STATE OF MICHIGAN

ENVIRONMENTAL IMPACT STATEMENT

prepared by

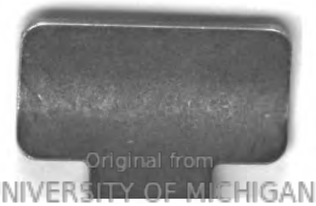
Department of Natural Resources

for

Potential Hydrocarbon Development on the
Pigeon River Country State Forest
Montmorency, Otsego, and Presque Isle Counties

Date Submitted

Signature of Appropriate Agency Official



Public Hearing Places, Dates and Times for the Pigeon River Country State Forest Environmental Impact Statement

December 18, 1975	Gaylord, Holiday Inn 2 p.m. and 7 p.m.
December 19, 1975	Ann Arbor, Huron High School 2727 Fuller Drive 7 p.m.

Written comments on the Environmental Impact Statement will be accepted through January 1, 1976. Write:

Department of Natural Resources
Office of Environmental Review
7th Floor, Mason Bldg.
Lansing, Michigan 48926

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SUMMARY

This Environmental Impact Statement was prepared as a condensation of Department of Natural Resources actions and conclusions relating to hydrocarbon development in the Pigeon River Country State Forest that have evolved since the majority of leases were first issued in 1968. The Pigeon River Country State Forest (PRCSF) was created after the leases were sold. When the first oil development occurred within the PRCSF in 1970, the public controversy began.

Numerous plans to allow controlled oil and gas development in the Pigeon River Country State Forest have been proposed in the last few years. A specific proposal for unitized development (a method to significantly reduce surface disturbance by sharing wells, pipelines, etc.) was presented to the Natural Resources Commission in January of 1975 and a revised approach was again presented to the Commission in August of 1975. The August proposal "Management of Hydrocarbon Resources of the Pigeon River Country State Forest" was reviewed with the Pigeon River Country State Forest Advisory Council and the Michigan Environmental Review Board (MERB). MERB passed a resolution asking the Natural Resources Commission to prepare an Environmental Impact Statement (EIS) on the question of whether or not any drilling should be allowed. The Natural Resources Commission directed that an EIS be prepared along the lines suggested by Governor Milliken which, in a letter to the Commission, the Governor suggested that the Department consider a no-drill boundary among the alternatives.

The first part of the EIS deals with an assessment of existing environment including the surface values that might be impacted by oil and gas development. The surface uses are quantified in as much detail as existing survey data allowed. The interrelationships of the natural systems within the PRCSF are discussed as to both structure and dynamics.

One of the most unique qualities of the Pigeon River Country State Forest is that it is one of the largest blocks of contiguous public ownership in the Lower Peninsula with very few isolated private inholdings. Large stretches of both the Pigeon and Black Rivers are flanked by public lands on both sides. Most of the lakes are entirely within State ownership. The lack of private development increases the sense of wilderness and remoteness in the Forest even adjacent to roads which traverse the area. Wildlife species which seek secluded areas, like the black bear, bobcat, and the introduced elk use much of the PRCSF during various portions of the year.

In recent years the PRCSF has attracted the attention of the public. Some fear that without adequate controls on public use, the character and value of the area will change.

A number of alternatives are reviewed including the implications of a no-drill option. The EIS does not discuss in depth the legal implications of a no-drill alternative. The Department's legal basis for denying drilling permits on State land previously leased is now being challenged in the Court of Appeals. This denial is for a well site within the Pigeon River Country State Forest. It is assumed that any decision by the Natural Resources Commission to forbid drilling on any lease which has a high potential for oil and gas production may be challenged in Court.

Competitive drilling, although discarded as a viable alternative by the Department several years ago, still remains as a potential proposal since no unit agreement has been signed with the lease holders. If the Department does not sign a unit agreement, the lease holders will submit drilling applications on a competitive basis. The competitive drilling alternatives also serve as a valuable comparison between the type of development initiated in 1970 on the PRCSF and the unitized approach now being considered.

Without specific information on where the productive oil and gas pools exist, it was difficult to propose a no-drill boundary. The boundary was finally established by estimating where the northern limit of the productive area might occur in the PRCSF by reviewing the results of drilling activity to the southwest and the northeast along the Salina-Niagaran formation; and then establishing the location of natural features and related surface values within the PRCSF which would form a natural boundary most closely approximating the estimated northern limit of productive oil and gas pools. The final line for the no-drill boundary option is somewhat arbitrary, but conservative and defensible on environmental grounds. It is likely that the northern limit of the most productive hydrocarbon pools lie three miles north or south of the line established. The northern limit is most likely an undulat rather than straight line that can only be determined with certainty by exploratory drilling.

For the purposes of the EIS, the Task Force assigned by the Director to write the EIS recommended that a specific action be proposed. The Task Force recommended that the unitized alternative tied with a no-drill boundary offered the best compromise if drilling was to be allowed. The Director authorized a detailed analysis of this particular alternative so that the public could compare the benefits and unavoidable impacts of a specific proposal compared to the no-drill alternative. The Natural Resource Commission has made it clear that it will reserve their decision on whether or not to allow drilling until after this EIS has gone through the entire review process established by the Michigan Environmental Review Board.

The proposed action, the no-drill boundary with unitized development, will have certain unavoidable impacts. Department wildlife biologists feel certain that the portion of the PRCSF developed for oil and gas will be lost to elk throughout the estimated thirty years of development and production. Some lesser impacts will occur to bear and bobcat who like elk, are sensitive to man-made intrusions. The specific impacts on bear and bobcat are unknown as they remain unknown for certain endangered and threatened wildlife species that frequent the PRCSF or nearby areas. During the drilling and construction period the upland areas will be disturbed although recovery is relatively quick and plant communities are expected to reestablish themselves. And, while wetlands will be avoided if at all possible, pipelines or flowlines may need to be constructed through some swamps and during the construction phase these areas will be adversely affected.

Similarly stream crossings with either bridges or pipelines will temporarily create negative impacts. Erosion control measures will prevent major problems in streams; but some siltation will occur despite the best prevention techniques.

The most difficult impacts to evaluate are those which would affect recreational uses of the PRCSF. The sight, sound, and odor of oil development will adversely impact on the quality if not the quantity of the recreational experience. Vapor control devices may well prevent most odors normally associated with hydrocarbon development, sound muffling techniques will reduce the level of noise, and natural and planted trees and shrubs can reduce the visual impacts. However, visitors to the PRCSF will know that oil and gas production is taking place. Several other special protective measures to reduce impact are proposed which are to be agreed to by the Unit Operator.

It has been suggested by several public groups and private citizens that if oil and gas development occurs, the State royalties derived should be reserved to invest back into the PRCSF. The Task Force recommends that not only the royalties deposited in the Fish and Game Protection Fund from any oil and gas production, but those royalties accruing to the State General Fund should be, at least in part, designated for expenditure for the aquisition of private in-holdings now in the PRCSF, the purchase of large private tracts adjacent to the Forest, or other capital improvements which are intended to enhance the recreational value of the area.

The appropriation of Fish and Game Protection Funds and the allocation of General Fund revenues is a Legislative prerogative; however, in this situation these royalties are the only source of funds available to mitigate expected negative impacts associated with any oil and gas development.

In conclusion, this EIS is a staff recommendation which will be presented to the Natural Resources Commission along with comments received from the public. It is, hopefully, a thorough discussion of the possible environmental impacts, and regulatory controls. It reviews the social and economic implications of specific alternatives and provides information for evaluation of the many possible combinations of alternatives not specifically discussed but equally possible. The EIS does not explore the legal implication of denying drilling permits on either leased State-owned property or on private inholdings, which may have a significant impact on the final resolution of this public question.

I. CIRCUMSTANCES REQUIRING ACTIONS

Much of what is now land within the Pigeon River Country State Forest (PRCSF, Figure 1) was leased under authority of Act 17, P.A. 1921 in 1968 and the remainder in 1972 for the purposes of extracting oil and gas (Figure 2). The Department of Natural Resources has the responsibility under Act 61, to manage the hydrocarbon resources extraction. The Department also has the responsibility under numerous laws of protecting the environment and natural resources of the state.

Because this State Forest has many unique resource values and a projected abundance of hydrocarbon resources, oil and gas development with proper safeguards is considered a major action under the Governor's Executive Order 1974-4. This Environmental Impact Statement (EIS) has been written to describe a proposed plan of hydrocarbon development which we feel is consistent with environmental protection, and to be responsive to today's and future citizen's desires. This EIS also describes the environmental impacts that will occur and the protective measures proposed to reduce these impacts.

II. ENVIRONMENTAL DESCRIPTION

The Pigeon and Black rivers are the major drainage systems within the PRCSF. In the PRCSF ecosystem, the vegetation, wildlife, water, geology and soils in the forest are elements that make up an inter-related natural environment. Man's present uses of the PRCSF are also an intimate part of the environment. In addition, what a person sees (the structure) in the PRCSF is as important as how the system works (the dynamics). The environment, therefore, will be described in three major categories: (1) biological systems of which the structure, dynamics, and uses of the PRCSF are a part, and (2) the social and (3) economic attributes of the local area. It should be remembered, however, that although the PRCSF has been described in parts, it is one large integrated and interrelated system.

A historical perspective, helpful in determining how the PRCSF was developed, is provided first.

As was most of the rest of northern Michigan, the area now called PRCSF was logged between 1860 and 1910. After the forests were depleted, the sawmills, mill towns and supporting farms were abandoned, there being very few roads, no industries, and climate and soils were not suitable for profitable farming.

Abandonment of mills and farms and non-payment of taxes caused large parts of the area to return to state ownership. By 1919, the state had acquired 6,468 acres in the northeastern township of Otsego County, and in that year, the former Pigeon River State Forest was established with a resident custodian.

The first planting of pine, forerunner of a major effort to reforest the denuded lands of the area, was made in 1920 when 81 acres were planted.

In 1924, the DNR designated the Otsego Wildlife Refuge Unit east of Vanderbilt, in part coincident with the Pigeon River State Forest. Elk, which had been released in 1918 were increasing rapidly by that time, and the refuge was intended to protect both them and the scarce deer in the area.

Most of the Otsego Refuge was leased or under permit from private owners until 1926 when 10,600 acres were purchased with Game and Fish Protection Fund money and added to the original 2,270 acres of the Refuge.

Except for young growth of spruce and cedar in the many narrow swamps and a thicket of hardwood saplings on some of the acres of upland which had escaped the most recent fires, the land was either barren hills or sparse "brush" when a Civilian Conservation Corps camp was established on the old farm land next to Cornwall Lake in 1933.

By 1927, elk were estimated to number as many as 500, not enough to allow hunting. In 1929, the Pigeon River Refuge was opened to the hunting of deer, which no longer needed complete protection. The adjacent Otsego Refuge was kept closed to protect the elk, but a study showed that the elk ranged onto nearby lightly hunted private hunting clubs which afforded them considerable safety, and in 1940, the Otsego Refuge was opened for deer hunting.

By 1950, and at an accelerating pace since then, timber, fish, wildlife and people have received considerably increased attention.

By 1973, 65 percent of the state-owned lands currently in the PRCSF had been purchased by the use of money from the Game and Fish Protection Fund. The remainder was acquired almost entirely by reversion to the state as a result of non-payment of taxes by the former owners.

Continuous state management of the area has occurred from 1919 to the present and the efforts to control people use, provide recreation, and manage timber and wildlife have increased.

The Pigeon River Country State Forest (PRCSF) was created in 1973 from parts of four other State Forests in the area. Ninety percent of the land within the boundary is state owned.

Most of the Forest was leased for oil and gas in 1968. Oil was discovered at the edge of the Black River swamp in 1970. Exploration by seismic survey has occurred from 1968 to the present.

II-A. NATURAL ENVIRONMENT

II-A *Biological and Natural Systems*

Wildlife Populations

The Pigeon River area holds several animals most typically restricted to large tracts of secluded habitat. Bobcats, black bear, and particularly elk use nearly all the plant communities in the PRCSF at one time of the year or another. Elk are unique to this area of Michigan. Many other mammals are resident here, and a great variety of birdlife passes through the area during seasonal migrations. Many species nest here or in the vicinity. A diverse population of lesser vertebrates, including reptiles and amphibians, also populate the PRCSF (Appendix 1).

Elk

The Pigeon River area is the core of the 600 square mile range of an elk herd descendant from an introduction of seven rocky mountain elk made in 1918-1919. This herd is the only sizeable wild herd east of the Mississippi River. Several attempts to introduce elk elsewhere in Michigan have been unsuccessful.

The elk population grew to an estimated 1,500-plus animals by 1963 and was beginning to have a detrimental impact on the range. Hunts were allowed in 1964 and 1965, harvesting a total of 472 elk from the 600 square mile core of the elk range.

Since that time, the herd has declined because of the following factors:

1. Forest succession is converting openings, brushlands, and young-stage forest growth into more mature forests with limited understories of elk food species such as forbs, grasses and shrubs.

2. Incidence of a parasite, the meningeal worm Parelaphostronylus tenuis contributes to elk mortality with an average of four confirmed deaths per year.

3. Human disturbance in the forest uplands has dramatically increased in the last ten years.

4. Illegal kill by poachers has been a constant drain throughout the years.

Factors 1, 3 and 4 are the most significant.

