNEY HILL
Medford
Cemetery
LONG RIDGE
BUCK HILL
Cemetery
Milo
OAK RIDGE
Medford Center
Sylvan Lane
Enfield
Derby
Lookout tower
FERRY MW
Howland
West Enfield
VINEGAR HILL
Corners
Freese Bog
East Lowell
Cemetery
Boyd Lake
Boyd Lake
Passadumkeag
Lowell
Lagrange
Black Bog
TO
DAVIS HILL
North Bradford
South Lagrange
Olamon
Charleston
West Charleston
Bradford
Bradford Center
Bradford
MURCH RIDGE
Greenbush
Cardville
Argyle
Holland Pond
Greenfield
HUDSON RIDGE
Gerry
Alton
Costigan
400K E
45'
30'
500K E
BANGOR 12 MI.
18 MI. TO INTERSTATE 395 BANGOR 18 MI.

400 K E
500 K E
LA GRANGE 13 MI
LINCOLN 31 MI
45'
30'
HUDSON HILL
Hudson
West Old Town
Orson I
Old Town
Orono Island
Sunkhaze Meadows
OAK RIDGE
TURNER MOUNTAIN
Higginsville
FAIRDALE HILL
Lakeside
Old Town
Sandy Beach
Glenburn
Luckey Landing
Cunningham Landing
Villa Vaughn
Elliot Landing
Stillwater
John Baker Camp
SPRINGY BROOK MOUNTAIN
BALD BLUFF MOUNTAIN
Orono
West Glenburn
Six Mile Falls
East Bangor
BUCK HILL
North Bangor
North Hermon
HERMON HILL
FERRY
HANCOCK CO
PENOBSCOT CO
PEAKED MT
Chemo Pond
Bangor State Hospital
Eddington
Down East
DOW AIR FORCE BASE
BANGOR
Hermon Center
North Brewer
Brewer
Clifton
Clifton Corners
East Eddington
Roosevelt Camp
MAINE CENTRAL
MANN HILL
East Hampden
South Brewer
Holden Center
BLACK CAP MT
North Newburgh
Hampden Center
North Orrington
COPELAND HILL
Holden Hill
EAGLE BLUFF
HOLDEN
East Orrington
Orrington Center
Newburgh Center
PENOBSCOT CO
HANCOCK CO
Lucerne-in-Maine
Dedham
BLOOD MT
BALD HILL
South Orrington
North Winterport
Microwave tower
Newburgh Village
Coles Corner
PAGE HILL
BALD MT
SNOW MOUNTAIN
COBB HILL
BEECH HILL
Bucksport Center
West Winterport
Frankfort
GREAT POND MOUNTAIN
FLAG HILL
Hurds Corner
North Ellsworth
HEAGAN MOUNTAIN
MOUNT WALDO
Bucksport
MACK MT
East Orland
Fort Knox State Park
Five Mile Corners
Grands Corners
West Ellsworth
DOLLARD HILL
Leonard Lake
Ellsworth
VERONA ISLAND
MT EPHRAIM
North Penobscot
FLETCHER HILL
Sandy Point
South Orland
MONTGOMERY MOUNTAIN
WALLAMATOGUS MT
Surry
East Surry
Cable area
mud
rocky
Stockton Springs
Fort Point
WALDO CO
HANCOCK CO
South Penobscot
Blue Hill
BLUE HILL
Turner Point
Lighthouse