An intensive aerial-ground survey of the 600 square mile elk range was completed during early March of 1975. This survey resulted in a minimum confirmed population figure of 159 elk. It is felt that no more than 10 percent of the herd could have beem missed; so the population probably lies between 170-180. A more recent but less rigorous survey in the fall of 1975, showed the elk had dispersed from locations in Spring. Very few signs were found in the Southern one-third of PRCSF.

Bobcat

The swamp habitats of the Pigeon River area have contained a relatively stable resident population of bobcats for the last four or five years. The population did decline during past years primarily because of the increasing human disturbances, but has stabilized at a fairly high level. At least three groups of bobcat hunters range over the PRCSF during the winter season; however, they choose to kill very few animals.

Coyotes

This species is common in the PRCSF. About five animals are taken each winter hunting season. The population has been declining due to high incidence of mange, as it has elsewhere in the Lower Peninsula.

Black Bear

The PRCSF is one of several large prime habitats for black bears remaining in the Lower Peninsula, the other being the Dead Stream Swamp in Missaukee and Roscommon counties.

With restrictive hunting seasons in recent years, black bears are in the PRCSF in good numbers. Hunters annually take only a few from the area.

White-tailed Deer

Deer are common in the PRCSF with spring populations averaging an estimated 12-15 per square mile. The state land attracts large numbers of hunters each year, including archers as well as rifle hunters.

Other Wildlife

Ruffed grouse, woodcock, snowshoe hares and other smaller animals and birds are abundant in the forest for viewing and hunting. These species are not unique nor as susceptible to human disturbance as elk, bear and bobcat.

Endangered and Threatened Wildlife

No endangered species, as defined by the Federal Endangered Species Act, reside on the forest. However, Kirtland's warblers were intermittently resident on adjoining lands in Presque Isle and Montmorency counties within the last 5-25 years. Given the reappearance of their habitat, the potential exists for their establishment on the PRCSF.

The northern bald eagle is occassionally seen within the PRCSF, but no nests are known within the forest boundaries. The nearest known nest on the Black River Ranch was deserted in 1975. Another nest, nine miles east at Valentine Lake, produced a single eaglet in 1975. Other nests at Grass Lake and Turtle Lake also produced eaglets; these nests are 17 and 25 miles easterly of the PRCSF.

There are two known osprey nests on the PRCSF at the Dog Lake and Cornwall Floodings. The Dog Lake Flooding produced one chick during 1975 while three chicks were produced in the Cornwall Flooding nest.

There are several species of mammals, birds, reptiles and amphibians that are classified as threatened, rare or scarce whose range includes the PRCSF. No recent work has been done in monitoring these populations on the forest, but they may be present by virtue of confirmed past county occurances, known ranges, and the presence of preferred habitats. These animals include the following:

<u>Mammals</u>:

Southern Bog Lemming
Pine Vole
Water Shrew
Gray Fox
Pigmy Shrew
Badger

Birds:

Black-Crowned Night Heron
Red-Shouldered Hawk
Coopers Hawk
Goshawk
Short-Billed Marsh Wren
Barred Owl

Reptiles and Amphibians:

Five-Lined Skink
Four-Toed Salamander
Wood Turtle

II-A *Plant communities*

General Discussion

There are six major plant communities in the PRCSF which are determined by soil types, water levels, and past disturbances including logging and fire. These are (1) the northern hardwoods, (2) aspen-birch, (3) lowland hardwoods, (4) swamp conifers, (5) upland conifers, and (6) grassy openings. The northern hardwoods (maple, beech, basswood) comprise a considerable percentage (18%) of the PRCSF. They are the oldest of the community types, although there may be individuals within any one community type that are older in age.

The aspen-birch community (34%) is a transient, earlier successional stage that would eventually change to conifers and hardwoods. This type provides good wildlife habitat, and is maintained by cutting and/or through natural or controlled burning. Both aspen and birch are important timber products.

Lowland hardwoods are found on soil types with high water tables. Red maple, balsam poplar, quaking aspen, and ash are the dominants of this community. A lowering of the water table in these areas by natural or man-made occurrences, would create a succession to tag alder, balsam fir and spruce.

The swamp conifer communities are represented by cedar and black spruce. These are characteristic of high water tables and muck or peat soils. Continuation of the cedar community is directly dependent upon the quantities, qualities and movement of water beneath the surface. Springs are often found in the lowland conifer communities. Swamps are an integral part of the PRCSF, important for winter wildlife cover and the maintenance of the quantity and quality of the surface drainage.

Upland conifers consist of white spruce and fir, and on the drier sites, red, white, and jack pines. White pine is invading most of the upland conifers. Conifers will also succeed to upland hardwoods given time. Conifers provide some winter cover for wildlife and are important in providing wood for man.

Grassy openings are the smallest community (5%) in the PRCSF and are the earliest successional stage on uplands. Some openings are temporary, changing from year to year, and without management eventually will be closed-in by brush and trees. Openings left from former farms are often sod bound and have existed for 50 years or more. These openings add to the variety of views. The edge between openings and woods produces abundant wildlife food and cover. Elk are especially dependent upon the grasses and forbs in openings. Some are grass covered, some support bracken or sweet-fern, others have a varying mixture of vegetation, including many shrubs.

Rare and Endangered Plants

The state list of endangered and threatened plant species is still undergoing review. Some species on the tentative list may occur here on individual sites.

II-A *Interrelated Aquatic Systems*

Streams

There are over 70 miles of streams in the PRCSF of which 88 percent are top or second quality trout water. This compares with trout water streams for the entire three counties in the PRCSF of only 54 percent. The Pigeon River flows generally northward from its headwater location about seven miles east of Gaylord, and empties into Mullett Lake just a few miles north and east of the village of Indian River. It is a typical coldwater stream with excellent brook and brown trout populations. No major sources of pollution exist and water quality is excellent

The geology of a watershed has a profound influence on the stability and character of streamflow. The high permeability of the sandy soils and occurrence of layered limestone in the headwaters of the Pigeon River Basin lends stability to the stream via a high rate of groundwater recharge. This insures a relatively high volume of streamflow, even during the dry periods of the year (Hendrickson and Doonan, 1971).

The headwater areas of the Pigeon River south of the PRCSF are characterized by higher stream flow velocities, a greater occurrence of gravel beds, and more bank cover in the form of trees and brush. Consequently, this area provides the best trout habitat.

The Black River Watershed lies to the east and roughly parallels the Pigeon River in direction of flow and length. It, too, is an excellent quality trout stream.

Groundwater discharge is less in the upper reaches of the Black than in comparable reaches of the Pigeon. This is believed to be a result of a smaller inflow of groundwater from adjacent basins to the south and the heavier soils of this portion of the watershed. The variability of groundwater contribution in different areas of the Black is suspected to be due to groundwater outflow into the Pigeon River basin to the west.

More than half of the Black River watershed above the village of Towers is state owned. In an area known as "the spreads", about half-way between the mouth and headwaters of the Black, the river divides into several small channels which makes canoeing extremely difficult.

Groundwater (Hendrickson and Doonan, 1971)

The entire northeast portion of Michigan's Lower Peninsula is blessed with abundant supplies of groundwater. This is governed by the glacial geology and topography found in the basin.

Generally, both the Pigeon and the Black rivers have higher groundwater inflows in the upper or southern most portions of their watersheds than in the lower or northermost portions. Thus, conditions for trout are more favorable in the upper watersheds which are cooler in summer and warmer in winter due to the moderating effect of the groundwater supply.

The Upper Pigeon and Upper Black rivers also benefit from inflow of groundwater via the adjacent basins to the south. The Pigeon River gets the greater share of this inflow, and possibly picks up some groundwater lost by recharge in some reaches of the Black River. This results in the Pigeon having the higher discharge of the two rivers.

Lakes (Figure 3)

The PRCSF contains 67 lakes (bodies of permanent standing water in excess of five surface acres) ranging from small unnamed ponds up to the large shallow floodings.

The Pigeon River "Sink-Hole" Lakes are seven landlocked lakes ranging from 2.6 to 10.7 acres in size. They are characterized by their nearly symmetrical outline and their water surface located 40 to 60 feet below the surrounding terrain.

Two of the sink-hole lakes are meromictic, that is, the upper and lower water layers do not mix. Only two other lakes in Michigan have been identified as being meromictic.

Wetlands (Figure 3)

In general, wetlands include lakes, streams, marshes (dominated by non-woody vegetation) and swamps (woody vegetation). All these types either have surface water or near-surface water tables. Since we have described lakes and streams, wetlands here refer to marshes and swamps.

All wetlands function as a stabilizing feature of the physical environment sustaining high water tables to balance precipitation deficits, retaining excess surface run off to diminish flooding, serve as settling basins for eroded soils, and as nutrient sinks to protect downbasin water quality. Wetlands are one of the most productive (in terms of amount of organic material) of biological community types, often surpassing modern agricultural land. Each particular wetland type can be differentiated by the species of plants and animals which it supports, and this wetland diversity is crucial to the survival of many diverse life forms. Wetlands provide habitat for wildlife that is not provided by most other communities.

The Forest wetlands have all of the above attributes as well as offering a diversity of view for people. Swamps are important for winter wildlife cover and surface water quality. Marshes improve water quality and are used by fish and wildlife. Marshes constitute but a small percentage of the area. Because other communities of the Forest are so dependent on wetlands, adverse impacts on the wetlands could have far-reaching effects on fish, wildlife, water quality, the aesthetics of the area, and forest productivity.

II-A *Geology*

The Pigeon River Country State Forest, extending over an area of about 150 square miles, covers a very small part of the Michigan Basin which includes all of the southern peninsula.

Geologic basins, such as the Michigan Basin, are universally important locations of oil and gas accumulations. Since 1925, more than 30,000 wells have been drilled in Michigan for oil and gas, and hundreds of oil and gas accumulations have been found. Since 1969, the primary drilling objectives in the northern sector of the basin have been Salina-Niagaran strata of Silurian age. The objective oil and gas traps which hold the accumulations are mainly reefs associated Niagaran strata, and basal Salina carbonates which overlie the reefs. In drilling to Silurian Salina-Niagaran objectives, potentially productive strata of Mississippian and Devonian age are penetrated.

In the northern part of the basin, nearly 300 oil and gas reservoirs have been found since 1969 in reef traps occurring within a belt about 12 miles wide and extending from Mason County northeasterly through the region designated as the Pigeon River Country State Forest (Figure 4). The reefs are isolated, and occur at random within the belt as presently defined by actual drilling. These reefs have attained variable heights ranging 600+ feet above the ancient sea floor on which they were formed. As topographic features, they range from the normal, minimal drilling unit of 80 acres to a maximum of probably 500 acres. Because very few of the known reefs have been sufficiently outlined by actual drilling, their geometric configuration and areal size is based mainly on geophysical data.

There is nothing unique about the surface geology of the Pigeon River Country State Forest, that sets it apart from other northern areas of the basin. Three productive reef reservoirs have already been discovered in a small part of the PRCSF (Figure 5). These individual reefs, classified as oil reservoirs, are integral parts of basal Salina-Niagaran reservoir rock strata present throughout most of the Michigan basin. They are clustered together within a very small part of the Southern PRCSF, and like virtually all the reefs heretofore discovered within the northern reef belt, their locations were based on seismic surveys.

The principal leaseholders of lands in the Pigeon River Country State Forest have had a high degree of success throughout the northern reef trend in detecting these buried reefs by seismic investigations. The density of reef occurrence within the PRCSF is not known at this time, but it has been stated that the density could range up to 30 reefs per governmental township.

II-A *Use of Natural Resources*

Activities of people who use the surface resources in the Pigeon River Country State Forest are many and varied. Primary use is for some form of recreation; second is economic activities involving removal of timber, or lately, oil and gas; and third is scientific or educational study in the area.

Recreation

Recreation in the PRCSF is of several kinds--camping, hiking, hunting, fishing, cross-country skiing, mushrooming, berry picking, as well as a few others. The snowmobile trail in the PRCSF was abandoned in 1974 as use was not enough to warrant the cost of maintenance, although snowmobiling occurs on unplowed county roads. All recreation uses in the PRCSF are enhanced by the aesthetic qualities in the forest. These include natural sights and sounds, and little visible impact from man's activities.

General Recreation

Camping use on the PRCSF occurs at the designated sites (Figures 6) and amounts to about 33,000 days of use per year in 1974 (Appendix 3).

Mushroom picking is a very important use. Large numbers of persons are involved in the activity. The hardwood forest area gets heaviest use for this purpose; mature aspen stands are next in importance.

Berry pickers have been estimated by the Area Forester as follows:

Strawberries - perhaps 60 persons annually
Raspberries - approximately 120 persons annually
Blackberries - as many as 300 persons annually
Blueberries - at least 1,000 persons annually

The following summarizes the estimated annual uses for various activities.

Scenic driving is continuous, peaks being reached in spring and again in fall.

Total sightseers were estimated at 4,000 per year in 1974.

Hikers, counted by electrical means on established trails, were 2,702 during 1975.

Cross-country skiers and snowshoers numbered 1,034 (counted as were the hikers).

Horseback riders certainly exceeded the number of those who registered also as campers at the Elk Hill Trail Camp (1,448).

Nature study and photography is estimated to occupy at least 500 visitor days per year.

Total use of all general recreation activities is not the sum of the above since many persons use the forest for more than one activity.

Fishing

Although the area's lakes are not generally noted as providing exceptional warm-water angling, they do sustain many thousands of angler days annually. In the 1974 Program for Fish and Wildlife Habitat on the National Forests in Michigan, it was estimated that the average annual fisherman use per acre on Huron-Manistee National Forest lakes was 36 days. Since the lake resource of the Pigeon River Country is very similar to that of the Huron-Manistee, angler use on PRCSF lakes would approach 30 days per acre annually. Annual fishing effort on PRCSF lakes then, is nearly 40,000 angler days annually.

Using similar estimation techniques from the 1974 National Forest Program, total stream angling effort on the PRCSF is about 7,000 days annually. Because of the popularity of this area's streams, it is estimated that about 100 days of effort per mile occur on the PRCSF's streams each year.

Total angling effort on the Pigeon River Country's lakes and streams, then, is estimated to exceed 45,000 angler days annually.

Hunting

Because of the large area of unbroken public ownership and a variety of wildlife habitats, the PRCSF is a popular area with hunters. Using the estimates projected from the DNR 1974 postcard survey of hunters, over 4,000 people enjoyed over 36,000 recreation days of sport hunting during that year (Appendix 4).

Hydrocarbon Development

To date, 19 wells have been drilled for oil or gas within the boundaries of the Pigeon River Country State Forest (only five have been producing wells). The locations of these tests are shown by symbol on the map of the Forest area (Figure 5), The wells include those drilled to shallow formations as well as deeper Niagaran strata.

There are now three producing oil reservoirs, or pools, located within the boundaries of the PRCSF. All are clustered together within a small area of Sections 4, 5 and 9 in T31N, R1W, Charlton Township, Otsego County. The first to be discovered, Charlton 1-4, in Sec. 4, T31N, R1W, was completed as an oil well in a Niagaran reef reservoir in late June, 1970, at a total depth of 5,270 feet. Several dry holes and two additional oil wells were subsequently drilled on the seismic anomaly. One of the two wells was directionally drilled from a surface location in Section 4 to a sub-surface, bottom-hole location in Section 5. Production and pressure data from this well showed it to be producing from a different reservoir. Consequently, the well was designated the discovery well for the Charlton 5 in Sec. 5, T31N, R1W pool.

Cumulative hydrocarbon production from the Charlton Sec. 4 pool (2 wells) from the date of discovery (June, 1970) through July, 1975, amounts to 843,774 barrels of oil and 790,801 thousand cubic feet (Mcf) of gas. Total hydrocarbon production from the Charlton Sec. 5 pool (1 well) from date of completion through July, 1975, amounts to 344,025 barrels of oil and 259,685 Mcf gas. Total probable hydrocarbon recovery from the Charlton Sec. 5 pool is calculated to be 1,083,292 barrels of oil and about 1,033 million cubic feet of gas.

The third oil pool in the PRCSF Charlton Sec. 9, T31N, R1W, was discovered in 1972, and completed in a Niagaran reef reservoir at a total depth of 5,045 feet. A second well, directionally drilled, was completed in 1972. Cumulative hydrocarbon production from the Charlton Sec. 9 pool is calculated to be 4,281,156 barrels of oil and about 4,281 million cubic feet of gas. Flowlines from the wells to a facility site on the PRCSF also exist.

Timber Harvest

Timber cutting is dependent on markets and on manpower to administer the sales. During the five years, 1965 through 1969, an average of 1,201 acres per year were harvested in the forest, while from 1970 through 1974, the average was 1,249 acres per year. Of this cutting in the last 10 years, 58 percent was in aspen type, 30 percent was in pine, 11 percent was in hardwoods and one percent in swamp conifers. Management plans call for an increase in these sales to well over 2,000 acres per year, much of the increase to be in the hardwoods, returning over $25,000 per year to the state, and over $125,000 per year to the local economy. Such work has been continuing for over 20 years on almost all parts of the PRCSF except in the wetlands.

Transportation and Transmission Corridors

Roads in the PRCSF are separated into three categories: County Primary roads, County Local roads, and State Forest roads or driveable trails (Figure 6). (Both the terms "roads" and "driveable" are loosely applied here.) There are 265 miles of roads on the Forest. Approximately 24 miles of impassable roads occur in PRCSF.

The PRCSF has only one quarter of a mile of paved road. Though some are listed as County Primary, some of the gravel or graded roads are frequently impassable; some have not been driven over for many years; and a few are not passable by passenger vehicles at any time.

One large (30") pipeline, the Lakehead oil pipeline, runs through the southwest corner of the PRCSF (Figure 5). This pipeline is an interstate collector for movement of oil from Canada, through Wisconsin and Minnesota and which terminates in Sarnia, Ontario. The Charlton development has one road, two feeder lines, one oil and one gas (6") that run south from the Charlton Township wells, plus flowlines and a buried electric cable.

No large above or below ground power lines are located in the PRCSF. Only small distribution lines exist.

Scientific Research

Since 1949, five miles of the Pigeon River and the seven sink-hole lakes have been used for fisheries research by the state. Trout plantings, stream improvement and other management practices on both river and lakes have been evaluated under a system of permit fishing and annual trout population estimates.

A five year research study on elk was completed on the PRCSF by Richard Moran in 1967 (Research and Development Report No. 267, "The Rocky Mountain Elk in Michigan').

II-B. ECONOMIC

The economy of the area surrounding the PRCSF is most influenced by tourism, timber and agriculture. However, this trend seems to be changing, at least in the urban areas. Gaylord, for example, has shown rapid growth in tourist-related and light industry sectors (Upper Great Lakes Regional Commission Newsletter, 1975). Prior to 1974, industrial development was hindered around Gaylord by lack of a sewer intercepter system. Now such a system has been financed, and a mushrooming effect is being seen in the industrial segment. An industrial park near Gaylord has two firms starting operations in heavy equipment related to the oil industry. With a new course offered at Northwestern Michigan College in Traverse City to train skilled labor for the petroleum industry, job opportunities for skilled petroleum workers should increase.

II-C. SOCIAL

Employment, population and quality of life

Jobs in the area are related principally to tourism, timber and agriculture. In Gaylord, there is an upward trend in recreation related services and jobs related to construction. About 250 new jobs have been created in Gaylord recently. Employment was up from 4,100 in 1970 to 5,272 in 1974.

Population growth in Otsego, Montmorency and Presque Isle counties is beginning to surge with a substantially greater increase from 1970-73 than the U.S. average (10% and over). Per capita income did not change substantially compared to other counties from 1969 to 1972--less than a 20 percent increase. This is compared to an Upper Great Lakes average of 20-24 percent; however, many counties in this northern Michigan region are below the average.

The PRCSF itself provides a large block of publicly-owned land for all kinds of recreational pursuits important to the region. Although there is much public land in the region, the PRCSF is very popular with many local people as well as tourists. There is no doubt that the people's use here significantly assists the local economy and provides a needed respite for all who use the Forest. This is a significant part of the quality of the human environment.

Archaeological and Historical

Any potential archaeological and historical resources of the PRCSF would be of importance. Archaeological resources may be located along the Pigeon and Black rivers, but according to the Michigan History Division of the Michigan Department of State no investigations have been completed in the area. No sites are listed in the "Archaeological Atlas of Michigan" (Hinsdale, W.B., 1931).

No registered historical sites exist in the PRCSF. There are, however, several areas with minor historical value. These are the Witness Trees, the sawmill site at Cornwall, the remains of the Grant School, the P. S. Lovejoy Monument, and Inspiration Point (Figure 6).

III. ALTERNATIVES AND GENERAL IMPACTS

In any discussion of alternatives to a proposed action, there is an implied alternative of no action. In this case, no action would mean that substitute energy sources need to be evaluated, or that means of conserving energy should be discussed.

No drilling or delayed drilling.

The most positive aspect of the "no-drill" alternative is that it eliminates all negative impacts associated with any new hydrocarbon development in the PRCSF. It would allow greater attention to other problems of allocation of the surface resources which need attention. Unlike most other uses, hydrocarbon development has impacts on virtually all other uses. A question often asked is, "Do we really need the oil and gas?" The answer depends on one's perspective. If there are readily available alternative energy sources, or if energy conservation programs actually reduce demand, then the "need" is less obvious. If on the other hand, alternatives are not readily available at the same price, or energy demand is still growing despite conservation programs, this "need" becomes critical.

A better question than that of "need" is one which addresses demand and supply, and how the hydrocarbon development in the PRCSF would affect the welfare of the people of Michigan.

The public value of oil and gas can be fairly estimated by the price people would be willing to pay for it. The price of a barrel of oil or a cubic foot of gas can be estimated with reasonable accuracy. The loss of other public benefits, those thingstermed negative impacts, as a result of extracting the oil and gas, are more difficult to measure or place a dollar value on since they are not usually bought or sold.

The conservation of energy issue relates to reducing our demand for energy or our rate of consumption through either pricing or increased efficiency in energy use. The issue of alternative energy supplies addresses the question of the

availability and price of other replacement energy sources. The proposal for an energy reserve assumes that the public value of extracting the oil in the future will be higher than it is today, and therefore, extracting it today would not be in the public interest.

The following is a critical evaluation of these "no-drilling" alternatives.

Conservation of Energy

There have been great strides made in the past three years in the conservation of energy; far greater changes have occurred than most experts predicted even a few years ago. Reduced speed limits, lower space heating temperatures and higher space cooling temperatures have been accepted by the public as necessary. Some measures have been forced through government controls (highway speed limits) while others are a direct result of decreased consumption due to increases in price and voluntary cut-backs.

Some economists feel increasing prices are the best control on energy consumption because it causes the least disruption. Federal rationing with controls, particularly on price, often causes serious allocation problems that are normally solved under free market conditions.

On a national scale, new, large domestic hydrocarbon resources are often found in environmentally sensitive areas subject to extreme natural hazards such as in the North Slope of Alaska or in the Pacific, Gulf and Atlantic coastal waters. At any rate, extraction of oil or gas from Canada or Alaska and not Michigan, only displaces the total environmental impact.

Without a specific national plan for energy conservation, it is very difficult to perceive what Michigan's role should be. Even under existing conservation measures, Michigan's high energy consuming products and processes are seriously affected as reflected in our state's high rate of unemployment.

Under any national energy conservation plan, the known hydrocarbon resources on relatively accessible land sites near industrial centers might be exploited first. The energy cost of extracting the hydrocarbons, and energy cost of transporting it to where it will be used, puts oil and gas resources that are accessible high on the nation's priority list.

Alternative Energy Supplies

A related topic is that of alternative energy supplies which may be equivalent in terms of cost and availability, and cause fewer negative environmental impacts. Although other sources of energy are not exactly equivalent to oil and gas, they can be equated in terms of available BTU's. The generation of electric power through either coal or nuclear energy is probably the next most available energy alternative although some products and uses of oil and gas can not be readily replaced by other sources. Unfortunately, both of these energy sources require a considerable time delay from planning to actual production.

The environmental impacts of both of these alternatives are considerable. Both require extraction and processing of raw materials, transportation and storage. The intake and discharge of cooling water, and, in the case of coal, the problem of air and water pollution control, and land disturbance make the environmental trade-offs uncertain.

In the long term, solar energy conversion or nuclear fusion may offer energy sources as economical with minimum environmental impact. Neither is expected to be generally available within the immediate future.

Oil from other states is available at a price. The environmental risks in extracting oil from other sources in the United States, especially offshore, are in many cases greater than in the PRCSF. New large natural gas supplies are not generally available in Michigan at any price, and severe shortages are expected. Natural gas from the PRCSF can not be replaced by other gas even if Michigan wished to displace the environmental impact of extraction to other places. With national price controls of interstate natural gas prices, the incentive for exploration and production is missing. Canadian policies regarding exports of hydrocarbons can change at any time.

It is national policy to reduce our dependency on foreign oil. This in turn increases demand on domestic supplies. Through federal controls and pricing schemes, the alternative of foreign oil supply is becoming less available.

Creation of Oil Reserve

There has been some public discussion concerning the creation of an oil reserve in the PRCSF. There are several important considerations. Reserves generally are created after the potential production of oil and gas pools are tested. Without knowing the amount of oil and gas available, it is impossible to create a known reserve for future use. Drilling and testing is necessary, and generally, pipelines are put in place when a reserve is created. Thus a large portion of the impacts associated with hydrocarbon development in the PRCSF would occur if the usual oil reserve were created.

If a reserve were created without exploration and testing, a serious problem would develop concerning the value of the oil and gas. Oil and gas under both private lands and public lands within the PRCSF are largely owned or leased by private companies or individuals.

Exercise of eminent domain and the creation of a reserve would be an expensive alternative which involves not only the delay of benefits from extracting the oil and gas, but the cost to the State of acquiring the mineral rights at a fair market value.

In light of the current federal proposal to produce from long held domestic reserves such as Elk Hills, California, it would be unlikely that Michigan would receive financial support from the federal government to create a reserve in Michigan.