SUGAR ISLAND
LAKE
DEER ISLAND
KENNEBEC RIVER
WEST OUTLET
MISERY RIDGE
Burnham Pond
Mountain View Pond
BURNT JACKET MTN
Squaw Brook
SCAMMON RIDGE
Thousand Acre Pond
COLD STREAM MTN
BIG SQUAW MOUNTAIN
Lookout tower
3196
Fish hatchery
TROUT POND MTN
Greenville Junction
Greenville
LITTLE SQUAW
PISCATAQUIS COUNTY
SOMERSET COUNTY
Round Pond
Ellis Pond
Dead Stream Pond
WILSON HILL
TO PARLIN
Power plant
CANADIAN PACIFIC
OAK RIDGE
BURNT NUBBLE
Baker Pond
BOARSTONE MTN
APPALACHIAN TRAIL
Moxie Falls
Prescott Pond
BLACK NUBBLE
Shirley Mills
Lake Moxie
The Forks
MOXIE POND
MOSQUITO MTN
DOUGHTY HILL
Mosquito Pond
Troutdale
PLEASANT POND MTN
2460
Pleasant Pond
MIDDLE MTN
Lookout tower
2630
BALD MOUNTAIN
BREAKNECK RIDGE
Blanchard
Doe Pond
DOE HILL
Caratunk
Little Austin Pond
RUSSELL MTN
MOXIE MTN
DIMMICK MTN
FOSTER RIDGE
Austin Pond
LITTLE RUSSELL MTN
Moosehorn
Monson Junction
Upper Abbot Pond
CATES HILL
BLACK NUBBLE
CROCKETT RIDGE
WALKER Hill
Abbot Village
COW MTN
Chase Pond
Palmer Pond
OAK HILL
Guilford
Rowe Pond
COBURN RIDGE
Kingsbury
Parkman
PIERCE HILL
BABBITT RIDGE
Cemetery
Withee Pond
HUFF MTN
BAKER MTN
Wyman Dam
Bingham
Smith Pond
JOHNSON MTN
KELLY MTN
FLETCHER MTN
OLD BLUFF MTN
Wellington
HARMONY
Cambridge
Cemetery
30'
15'
JACKMAN 25 MI.
500 000 FEET (EAST)
45'
200 000 FEET


MOOSE RIVER
SITE (AEC)
JACKMAN
SITE
PARLIN MTN.
TO OAK RIDGE
Abandoned
MOOSE MOUNTAIN
Jones Pond
NUMBER 2 MOUNTAIN
IRONBOUND MOUNTAIN
Lookout tower
BOUNDARY BALD
MOUNTAIN
SANDY BAY
MOUNTAIN
SANDY STREAM
MOUNTAIN
SLIDEDOWN MOUNTAIN
Heald Pond Camps
Ruins
U S Customs Station
Hydro plant
QUEBEC
MAINE
Beaver Pond
Camp
Sky Lodge
Moose River
Jackman
Newton
Jackman Station
CANADIAN PACIFIC
Long Pond
Turner Pond
Little Turner Pond
Mud Pond
BURNT JACKET
MOUNTAIN
Benjamin Pond
Attean Camp
OWLS HEAD
Attean Pond
ATTEAN MOUNTAIN
Big Bartley Pond
No. 5 Bog Pond
CATHEART MOUNTAIN
BEAN BROOK
MOUNTAIN
Lake Parlin
PARLIN MOUNTAIN
Horseshoe Pond
SOMERSET COUNTY
FRANKLIN COUNTY
NUMBER 5
MOUNTAIN
NUMBER 6
MOUNTAIN
Lookout tower
Boulder Pond
Hall Pond
Whipple Pond
Moore Pond
Grace Pond
KING MOUNTAIN
MOOSE
MOUNTAIN
COBURN MOUNTAIN
Lookout tower
TUMBLEDOWN
MOUNTAIN
THREESLIDE
MOUNTAIN
HARDWOOD
MOUNTAIN
HARDSCRABBLE
MOUNTAIN
JOHNSON
MOUNTAIN
Enchanted Pond
COLD STREAM
MOUNTAIN
Fish Pond
Camp
HEDGEHOG
MOUNTAIN
SHUTDOWN
MOUNTAIN
KIBBY
MOUNTAIN
Lookout tower
SPENCER BALD
MOUNTAIN
SPENCER MOUNTAIN
GRANNYS CAP
West Forks
Johnson Bog
Baker Pond
Bill Morris Pond
HEALD MOUNTAIN
SPOTTED SPRUCE
MOUNTAIN
BEAR
MOUNTAIN
KING AND BARTLETT
MOUNTAIN
Hurricane Pond
Spectacle Pond
Spencer Dam
ANTLER HILL
CAMERA HILL
PRAY HILL
BURNT HILL
HURRICANE MOUNTAIN
DEAD RIVER
MOUNTAIN
OTTER POND
MOUNTAIN
Dead River
1 100 000 FEET
1 200 000 FEET (VT.)
45'
30'
506
505
504
503
502