Some who support the concept of a reserve hope that technological breakthroughs such as slant drilling will allow extraction of the oil and gas beneath the Forest from drilling sites outside the Forest boundaries. While slant drilling from a half mile is practical, and slant drilling from 3/4 mile has been accomplished with increased accident risk and other problems, it is not reasonable to expect slant drilling into the relatively shallow Niagaran formation from three to six mile offset wells. These are the minimum slant drilling requirements necessary to keep drilling pads outside the Forest while allowing extraction of internal oil and gas pools.

Another problem develops concerning the concept of a reserve. If the oil resources underlying the PRCSF are not extracted at the same time as other oil in northern Michigan, the refineries which do operate in Michigan may not be available to process the oil. The cost of establishing pipelines to the nearest refinery, or the environmental risk in trucking large quantities over great distances, may make the alternative of a future reserve impractical. Canadian crude which is now supporting independent Michigan refineries is not expected to be available in the future.

The creation of a reserve would appear to be less desirable than a relatively simple decision not to extract the oil and gas at all.

III-B. DRILLING ALTERNATIVES

General Description of Impacts Associated with any Hydrocarbon Extraction

Hydrocarbon development includes several separate phases: exploration, drilling, construction or production facilities, transportation, operation, abandonment, and restoration. Impacts observed in northern Michigan with each of these phases are listed below. This description is included to provide a general picture of any oil and gas development. The following describes typical oil and gas operations, not necessarily those required in the PRCSF. (Most of this material was excerpted from Oil and Gas Development and Your Land, 1975, Michigan Forest Association.)

Exploration

Since Niagaran oil and gas bearing reef reservoirs are scattered throughout Michigan, they must first be located. The most frequently used tool for this purpose is a seismic survey. There are presently two methods of seismic survey normally used in this area: Vibroseis, and conventional methods using deep and shallow shot holes. Vibroseis uses large trucks equipped with vibrators which emit and record sound waves. Specific seismic information is also obtained by detonating an explosive charge from surface level to as deep as 250 feet (shot holes). Best results are obtained when the explosive charge can be detonated below the water table. The depth of the shot hole determines the type of equipment that must be used. Shot holes may be drilled with portable backpack drills

or augers. These augers can be carried by two men and are used when it is necessary to traverse areas which may be environmentally sensitive and where shallow (5-10') holes are sufficient. Deep shot holes are holes drilled to a depth of 60-250 feet by using a truck-mounted drilling rig. Vehicle access and shot hole drilling can cause disruption to surface vegetation.

Drilling

Each well location requires a cleared site of two or three acres out of a normal 80 acres drilling unit. Typically, the site will be a rectangle measuring approximately 250 to 350 feet. State regulations and good safety practices require that certain surface equipment and facilities be located at specified distances from each other, the well, and vegetation.

The access roadbed must be a minimum of 12 feet wide with a cleared area on each side. To provide for all weather operations, the roadway is often widened to 33 feet. It is the responsibility of the well producers to maintain the roads, except any county road used is maintained by the county.

Construction of the access or lease road and drilling pad will result in loss of vegetation on the site for the life of the facilities which may extend for several years. There will be a change in wildlife habitat, and some species of wildlife will be displaced either temporarily (during construction) or permanently. The drilling operation and its attendant noise and truck traffic may continue three to four weeks, longer in the case of directional drilling. After this time, the equipment will be removed. If it is a producing well, some traffic and human activity will continue. The equipment, activity, noise, odors, and the clearing are all activities which are disruptive to the natural scene.

Each successful well produces three components in some quantity: (1) water, (2) liquid hydrocarbons (oil or condensate), and (3) vapor hydrocarbons (commonly referred to as natural gas). The natural gas, oil or condensate, and water must be separated so that the natural gas and oil can be sold and the water (waste product) can be disposed. This operation is accomplished by pressure and temperatures changes and controlled through several process vessels. Many of the process vessels contain a fire and operate at pressures ranging from 25-1,000 pounds per square inch and up. These facilities may be located near the well site or at a distance in central processing facilities which can serve several separate wells. The facilities are specialized and can be dangerous to an untrained individual. The potential impacts from production facilities are essentially the same as for the drilling operation, and include impacts on wildlife, the emission of varying amounts of odor and noise from production facility operation. It is necessary to upgrade some roads and other local services for maintenance crews. Electrical service lines have normally been required, either buried or above ground, along the access road or on a new right-of-way.

Transportation

Ordinarily, at least one pipeline (called a flow line) will be connected to the well. It will either transport the fluids to a processing point, transport the gas from a gas well to a main gas transmission pipeline, or transport the gas from an oil well to a main gas transmission pipeline. If production equipment is located at an oil well site, then a second pipeline may be built to transport the oil to a main oil pipeline. If the second pipeline is not constructed, then the oil must be carried away by truck.

Generally, during the first year or two, oil is trucked from a well to a point of entry at a pipeline or to a refinery. Should a sufficient volume of oil be be developed in a geographic area, then a pipeline may be built to transport the oil to the refinery. The State of Michigan has a No Flare Order which prevents the waste of natural gas by burning or venting. An exemption can be obtained if the well produces only a small amount of gas which would make it uneconomical to build a pipeline.

The allowable oil production in the Northern Michigan Reef Trend is 300 barrels per well per day, but exceptions occur. One or more truckloads per day may be hauled out. Loading time can take approximately two hours. Gas wells might also require trucking of the condensates and water that is removed from the gas treatment at the well site.

Pipeline construction usually takes place in the following sequence: brushing, clearing, grading, pipestringing, welding, ditching, pipelowering, backfilling and cleanup. In the case of winter construction, the clean up takes place in the spring or early summer. All lines are coated and designed with a safety factor. This factor depends on the population density in the vicinity and the type of product carried. Gas pipelines are tested with water to a pressure of at least 1.5 times their operative pressure before the line is placed in service. Water from local streams, lakes or wells is used. Pipeline markers are located along the line in accordance with code requirements. Pipeline rights-of-way vary from 15-50 feet wide, depending on the size of the pipeline. On the PRCSF small diameter pipelines would be used, thus narrower rights-of-way would occur.

State Forest guidelines require that a 3 or 4 inch pipeline be built in a 15 to 20 foot right-of-way, and 30 feet for a 6 to 12 inch pipeline. On state lands, 20 feet of the 30 foot clearing would be maintained, and 10 feet allowed to revegetate. Companies will often ask to clear 30 feet for a 4 inch line and 50 feet for a 6 to 12 inch line on private land where state guidelines do not apply. Wider rights-of-way may be necessary where the ground is soft, and a 20 foot separation between a gas and oil pipeline is necessary for safety. There are a number of special construction techniques that have been used in sensitive or special areas to reduce the amount of clearing and surface disruption.

Pipelines with rights-of-way of 10-15' can be employed using the "plow-in" method. The plow-in method involves the use of a hard-pan plow mounted on a doyer to which the assembled pipeline is attached and installed in one as narrow as possible. Using the "push-pull" method, or using standard construction equipment and working over the spoil pile, pipeline widths can be restricted

to 15-20'. The Michigan Gas Safety Code requires 3' of cover minimum over pipelines. More is often used in stream crossings. The 20' separation between pipelines pertains to separation between oil and gas pipelines. Oil flow lines can be built in the same ditch close to one another. The 20' separation between pipelines can be reduced to 15' in certain circumstances. A 50' separation is generally desirable in swampy areas because of the soft ground and hydraulic shearing potential of the soils from construction equipment. In some cases, it may not be advantageous to locate oil and gas lines in the same cleared right-of-way and much smaller separate rights-of-way may be more advantageous.

Construction through swamps requires a right-of-way and is usually done using special construction techniques (i.e. push-pull method). No more than 20' of clearing would be allowed, and less may be possible, depending on specific instances in swamps. Following construction, the right-of-way is seeded to grasses and legumes for wildlife browse in accordance with the recommendations of the district conservationist (on private lands) or the county implementing agent for Act 347. In swamps, the company is sometimes required to leave stumps, brush, and debris in the right-of-way to discourage human intrusions and increase cover.

The potential environmental impacts from pipeline construction may include all of those from drilling and production facility construction. Because of the long, straight nature of pipelines, other impacts may also occur. Many pipelines cross a stream and some siltation and sedimentation has occurred, even with good engineering practices. Construction techniques and timing of construction to coincide with the low flows and to avoid fish spawning periods is important. Before a stream can be crossed either by pipeline or by road, the company must get a crossing permit from the Department of Natural Resources under Act 346 (P.A. 1972), the Inland Lakes and Streams Act. The permit will specify the location type and methods of construction for erosion control and environmental protection.

In some instances, pipeline construction has resulted in a change in drainage patterns. Woody vegetation will normally not be allowed to grow within the transmission pipeline right-of-way for the life of the pipeline. The opening created will displace some wildlife and encourage others by creation of new edge. There may be subtle micro-climate changes and new species of vegetation may grow into areas. In most cases, this is a temporary effect which may revert once pipeline use ceases. A more serious problem exists in the use of pipeline rights-of-way by off-road vehicles. Snowmobiles in the winter and trail bikes in the summer compound problems of trespass, erosion, wildlife disruption, and revegetation. Pipeline operation is silent and unobtrusive; like aesthetics, its manifestations (right-of-way) can be viewed either as beneficial or adverse, depending on the individual.

Operation

During the life of a well, there will be daily visits to the well site by the oil company personnel to check on equipment operation and possible maintenance work. Gas company personnel will visit the site daily to replace meter charts

and visually inspect equipment. Maintenance may be performed on the pipeline rights-of-way to remove some of the woody stems and brush. Pipeline rights-of-way will be inspected periodically from the ground and from the air. Well operations will include snow removal activities. Other drilling and production activities in the area may result in an additional pipeline being routed alongside existing pipelines forming a transportation corridor. All of these activities will have additional impacts on the environment during the life of the facilities.

Many Niagaran reef resevoirs are ideal for underground gas storage. Depending on the market area and gas availability, certain reef reservoirs may be used for gas storage, and this would involve use of the reef for an indefinite period of time. This would require obtaining storage rights from the surface and mineral rights landowners, as well as construction of additional above-ground facilities for the storage, injection and withdrawal of gas and observation of reservoir storage conditions. A typical oil and gas lease does not give the lessee storage rights.

Abandonment and Salvage

If a well drilled is unproductive or at the end of the productive life of a well, the well must be permanently plugged in accordance with state requirements. The pipe is sealed and cut below the surface of the ground. If pits have been used to contain drilling mud, these will be filled in and graded smooth. All equipment is removed, and the drilling site reseeded and returned to a clean, unlittered state. Erosion is repaired and stumps removed. Pipelines may be left in the ground or may be salvaged. The companies will purge the pipelines of any liquid hydrocarbons and leave them in an inert state, where they represent neither a gas safety nor an oil leakage hazard. The impacts resulting from removal and salvage of the pipeline can be as great as the initial installation, but in general, impacts are restricted to soil erosion and loss of vegetation.

Competitive Versus Unitized Approach

Competitive

Ordinary competitive exploration and development of hydrocarbon resources, where land ownerships and leases are owned by different parties, results in the following activities and installations:

(1) Each separate interest, usually the lease holder, conducts his own investigation and analysis to determine the location of any oil or gas reservoir which may underlie the land surface of that ownership or lease.

(2) Where analysis of survey results indicates anomalies in the subsurface strata of possible oil or gas-bearing reefs, only actual drilling will determine whether hydrocarbons are indeed present.

(3) If hydrocarbons are encountered, the well is tested to determine the volume and kind of products. Testing determines whether or not production will warrant the additional activity.

(4) If an oil or gas reservoir is located by drilling, it next is studied to determine whether additional development wells should be drilled into it to achieve higher recovery (percent) of the trapped oil, or to assure draining of the reservoir under the owned land without danger of loss by competitive drainage from an adjoining ownership or lease.

(5) Producing wells generally yield gas, gas condensates, oil and water brine, each in widely varying amounts.

In order to separate these products, an installation of equipment to perform these tasks is constructed either adjacent to or in the vicinity of the well head.

A small diameter pipeline (usually 3-6 inch) called a "flowline" is or may be required to pipe the mixed products of the well to the facilities site.

After a producing well is "brought in", then a flowline and facilities site must be constructed.

(6) To move separated and pressure-controlled products to market, larger diameter pipelines (up to 8"), or sometimes tank trucks for liquid products, are required to serve the facilities site. This completes the production system.

Where leaseholders or separate landowners are on adjoining properties overlying a single resevoir, each has a right to drill into it to obtain his share of any hydrocarbons. This frequently results in more than one well drilled into a reef which may not require more than one to drain its products. The competition for products of such a reef, in fact, may encourage one or more of the interest owners to drill even more wells in order to assure getting full production from that interest. The Supervisor of Wells must approve permits to drill. Competition may lead to unnecessary duplication of drilling.

Where adjoining lease holders ("operators") differ, and each completes one or more producing wells, each must then construct serving facilities, which in turn, may require transporting pipelines to market the products. Facilities to serve from one to several wells can be installed at one facilities site. The usual distance limitation is a maximum lateral distance of about two miles from the well or wells served.

Unitized (See Figure 7 for unit areas)

By agreement, it is both legal and feasible for adjacent mineral owners and leaseholders to pool their resources for more efficient operations and to reduce costs to themselves and disturbance of surface resources. For this reason the early hydrocarbon development plan for the PRCSF identified four areas as units I-IV (See Management of Hydrocarbon Resources of the PRCSF, January, 1975). Areas within each unit had similar probabilities of oil and gas, the probability lessened from Unit I to Unit IV. Such unitization is commonly accomplished after production of a discovered field has diminished and secondary recovery becomes necessary. Unitization may also precede development by joint agreement of working and ownership interests.

Unit agreements reached at an early stage may preclude the need for separate overlapping seismic surveys, and allow the construction of only the minimum necessary wells needed to drain reservoirs found and the construction facilities to serve the wells. With fewer facilities from which products are marketed, fewer market pipelines are required, and service traffic is concentrated and reduced to serve these common facilities sites.

The unit agreement provides that adjoining ownerships and leases be considered as one property, and that one operator be chosen to conduct operations for all pooled interests. Rather than numerous well sites, facilities sites, access roads, and pipelines, only those needed to assure optimum recovery and marketing of the hydrocarbons are constructed and used. The costs and returns are shared under terms agreed to in the unitization plan. Because of reduced total costs, better, though possibly more costly individual equipment and methods, can be economically employed.

Alternate Drilling Proposals

With any development plan for hydrocarbon resources, it can be assumed that as the intensity of activity increases, environmental impacts increase. The amount of land surface disturbance will increase as number of wells, pipelines, and roads increase. More wells mean more noise for pumping and higher odor levels. Screening well sites becomes more difficult with increasing numbers of sites. Therefore, even with mitigating measures used to reduce the impact of hydrocarbon development, as the number of surface disturbances intensifies, the environmental impact will also intensify. With any hydrocarbon plan, it follows that reducing the number of activities to an acceptable level while still meeting the objectives of development will reduce the environmental impact. The following "drill" alternates are discussed with this assumption in mind.

Four alternate development plans are discussed covering two areas, i.e., a revised Unit I (See "Management of Hydrocarbon Resources of the PRCSF, DNR August 1975 for unit descriptions and locations) and the whole PRCSF, each with the option of competitive or unitized development. (1) a unitized approach on an area very near the size of the previously proposed Unit I; and (2) a competitive, drill-as-usual plan in the present Unit I area; (3) a unitized approach to the entire PRCSF, and (4) a competitive, drill-as-usual plan for the entire PRCSF (Figure 8). All four alternates assume no drilling in environmentally sensitive areas such as wetlands, campgrounds and one-quarter mile from surface water.

A matrix (Figure 8) compares quantitive surface disturbance and social and economic impacts for each alternate including "no drill" or do nothing. The higher the values under Pads, Facilities and Pipelines, the higher the adverse impact. The higher the values under Social and Economic, the higher the positive impact.

The development plan for a unitized approach in the southern portion of the PRCSF assumes no additional (some seismic work is completed) oil and gas activities on the surface north of the following line: Starting on the west boundary of the PRCSF, one-quarter mile south of the Pigeon River, east to Headquarters Road then north to the Unit I boundary, and then finally along Unit I boundary to the east edge of the PRCSF. Among the alternates, this would produce the least amount of surface disturbance, the least amount of environmental impact, would preserve the northern portion of the PRCSF which is presently least developed for other uses, and concurrently would produce most of the potential economic and social gains.

Using the same area with a "no-drill" boundary, alternate two would entail competitive development without unitization. The range of likely pads, wells, pipelines, and facilities increases over that of alternate one (Figure 8).

Alternate three employs unitization throughout the entire PRCSF in four operational unit areas that could be developed either simultaneously or sequentially. Since the likelihood of oil and gas reserves north of revised Unit I may be very slight, the low range of surface activities for the entire PRCSF is the same as for alternate one (Figure 8). The level of surface disturbance estimated for the high range is about double that of alternate one, but would be substantially lower than alternate two, competitive drilling in revised Unit I. The economic and social gains under unitization of the entire PRCSF is higher than for development of only Unit I, but certainly the environmental "costs" are also higher.

Alternate four entails competitive hydrocarbon development on the entire PRCSF. The greatest amount of surface disturbance and environmental impact would occur with this alternate (Figure 8). The likely economic and job gain is little different than for alternate three with unitization.

In summary, the alternatives represent a range of possibilities from no drilling ever on the PRCSF to competitive hydrocarbon development on the entire area. The environmental impact increases from the no-drill option to competitive drilling on all the PRCSF, even with equal environmental controls for the drilling alternatives. The legal implications of no-drilling have not been discussed in-depth, but denial of a drilling permit for an area with a high probability of oil and gas would be challenged in court as it has in the past. The natural gas which would be produced is not available from other sources.

Delayed drilling or creation of a reserve would reduce some of the environmental impacts for a period. A reserve would appear to create more institutional problems than would the simple decision not to drill.

The two competitive drilling alternatives have been discussed because they are possibilities. If the Natural Resources Commission does not sign a unit agreement, drilling permits will be requested on a competitive basis. In addition, the competitive alternatives provide a basis of comparison to the unitized alternatives and represent past planning efforts. The competitive alternatives would create twice as much or more environmental impact as the unitized alternatives.

Two unitized alternatives represented a planned approach to extracting hydrocarbon from either the southern one-third or the entire PRCSF. Environmental impacts of each would be significantly reduced and still allow hydrocarbon development. Unitization on the entire PRCSF would allow drilling in northern areas where the probability of finding hydrocarbons is much reduced from the southern one third. Thus environmental impact would occur with the possibility of little economic or social gains. The revised Unit I, unitized plan represents a no-drill boundary that approximates the northern limit of the hydrocarbon trend and more importantly provides a defensible line on environmental grounds (see Proposed Action). This alternate or any minor variation of the line would have the least environmental impact of the drilling alternatives.

IV. PROPOSED ACTION

The Department of Natural Resources proposes to allow exploration for development of oil and gas by drilling within the area previously described as revised Unit I of the PRCSF. This is an area of approximately 40 square miles or slightly larger than a township. This area excludes the present hydrocarbon development area. The exploratory drilling and all subsequent activities thereafer will be limited to the line described in Alternate I. (See Figure 11) All activities will be unitized.

The estimated time components are as follows:

Function	Calendar Years
Exploration Program	1974-1977
Development Program--Production, Service and Transportation Facilities	1977-1979
Productive Life (Including supplemental recovery)	1978-1998
Abandonment and Restoration	complete by 2000

As is implied above, after abandonment, all equipment will be removed and steps will be taken to restore the areas occupied to natural conditions, or as determined best at that time (see Mitigating Measures).

This alternate has been chosen with the no-drill boundary because it has several advantages over the other alternates. Indications are that a majority of the recoverable oil and gas that exists on the PRCSF can be extracted from the proposed development area. This represents an economic and social plus for Michigan and serves the public interest in providing energy and jobs. The remaining northern two-thirds of the PRCSF will not be developed where continued emphasis on recreational management will occur. Specifically no drilling would occur in the northern two-thirds and the Pigeon River within the PRCSF would be completely protected from any pipeline crossings with this alternate. Also, most wild areas where disturbance is and has been low occur in the northern two-thirds of the PRCSF. This includes the two areas being studies for inclusion under the Wilderness and Natural Areas Protection Act (Figure 9) as Nature Study Areas. The northern portion of the PRCSF offers good opportunities to accomodate any activity which may be displaced by oil and gas development in the southern portion.

A. *Management of Hydrocarbons*

The extraction of mineral resources, including oil and gas from the forest will serve a vital public service and will be directed and controlled by the Department so as to be most compatible with the other uses of these lands, such as recreation, wildlife procreation and forest management.

Seventy-six percent of the state-owned lands within this Forest have been leased to oil and gas companies or independent developers for purposes of developing and extracting the hydrocarbons.

No facilities, drilling sites, pipelines, or access roads will be placed within or through the Pigeon River Country State Forest as an accomodation to the development, production or transportation of resources not originating in the PRCSF unless it can be shown that such actions could be used to haul oil and gas away from the PRCSF and thus reduce impact from the proposed action.

There is not yet sufficient seismic data or drilling coverage in the PRCSF to predict how many reefs might be found in this area but the density of occurrence could range up to 30 reefs per governmental township. Our best estimate for planning purposes is about 20 reefs per township in the southern portion of the Forest.

The procedures presented herein deal only with the Salina/Niagaran reefs since experience to date has demonstrated a reasonable degree of predictability for finding and developing these objectives. This proposal is limited to the Salina/Niagaran reefs, but multiple recovery wells from the same pad will be allowed if significant accumulations are found in other strata.

Objectives

To the fullest extent possible and consistent with the importance of the resources, careful effort will be made by the Department to allow drilling and recovery of the oil and gas resources. However, no drilling, facilities, roads,

or pipelines will be allowed in vitally sensitive environmental areas which would suffer irreparable damage. The procedures described will provide opportunities to plan locations for all necessary work and installations without intruding into such areas.

Following are specific objectives of the program to be directed by these procedures:

(1) To allow recovery of oil and gas from beneath the revised Unit I of the Pigeon River Country State Forest and to direct the placement of drilling sites, access roads, facilities, and pipelines to cause the least possible harm to surface resources and the least possible disturbance to wildlife, waters and activities in the area.

(2) To conduct exploration and recovery operations in a sequence which will allow careful, detailed planning before each major action step, with an opportunity to revise the proposed plan to action as needed.

(3) To establish a time schedule which will provide adequate opportunity for care in exploration and development while yet demanding efficient action and operation. This will minimize the time required for recovery of the hydrocarbons and restoration of the area occupied to natural conditions, or to serve future intended use.

Program, Sequence, and Timing

An important consideration is the time span which will be required for inception of exploration to abandonment and restoration of the land. This time requirement should be no longer than that which is reasonable and necessary to extract the oil and gas reserves without wasteful practices. It is estimated that the program can be accomplished in about 20 to 25 years. Most restoration can be achieved during development and operation and will be completed before the end of production.

The following schedule anticipates that a final development plan for the development area will be completed sometime in late 1977 or early 1978. Much of the seismic survey has already been completed. The first drilling permit requests will be acted on only after approval by the Natural Resource Commission of a drilling plan.

B. *Schedule*

Schedule Leading To Hydrocarbon Resource Development on the Pigeon River Country State Forest.

(The following schedule assumes approval at each review stage.)

1. August, 1975--Natural Resources Commission (NRC) receives "Management of Hydrocarbon Resources of the PRCSF". (see footnote)

2. NRC approves above procedures and Director signs Unit Agreement.

3. Operator (Shell) reveals to DNR prospective drilling locations for first Phase of exploration.

4. DNR and Operator jointly select acceptable surface locations for exploratory drilling. (Public Service Commission will be consulted during this process.)

5. ENVIRONMENTAL ASSESSMENT OF first phase of exploration prepared by Unit Operator and reviewed with Michigan Environmental Review Board (MERB), Pigeon River Country Advisory Council (PRCAC), and NRC.

6. Permits for first exploratory drilling issued.

7. Complete seismic and first exploratory drilling information combined and all potential producing areas in revised Unit I identified to DNR.

8. Operator, DNR and Public Service Commission select acceptable surface drilling locations.

9. ENVIRONMENTAL IMPACT STATEMENT (EIS) prepared by Unit Operator on second phase of proposed exploratory drilling including a review of sites, access roads, time of drillings, etc.

---EXPLORATION---

ANTICIPATED FALL, 1976:

10. Second EIS reviewed at public hearing with MERB process, with PRCAC, and finally with NRC.

11. Permits issued for second phase of exploratory drilling.

12. Operator shares with DNR results of all exploratory phases.

ANTICIPATED 1977:

13. Operator, DNR, and Public Service Commission jointly prepare development plan including oil and gas producing wells, permanent roads, location of pipelines, and centralized facilities.

14. Final EIS prepared by Unit Operator covering FINAL DEVELOPMENT PLAN.

15. Final EIS reviwed at public hearing, with MERB, with PRCAC, and finally presented to the NRC.

---FINAL DEVELOPMENT---

16. With NRC approval, Director authorizes initiation of oil and gas production.

FIRST OIL AND GAS PRODUCTION ANTICIPATED IN 1978

ANTICIPATED 1988 (± Several years)

17. Abandonment of wells and restoration of areas used.

NOTE: After receiving this plan of management, the Natural Resources Commission ordered the preparation of an environmental impact statement to be prepared concerning the proposed plan.

Wells will be produced at the highest rate which will allow maximum recovery of the hydrocarbons without damage to the reservoir as determined by the Supervisor of Wells.

A development program will be undetaken after the second phase of exploratory drilling, when the exploration program has reached the stage where it will be possible to draw up an overall proposed plan for drilling and producing the hydrocarbons from the area or segments of the area. Once the reefs have been defined it will be possible to select surface drilling sites and production facilities sites and to plan pipeline routes. At this stage, the program can be designed for maximum efficiency of production and minimum impact on the surface environment. The proposed plan will be submitted for Commission approval before the development program is undertaken.

At such time the exploratory wells, production wells, well sites, flowlines, facilities sites, or pipelines are found to be no longer useful for production or service, they will be abandoned according to rules established under Act 61, P.A. 1939. After this, the areas occupied by them will be restored to natural contours and revegetated in accordance with instructions of the Department. (See Mitigating Measures).

C. *Exploratory Drilling, Testing and Completion of Wells*

The first phase of the exploration program for Unit I will be completed by limited exploratory drilling to confirm the seismic data in Unit I. A relatively small number of test drillings will be needed. After these are proposed, this proposal will be the subject of a field investigation, and an environmental assessment and review.

-Permits for Phase I exploratory drilling will be issued only after preparation of a map and time schedule of the proposed drilling.

-The Department will exercise the prerogative to relocate proposed drilling surface locations and will decide upon access routes to safeguard the forest environment.

Permitting of exploratory wells will be subject to rules now in force under the General Rules Governing Oil and Gas Regulations.

The second phase of the exploration program will consist of completion of seismic survey (as above) and will be completed by exploratory drilling and testing of reefs found within the productive reef trend. As in earlier exploratory drilling, the siting and access will be governed by joint planning between the companies and the Department. Before second phase drilling will be permitted, the proposed action alternatives, modifications, and anticipated effects will be described in an Environmental Impact Statement prepared by the Unit Operator which will be subjected to review by the Department, the Michigan Public Service Commission, the Pigeon River Country Advisory Council, the Inter-Departmental Environmental Review Committee, the Michigan Environmental Review Board, and public hearings.

Any exploratory wells, in either the first or second phase which find oil or gas must be tested to determine whether production efforts are warranted.

-If successful, such wells will not be produced except for such testing, but will be shut down until an approved Final Development Plan has been drawn up and transporation and processing facilities are ready.

It is anticipated that these latter steps will take place after all exploration is completed and second phase drilling is finished.

The following is an outline of design criteria, together with environmental and safety precautions which will be adhered to in the drilling and completion of wells.

1. Land Use--Drilling Sites -- The size of a drilling site will depend on the number of wells to be drilled from a single site. Where practical, after consideration of all surface resource and land use values, wells will be drilled from common sites using the least possible number of surface drilling locations. All wells anticipated to be served by a common facilities site and pipeline will be drilled and completed before development begins in another one. The range of size requirements is as follows:

   a. Single wells--300' x 300' (approximately two acres).
   b. Multiple wells--each additional well drilled from a common site adds approximately .7 acre.

   Based on the aforementioned assumption that 20 reefs may be found per governmental township, the total land used for drilling sites should be about 100 acres out of approximately 23,040 in a government township.

2. Well Design -- (Typical drilling prognosis attached--Figure 10).

3. Safety Measures Casing Design -- Rules established under Act 61, P.A. 1939, as amended, must be observed.

4. Operational Safety for Drilling Program -- Rules established under Act 61, P.A. 1939, must be observed. In addition:

   a. All well testing will be done through a separator and the vent gas flared for safety and reduction of noxious odor.

   b. The site is to comply with Air Pollution and Occupational Safety and Health standards and regulations in effect.

5. Directional Hole Limitations -- In environmentally sensitive situations, some directional drilling will be required. Directional drilling will also be used to reduce the number of drilling sites.

   As a practical measure, maximum deflection angles will be limited to not more than 30° under normal develop operations. Efforts will be made by the Department to avoid the necessity of exceeding these limitations.

Facilities

Central facilities will be used to serve several wells wherever possible. It is now estimated that there should be a need for only about six or seven central facilities to serve as many as 20 reefs which may be discovered in a 36 square-mile area. The facilities sites will be chosen on the basis of efficient service, protection to the environment and safety precautions. They will be placed outside of the PRCSF if possible.

1. Land Use -- The minimum size facility for planning purposes would be designed to serve only one reef with one to three wells. Such a facility could be constructed in an area of about 4.7 acres. The maximum size facility recommended in this preliminary plan would be designed to serve from three to five reefs with a total of ten or twelve wells. This larger facility would require a surface area of about 8.3 acres. In the projected estimate of 20 reefs, the plan would provide for six to seven facility sites with a total land use of about 40 acres per governmental township.

   Flowlines and utility lines from each well site to the facility site can be laid in or alongside access roads. In some instances it may be more desirable from an environmental standpoint to build cross-country flowlines.

   A sketch of a typical facility indicating layout, access and equipment placement is shown in Appendix 5. Modifications in areal placement to accomodate surface conditions and aesthetic appearances are possible so long as they meet safety and functional requirements.

Transportation System

A pipeline system will be required to move the products from the facilities to market outlets outside of the PRCSF. (Trucking of products will be permitted only during the initial period of testing to ascertain production.) Routes will be selected so as to cause minimum environmental disruption and shall be subject to approval by the Department and the Public Service Commission. The routes

selected will make use of existing rights-of-way and roads wherever possible. This accomodation will be easy since roads and trails in the southern one-third of the PRCSF provide ample rights-of-way (Figure 6). Where it is preferred that a stand-off distance from existing roads be adhered to for environmental reasons, pipelines will be so placed.

1. Land Use --

   a. Maximum width of right-of-way to accomodate installation of equipment is about 50 feet. The right-of-way will be allowed to grow back except for timber and brush which must remain cleared over a narrow strip to provide access.

   b. The gross possible land use for pipeline right-of-way is estimated to be about 16 miles x 50 feet or 95 acres in an area of 6 miles x 6 miles.

   c. The necessity of stream crossings will be reduced and placement will be at least sensitive locations by the opportunity for complete planning prior to development. Wherever a pipeline or utility crossing is necessary, the installation will comply with Acts 346 and 347, P.A. 1972, and conform to guidelines as specified in the publication by the Department, entitled "Protection of Natural Resources (Handbook of Specifications), 1971 Edition", and all regulatory requirements.

Combined Land Use Requirements

The breakdown of estimated land use requirements within a township-sized area in which 20 reefs might be found is shown in the following tabulation:

ESTIMATED LAND USE WITHIN A 36-SQUARE MILE AREA
(Approximate Size of Revised Unit I)

"Permanent" Surface Requirements	Average Dimensions		Area Acres
Service Roads	5.5 miles x 15 feet		11
Drilling Sites (7)	300 feet x 300 feet		14
(16)	500 feet x 500 feet		92
Facilities Site (7)	500 feet x 500 feet		40
		Subtotal	157

Percent of Total Land Area: 0.68

Buried Surface Requirements	Average Dimensions		Area Acres
Flowlines & Utility Lines			
(along service roads)	5.5 miles x 15 feet		11
(cross-country)	6.8 miles x 30 feet		25
Pipelines (includes flowlines and utility lines where applicable)	16.0 miles x 50 feet		95
		Subtotal	131

	Area Acres
Percent of Total Land Area: 0.57	
TOTAL ESTIMATED LAND USE-(if 20 reefs found)	
PERCENT OF TOTAL LAND AREA: 1.25	288

These required areas are liberal since, for example, most pipelines can be accomodated in a 20 foot right-of-way.

D. *Development and Operation*

Requirements of Act 346, P.A. 1972, the Inland Lakes and Streams Act, Act 347, P.A. 1972, the Soil Erosion and Sedimentation Act; Act 245, P.A. 1955, the Water Resources Commission Act (calling for pipeline, storage tank, or well emergency contingency plan); and Public Service Commission jurisdiction Act 9, P.A. 1929 as amended; Act 165, P.A. 1969, the Michigan Gas Safety Code and all other applicable laws in effect must be followed in all activities, installations and operations.

Wells and Well Sites

After approval has been given for the Final Plan of Development, actual development and operation will be permitted. The Oil and Gas Act (Act 61, P.A. 1939) will provide control of drilling, operating, and abandoning of oil and gas wells to prevent surface and underground waste.

Wells will be produced at the highest rate which will allow greatest possible recovery of the hydrocarbons without damage to the reservoir as determined by the Supervisor of Wells.

Directional drilling up to 1/2 mile will allow most pads to be established adjacent to existing roads. Very few areas in the southern third of the PRCSF are more than 1/2 mile from existing roads (Figure 11). Sub-surface geology limits directional drilling to 1/4 mile in the northern 2/3 of the PRCSF.

Little additional impact on the environment is anticipated if supplemental recovery operations are implemented after pressure in a well subsides. There may be a need for drilling some additional wells (injectors and/or water supply wells) and for alteration of the facilities area to install injection equipment.

E. *Abandonment and Restoration*

The Oil and Gas Act provides for control of abandoning to provide for inspecting, repairing and plugging of oil and gas wells. The Department will enforce its provisions. Companies will not be allowed to sell to strippers.

Additionally, the drill sites, facilities sites, and pipelines where abandoned must be restored by the following steps:

-Remove all equipment buildings.

-Regrade the land surface to approximate natural contours and to blend with surrounding terrain;

-Revegetate the land surface by disking, fertilizing, seeding, and mulching as requested by the Department.

Present leases do not provide for gas storage in this area and no such leases will be issued by the DNR in the future. The Public Service Commission has been requested to agree not to issue a certificate of public convenience and necessity (Act 26, P.A. 1973) which is necessary for any condemnation of the PRCSF mineral rights for gas storage.

Cleared sites may be maintained as wildlife openings, or may be either reforested or aesthetically improved. Access roads in many instances will be used as service routes and for recreational purposes, as may pipeline routes.

V. ENVIRONMENTAL IMPACT

To adequately assess the impact on, or change in, an element of the environment, that element's susceptibility to change and ability to recover must be considered. Since man's use is an integral part of the PRCSF, people's attitudes are also a factor in assessing impact. The following impacts are described in these contexts.

The impacts are described as they affect the proposed area only where hydrocarbon development is considered. The combined impacts on the whole PRCSF are, therefore, less than the impacts associated with just the proposed development area. Impacts also are separated first by those associated with normal development and operation; second, those that could occur through accidents or human error. Refer to the matrix (Figure 12) for a visual display of all activities and impacts.

V-A. NORMAL DEVELOPMENT IMPACTS

Wildlife

Elk

Field biologists feel that the 400-plus miles of seismic survey have already had a major impact on the elk population of the area. The animals have moved away from their normal haunts towards the large club holdings where they can enjoy relative quiet and minimal disturbance. Traditional rutting and calving areas have been abandoned and the only rutting or harem areas known to be active recently are on club lands. The March, 1975 elk survey located only 36 elk within the PRCSF boundaries. This is just 23 percent of the known herd. Before seismic activity began, the majority of elk were found within the PRCSF despite the fact that the Forest represented less than 30 percent of the total elk range. It is interesting to note that elk have also left club lands where seismic activities have started. Adjacent club lands*have now all been leased for oil and gas development, and the last remaining sanctuaries against this kind of disturbance have now disappeared.

Whether the elk will return to their former range following completion of the last seismic survey work is unknown. With the possibility of drilling and production development following the survey, an early return by the elk is doubtful.

Elk have similarly retreated in the face of man's intrusion wherever studied:

Colorado biologists found that mature bulls vacated accessible areas for roadless areas when the October hunting season opened. The ratio was 3.5 roadless-area elk to 1 accessible-area elk at the season opener, and 4.7 to 1 following the hunt (R. Boyd, 1970).

In elk herd studies in Montana, use by elk of parts of the study area was adversely affected by motor vehicles (K. Coop, 1971).

In Colorado, deer and elk pellet-group densities increased with distance from roads. Paved, gravel and unimproved dirt roads were avoided by deer, while elk

*Canada Creek, a large private club holding just to the east of the PRCSF, is the only remaining exception. The recent lease offer had neither been accepted nor rejected at the time of printing this EIS.

avoided gravel but not dirt roads. The U.S. Forest Service agreed to avoid construction of roads, particularly permanent roads, in critical elk habitats unless other considerations were overriding (Rost and Bailey, 1972).

Reporting from Wyoming, Ward found that elk preferred to be at least one-half mile from people engaged in out-of-vehicle activities. Also, Interstate Highway 80 acts as a barrier to elk movement, but traffic on the forest service road system has little effect on elk activity, especially beyond 300 yards. During the hunting season, elk moved to densely timbered and remote areas (Ward, 1972). On Bureau of Land Management lands, Cole found that snowmobile and gas extraction forced elk to move to other territory (Cole, 1971).

Cooperative studies in Montana during 1973 showed the following: Elk avoidance of sites within one-quarter mile of roads was described as "fairly strong" Elk appeared to avoid active logging areas. Closure of roads to vehicles appeared to increase the capability of a management unit to "hold" elk for a longer period of time. It also increased hunter success as well as elk observed per unit of hunter effort. Another closure result in hunters reporting seeing almost 50 percent more elk than during unrestricted access. Elk avoid roads even when there is no traffic. Active road building and logging have resulted in temporary elk displacement of up to four miles (Intermountain Forestry and Range Experiment Station, 1973).

The study of the use of clear-cuts by elk in Montana found the most suitable conditions for elk were present when the cutting was located the greatest distance from other human disturbance (Day, 1973).

Human disturbance and harassment by all types of vehicles were recognized as prime factors affecting elk presence on both summer and winter range in Oregon (Brown, 1968).

The most pressing need of Michigan elk is to protect their range against further human intrusion for purposes other than timber or wildlife management (Moran, 1973).

In a summary of research done in several states and provinces, Sundstrom and Norberg (1973) reported the following:

> Detrimental influence on elk from road construction was reported from Montana, Idaho, Oregon, Wyoming, New Mexico, Colorado, Alberta and British Columbia.
>
> The larger elk herds are in roadless, wilderness or otherwise inaccessible areas.
>
> Road construction and increased human-use resulted in elk decrease and/or distribution changes in all the larger elk-producing states and provinces.
>
> Hunting seasons were altered due to improved access in British Columbia, Alberta, Idaho, Montana, Wyoming and Oregon.

> All provinces and states contacted (except Washingtin, Nevada and California) found roads increased human use which changed elk distribution.
>
> Little data exists on the level of human disturbance which disturbs elk.
>
> Elk tolerate more human activities in parks where they are unhunted.
>
> Oregon believes the best elk range has no more than one mile of road per square mile of range. Road construction must be restricted to protect elk. Such is done by the U.S. Forest Service in Colorado.
>
> (Sundstrom and Norberg, 1973)

Testimony given at the Corwith 1-22 hearing was to the effect that the oil well drilling with attendant development will cause serious damage to wildlife, specifically elk (Corwith 1-22 Hearing, 1972).

Additional disturbances from hydrocarbon development, new roads, initial drilling activities, and the presence of facility sites will significantly reduce elk numbers in the proposed area. It is likely that much of the existing herd will not remain in revised Unit I, but will spread out to the northern areas of the PRCSF and to private lands. However, private lands also may be impacted by hydrocarbon development. An unknown number will not survive since habitat is finite. A viable population may survive, however, if intensive management efforts are established in priority areas in the northern PRCSF and if poaching can be substantially decreased throughout the elk range.

Bobcats

Similar to elk, the bobcat is expected to retreat in the face of hydrocarbon development. The history of this species indicates a high degree of incompatibility with the works of man. The following remarks concerning bears are equally true of bobcats. Protection of swamps from drilling will decrease the impact on bobcats.

Black Bears

Bears have been pressed into wild areas of diminishing size by the increasing pressures of land development and other human disturbances throughout much of the northern Lower Peninsula. The avoidance of swamps for drilling and facilities site locations can afford this animal some degree of protection. It is expected that the 1-2 percent of the land which will be intensively developed as sites will have less impact on bears than will the development of service roads with resultant multiplied human activities and increased human contact. Avoidance of the swamps by oil-extraction activities will provide some protection.

White-tailed Deer

A remarkably adaptable animal, the deer should continue to prosper in association with man's increased activities in the PRCSF. This increased opening acreage, if

properly treated, might be expected to benefit deer by creating additional preferred foods in the form of grasses, forbs and shrubs.

Bald Eagle

This bird does not nest in the PRCSF, although two active nests are within three to nine miles of the east Forest boundary. Development proposed by any hydrocarbon plan is not expected to affect these nests, but there will be lessened possibilities of eagles using this area after intensive drilling begins.

Other Wildlife

Other animals, both great and small, will not be significantly affected by this plan except where the 1-2 percent surface disruption actually occurs. Ruffed grouse and woodcock, like the deer, may benefit from the slight increase in forest openings.

For the most part, the more common animal species other than those discussed above should be relatively unaffected. This presumes that no gross oil spills or other large-scale contaminations will result from the development.

Endangered and Threatened

The bald eagle would be inhibited to some degree in using the proposed area of the PRCSF where hydrocarbon extraction would occur. Successful nesting would be impossible with near-nest disturbances during the critical egg-laying and eaglet-raising period from March 1 through August 1.

Ospreys do quite well despite man's disturbances and are expected to fare well with the proposed restriction on wetlands activities.

The other birds listed as threatened, rare or scarce would probably suffer only minimally from hydrocarbon expolotation. These include the black-crowned night heron, coopers and red-shouldered hawks, goshawk, barred owl and short-billed marsh wren.

The insectivores and rodents would receive adequate protection from the restrictions against developments in the wetlands. These species include the water and pigmy shrews, the bog lemming and pine vole.

A greater threat to some of these species would be the change to the later successional stages of vegetation that occurs with forest cutting.

Reptiles and amphibians would be adequately protected by exclusion of development from wetlands.

V-A. Plant Communities

Uplands

Upland plant communities will be impacted little by any of the surface disturbances. Pads, roads, pipelines, flowlines, electric lines and facilities will require

clearing vegetation. Such clearing will create openings in wooded areas and will last at least as long as hydrocarbon production continues, about 25 years. About one percent of the land in the proposed area will be cleared for these uses. All cleared areas, however, will recover to the former vegetative type if they are not maintained by man. The cleared areas in advanced northern hardwoods would take longer to recover than will other upland community types. Total impact on the combined upland communities will be slight. How man views the clearings will be dealt with in the impact on use of natural resources.

Swamps (see wetlands)

Endangered and Threatened

No endangered and threatened species of plants are known to exist on the PRCSF. Michigan is completing the total identification and description of all endangered and threatened species. The locations of all surface activities will be reviewed for the presence of endangered and threatened plants before action begins on development. If any question arises as to whether an area proposed for development could contain endangered or threatened species, outside professional botanists will be called in. This will insure that no impact from hydrocarbon development occurs on endangered and threatened plants.

Interrelated Aquatic Systems

Streams

Pipelines, flowlines, electric lines and new access roads could cross streams. The Black River will be crossed by one pipeline in the vicinity of the Tin Shanty Bridge. The Pigeon River will not be crossed within the PRCSF. One or two small tributaries may be crossed. All crossings cause some stream bank erosion and siltation in the waterway regardless of the care taken. Siltation kills fish food organisms and may destroy spawning areas. In cases where siltation is minimal, the stream is quickly able to recover by flushing downstream to low productive areas the low volume of materials washed in. In extreme cases, sections of a stream can be lost to fish production.

Stream crossings and thus the potential for erosion and siltation will occur to a slight extent in the proposed areas of the PRCSF. This will be held to an absolute minimum by requiring various protective and mitigating measures described further on.

Groundwater

Impacts on groundwater from normal drilling operations are unlikely. The surface casing must be set and cemented through the glacial drift and into 100 feet of bedrock, thereby sealing-off hydrocarbon flow from ground waters. On occasion, however, a drill may punch through an artesian aquifer. Water flows to the surface and the well must be sealed off by cement. No contamination of groundwater occurs and little water is lost. Accidental contact with hydrocarbons can occur and this point will be discussed later.

Roads can cause changes in groundwater movement in areas where the water table is high. Since few, if any, roads will need to be placed in wetland areas, no impact on the groundwater from roads will occur.

Wetlands

Pipelines, flowlines and electric lines will cross some wetland areas. It will be necessary for one pipeline to cross the Black River. A narrow band of wetland will be encountered. Pads and facilities will not be allowed in wetlands. All likely pads and facilities should be accessible via existing or new roads without crossing wetlands. Clearing, ditching and burying lines in wetlands will require disturbing the wetland vegetation. Any trees present on the route will be cut. The result is loss of the canopy which is important for aesthetics and cover for wildlife during the production period if the corridors are maintained. The area involved will be small since little clearing in wetlands will be necessary.

More importantly, ditching and burying lines and development of access roads to pads or facilities can disrupt surface and sub-surface water flows. Since maintenance of wetlands is dependent upon proper water movement, pipelines and roads particularly could cause mortality of wetland vegetation where water is impeded or cut off.

V-A. *Surface Geology*

The only unusual surface geologic features in the PRCSF are the limestone sinks or "sinkholes". Drilling will not be allowed within 1/4 mile of sinks and therefore no impacts are expected.

V-A. *Use of Natural Resources*

All present uses of the PRCSF in Unit I except timber harvest and hydrocarbon extraction will be reduced in quality of experience wherever, and to the extent that development occurs. These activities include hunting, fishing, camping, hiking, cross country skiing, berry and mushroom picking and scientific study. The visual presence, odor and noise associated with oil and gas development and operation will degrade the aesthetics and very likely reduce some present recreational uses, especially those associated with solitude or quiet.

Not all who use the PRCSF and not even all who use the proposed area for these activities will come into contact with a facility, well pad, pipeline corridor, or new road. However, many uses which require moving about the area increase the chances of observing surface disturbances. (See Corrective and Protective Measures.)

Noise associated with development (drilling, trucks; 4 years maximum) and with the operation of the facilities (25 years) will be heard over a mile on a quiet evening or night. Although noise levels will not exceed 45 decibels on the A scale at 1500 feet from a facility (about the noise level associated with light traffic 100 feet away), this noise is a foreign element in an otherwise natural sounding background. It may be disturbing, therefore, even at low levels. (See Corrective and Protective Measures, Section VII.)

Odors, mostly mercaptans associated with oil and gas, will be present around the facility sites and some unknown distance beyond. These foreign odors will further reduce the aesthetic qualities of the natural environment. Recently, vapor recovery units have been installed and odor problems have been controlled. However, experience with this equipment is limited.

Past scientific study in the area has been in a natural environment. The presence, noise and odor of hydrocarbon development may adversely affect some of these studies in the proposed area.

Camping will not be affected by the visual presence of pads, pipelines, facilities or roads since none of these activities will be permitted near campsites.

Timber harvest will not be impacted at all by hydrocarbon development since only approximately one percent of revised Unit I will be used for above-ground activities. In fact it may be possible to utilize timber-harvest areas for placement of rights-of-way to reduce necessary cutting.

Hunters will find transportation corridors (pipelines, flowlines) good access for hunting. Success should increase to a small extent due to increased visibility and the attraction of the edges to wildlife. However, some habitat will be lost and the overall impact on the aesthetics of hunting will be slightly adverse.

Fishermen who encounter the pipeline crossing on the Black River will find it objectionable from the aesthetic standpoint because of the vegetation removal along the bank. Bends in the pipeline close to the Black River can reduce the bowling-alley affect. In the proposed area the only other fishable stream which may be crossed is Hardwood Creek, where a crossing may be objectionable.

No private vehicles will be allowed on transmission corridors, however, some use will occur anyway (snowmobiles, motorbikes) to the detriment of vegetation and other recreationists who desire solitude.

V-A. *Social*

Opportunities provided by the PRCSF for recreation by state and local people is also a part of the social environment. This could be defined as the quality of life for the recreationists. For them, the quality of life on the proposed area of the PRCSF will be adversely affected for the duration of the project. After completion the adverse impacts of sight, sound and odor will be virtually eliminated.

Existing historical and potential archaeological sites on the PRCSF will not be impacted by hydrocarbon development. Historical sites will be protected by adequate, non-disturbance buffers. The archaeological sites (number and location unknown) are likely to be found adjacent to lakes and streams. No pads or facilities will be located within one-quarter mile of surface waters. If pipeline routes encounter archaeological sites, proper investigations will be completed under the authority of the History Division, Department of State.

Social aspects of the proposed action also includes jobs generated by hydrocarbon development and associated operations. From Figure 8, temporary jobs generated on-site amount to approximately 300 man-years. These jobs include well drilling, pipeline completion and facilities construction. One well and its attendant pipeline (or flowline) can be completed in about a month's time. Development activities for all of revised Unit I should be completed in less than four years.

Permanent jobs created included those involving refineries, trucking, well servicing, etc., but exclude retail sales (gasoline stations for example) which could occur outside the State of Michigan. About one man per six wells is needed for servicing operations after development or about eight men full-time during the life of the operation. A total of 1400 off-site jobs are anticipated as based on 100,000 total jobs per 16 million barrels of oil equivalent.

Anticipated oil and gas production from revised Unit I would heat approximately 458,520 homes for one year with natural gas and 413,725 homes for one year with oil. To put it in another perspective the total oil and gas produced in revised Unit I would be about equal to the total oil and gas produced in Michigan in 1974. It should be remembered, of course, that the hydrocarbons from Unit I would be produced over a 25 year period and the estimates are maximum.

Little or no new increase in the number of students in local schools should occur due to hydrocarbon development in the PRCSF. Some claims have been made in the past that hydrocarbon development puts a burden on local schools by creating an influx of workers with children. If this has occurred, no significant new increase in students is expected since very few new workers would be required to develop revised Unit I of the PRCSF.

The presence of wells and facilities should not create any safety hazards to the recreationists using the PRCSF. All facilities will be fenced and the gate locked. Wells will not be located near campsites. Loss of well control will be handled by established procedures to protect the recreationists (see Section VII).

V-A. *Economic*

The economic impact of the proposal can also be read from Figure 8. The estimated gross value of the oil and gas ranges from a low of $450 million to a high of $900 million. The total royalties (about 1/8 of the gross value) amount to somewhere between $57 and $113 million. The state will receive 91 percent of this amount. Of the total royalties, 33 percent accrues to the State General Fund and 58 percent to the Game and Fish Fund.

Local taxes on the wells and pipelines amounts to about $750,000 over the 25 year production life.

Severence taxes (2 percent of the gross value) amount to $9-18 million. These monies go to the State General Fund.

The surveillance fee is an assessment of one percent of the gross cash value of $4.5-$9 million. The planned use of the money by the state will be described in the Mitigation Measures.

V-B. IMPACTS ASSOCIATED WITH ACCIDENTS

Several redundant measures are always taken to control the well and reduce the probability of accidents during drilling and operation. In addition, pipelines are constructed, buried and used with several, built-in safety measures. The chances of a well blow-out or a pipeline leak are remote. A blowout can be

described as a situation where oil, gas, formation fluids, drilling fluids either in combination or singularly, flow uncontrolled from a wellbore out into the atmosphere and/or onto the surface of the land.

Surface blowouts can probably be credited to any number of causes and may last a few minutes, a few hours, several days or a few weeks depending on circumstances. The blowout might involve a gas well, an oil well, fire, destruction of drilling rig, or the blowout might not be accompanied by fire and destruction of drilling rig.

What the impacts are depends on the individual case and circumstance.

In a situation where blowout preventers were not closed quickly enough, the impact would be the discharge of X amount of oil or gas to the atmosphere and surface of the land. If gas,it would bedissipated to the atmosphere. The drilling fluids and muds would be cleaned up over the polluted area. If the fluid was oil and drilling mud, it would be handled in the same way.

A blowout of an oil well and not accompanied by fire could continue for a considerable number of hours or days. The type of dike that would be constructed to contain the fluids would depend on the terrain, volume of fluids ejected and other factors. Surface vegetation would be lost in forming the dike. If the blowout is accompanied by fire and inevitable destruction of the equipment, it will be necessary to drag away the equipment and shoot out the fire. Again it is not possible to specify how long it would take to gain well control.

Because the wells will be located at least one-quarter mile from surface waters, it is highly unlikely that pollutants would reach them.

Pipeline leaks could occur with either gas or oil. The gas would be dissipated to the atmosphere, but oil could flow to surface waters. It would take a very large amount of oil to contaminate surface waters unless the oil leak occurred near a stream. Only the Black River and a couple of tributaries will be crossed with a pipeline and the possibility of a leak is remote. However, an oil leak on the Black River would reduce water quality for some unknown distance downstream for an unknown time period dependent upon the amount of oil spilled and the purifying ability of the Black River. Various protective measures are planned to reduce the probability of water contamination with oil (Section VII).

VI. UNAVOIDABLE ADVERSE IMPACTS

Numerous corrective, protective and mitigating measures are planned to avoid or reduce the adverse environmental impacts associated with hydrocarbon development in the area previously described. However, some adverse impacts can not be avoided.

Referral to Figure 12 provides a pictorial summary of the unavoidable adverse impacts. All of the activities of hydrocarbon development and operation will significantly effect the elk that use the southern one-third of the PRCSF. In our judgement few, if any, elk will remain in the production area for the life of the project.

Bear and bobcat also will be adversely affected by all the activities but to a lesser degree than elk. Bear and bobcat depend more on the lowlands during all times of the year than do elk. Because the lowlands will be protected from pads or facilities, they will continue to provide refuge for bear and bobcat without increased disturbances due to hydrocarbon development. To translate these impacts into changes in the numbers of elk, bear or bobcat is not within the "state of the art" at this time.

Other wildlife will be slightly adversely impacted by the intrusion of noise, activity and odors within the southern one-third of the PRCSF.

There will be unavoidable adverse impacts on the upland plant communities. Although the areas needed for pads, facilities, roads and lines will be kept to a minimum and strictly placed to reduce environmental impact, some upland vegetation will be lost for the duration of the project. Since some lines may be routed through wetlands, the total upland acres lost will be somewhat less than the approximately 300 acres needed for all activities. (See Management of Hydrocarbon Resources of the Pigeon River Country State Forest, DNR, August, 1975).

A limited, but unknown amount of lowlands will be adversely effected by pipeline, flowline or electric line crossings. For swamps, vegetation will have to be cut. Corridors through marshes, if no other alternative routing exists, will require that vegetation be destroyed for a brief period before natural recovery and regrowth. In both swamps and marshes, the vegetation that regrows may be different after the corridor is disturbed.

Some bank erosion and stream siltation will occur on the Black River near Tin Shanty Bridge due to a pipeline crossing. Although this will be held to a minimum, some erosion and siltation is unavoidable. If other tributaries to the Black River, such as Tubbs and Hardwood creeks, are crossed by lines, some erosion and siltation would occur here also. It is very doubtful that any new access roads would necessitate a stream crossing. However, the same impacts as for pipelines would occur if a new road crossed a stream.

All uses of all the natural resources except timber harvest will be adversely affected to an unknown extent by the truck traffic, visual intrusion, noise and odor of hydrocarbon development in the proposed area. In this sense, the quality of the experience and quality of life for recreational users of the southern one-third of the PRCSF will be decreased.

VII. MITIGATING, PROTECTIVE AND CORRECTIVE MEASURES TO REDUCE IMPACT

There are three types of controls that will be used to reduce adverse impact from the proposed action in the PRCSF. These are acts over which the Department of Natural Resources or Public Service Commission has authority, adopted guidelines for any uses within State Forest lands, and specific constraints established for this proposed action that may be more stringent and will supercede existing policies.

All applicable authorities, rules and regulations under the following acts will be employed in the proposed hydrocarbon development plan:

Act 61, P.A. 1939 Oil and Gas Conservation Act
Act 346, P.A. 1972 Inland Lakes and Streams Act
Act 17, P.A. 1921 Creation of Department of Conservation
Act 347, P.A. 1972 Soil Erosion and Sedimentation Control Act
Act 315, P.A. 1969 Mineral Well Act
Act 165, P.A. 1969 Gas Safety Code (Public Service Commission)
Act 9, P.A. 1929 as amended (Public Service Commission)

In addition, the following guidelines and approvals will be implemented:

State Forest Use Permit
Guidelines for Utilities on State Lands

The Public Service Commission has jurisdiction for regulating the placement of gas lines and common carrier oil pipelines, and will be involved with DNR in minimizing negative impacts.

The following specific constraints to be agreed to by the Unit Operator, DNR and PSC are to be used rigidly. Any exemptions will not be allowed unless the Unit Operator can show that an exemption will reduce environmental impacts or that no feasible alternative exists.

1) Unit Agreement

2) Approval of a total development plan by the DNR, PSC and Natural Resources Commission before production begins.

3) All above ground, stationary equipment shall be painted a color as determined by the DNR that will best harmonize with the surrounding environment.

4) All pumps at the wells will be run by electric motors with transmission lines buried along corridors determined by the DNR.

5) All well pads, pipelines, flowlines, and facilities shall be visually screened from existing roads and trails by trees, natural or planted, as determined by the DNR.

6) All roads, new and improved existing shall be routed as determined by the DNR and the ROW shall be no wider than 15-20 feet unless the existing roadway is presently wider. Roadways may be allowed to be 33 feet if the company can demonstrate a need for an all-weather road. Roadway placement will be coordinated with pipeline placement through the Public Service Commission so that pipelines and roads use the same corridor.

7) After test well locations are reviewed, accepted and completed, and all locations of production wells are known, the Unit Operator with DNR approval will prepare a final development plan of locations for all activities, and the Unit Operator will prepare or have prepared an Environmental Impact Statement on the Final Plan.

8) Pipeline and flowline rights-of-way will be placed along roads or existing utility transmission corridors where possible. Aesthetic bends to reduce straight corridors will be employed. Single flowline (usually 3" - 6" lines) rights-of-way shall be no wider than 10 feet and single pipeline rights-of-way no wider than 20 feet. Oil and gas pipelines on shared rights-of-way must be 15' apart. Through wetland areas separation may be increased because of soft ground.

9) All stream crossings by flowlines and pipelines where no other non-stream crossing route is feasible will be plowed or bored unless subterranean characteristics prevent this method or if the machinery necessary to plow would disrupt sensitive wetlands in which case dry crossing will be considered.

10) No drilling pads or facilities will be allowed in wetlands.

11) Automatic check valves will be mandatory for all oil line stream crossings and blocking valves will also be required in sensitive areas. Dikes set back from stream banks will be required to prevent oil from entering the water.

12) Noise levels will be a maximum of 45 decibels on the A scale at 1500 feet from any wells and facility sites or less as it becomes feasible to install and operate new, presently untried muffling equipment. All facility buildings will be windowless and insulated. Compressors will require shock mountings. Tree screening will also be required to reduce noise.

13) If secondary recovery wells are needed they will also be subject to an Environmental Impact Statement as prepared by the Unit Operator.

14) After production ceases all above-surface equipment will be removed entirely from the PRCSF. All land disturbed will be revegetated according to specifications of the DNR. No gas storage fields will be allowed by the DNR under provisions of the present leases.

15) The surveillance tax will be used for monitoring all activities during the course of the operations. The monitoring will include normal and required (Act 61) safety aspects and environmental aspects as written in this EIS and also required under Acts 346 and 347. An Enforcement Officer as designated by the Supervisor of Wells will have the authority to cause an immediate, temporary shutdown of any operation causing or about to cause any action not in conformance with this agreement. A permanent shutdown also may be warranted.

16) A performance bond of $10,000 for each facility site will be required by the Unit Operator to insure removal of surface equipment and site clean up and revegetation following oil and gas production on the PRCSF.

17) No pipeline, flowline or electric line crossings of the Pigeon River will be allowed.

18) No roads will cross streams or where no other feasible alternative exists, only bridges (no culverts) will be allowed.

19) All facilities will employ vapor recovery units to reduce odors.

20) Loss of well control at any well will be handled under the Guidelines set forth by the DNR and the rules of Act 61, P.A. 1939, as amended. This includes notification of the Public Service Commission. An important element of the Rules is Special Order 2-73 which require that an intermediate casing be set and cemented and specific testing procedures be followed. This order covers blowout prevention equipment and the testing of this equipment on every tour. In the event that an oil or gas loss should occur while drilling or testing a well or in some phase or oil and gas operations incidental to the development of PRCSF hydrocarbon resources, Rule 907 provides for notification to the Supervisor of Wells. Also, the Pollution Emergency Alert System (PEAS) will be effected by the Supervisor of Wells if there is ground or surface water contamination. PEAS maintains a 24-hour emergency telephone number. Immediate action by the Hazardous Spills Unit of DNR is taken. The Oil Pollution Control Unit is notified in case of oil spills.

Rule 907, titled NOTICES TO SUPERVISOR OF OIL LOSSES, and promulgated under Act No. 61, Public Acts of 1939, as amended, specifies the events and conditions requiring prompt notification to the Supervisor of Wells. The Rule reads in entirety:

> "A person, owner or operator of a drilling or producing well, refinery, and transportation agency, including truck transports, shall notify the Supervisor of oil or refined product losses which occur at an oil well, oil tank, pump station, refinery and other facility owned, operated or controlled by him; a tank struck by lightening; other oil or refined product losses which destroy oil or gas or create or may create fire or pollution hazards, breaks or leaks in a tank, pipeline or transportation facility from which oil or gas escaped or is escaping and a serious accident which has created or may create a fire or pollution hazard or cause damage to or destruction of life or property. Notification shall be made promptly by telephone or telegraph giving briefly the particulars, and by written report giving a more detailed account of events and conditions. A written report shall specify the location of the oil or refined product loss, giving the quarter-quarter section, township and range in unplatted land, and the lot or portion thereof in platted land."

In the event that during the drilling, completion and testing of an exploratory, development or service type well control of the fluids in the well borehole is lost and a surface or subsurface blowout occurs, the operator shall immediately take these actions as a part of the minimum contingency plan:

1) The operator shall immediately take action to remedy the blowout situation by putting into effect his emergency control procedures or contingency plan. In recognition of the fact that no two blowout situations are identical or necessarily caused by the same circumstances, exact procedures cannot be specified herein but are best handled by the operator who will take all proper action to overcome the blowout situation which may or may not be accompanied by fire.

2) The operator shall promptly notify the Supervisor of Wells, the Assistant Supervisor of Wells, or his nearest representative, and state the nature of the blowout situation. The names, addresses, and telephone numbers of these persons shall be posted and available at all times at the well site. The DNR representative will activate the PEAS in case of surface or ground water contamination.

3) The operator shall promptly advise by telephone or radio the Gas Section, Michigan Public Service Commission, Lansing, or the local representative of that agency. In the event of a gas loss, the State Police must also be notified. The name, address and telephone number of the agency and its local representative shall be posted and available at all times at the drilling site.

4) An acceptable Pollution Incident Prevention Plan (PIPP) must be filed by the Unit Operator. The PIPP will include the storage of emergency clean-up materials at the facility and at pipeline stream crossings as well as specific actions to be taken in case of a spill.

5) Communications will be available at all times on the site via radio and/or radio telephone. Pertinent names and phone numbers of the local DNR, State Police Post, State Fire Marshall, and County Sheriff Department shall be posted at the drilling site and be in the possession of supervisory personnel.

After notification of the agencies specified in Items 2 and 3 and an appraisal of the problem has been made by these agencies, their evaluation of the circumstances will determine which additional agencies should be called into action.

VIII. UNRESOLVED CONTROVERSIES

In 1972 Michigan Oil Company applied for a permit under Act 61, P.A. 1939, to drill a well in the PRCSF, Corwith Township, Section 22 T32N R1W. The permit was denied by the Department of Natural Resources on the basis of the potential environmental damage that could occur to the whole PRCSF if additional and continued producing wells were completed. The issue went to a contested hearing. Michigan Oil Company claimed that the DNR could not support the fact of environmental damage and therefore could not deny the permit. The hearings officer ruled in favor of Michigan Oil Company in 1973. The Natural Resources Commission determined there would be unnecessary damage. The Commission decision was challenged in court. The Circuit Court ruled in favor of the Department in 1975. Michigan Oil Company has taken the issue to the Court of Appeals and it is still unresolved.

Public opinion has been and still is mixed toward oil and gas development anywhere in the PRCSF. The Pigeon River Country Association opposes all drilling in the PRCSF as do some individuals. Many private landholders within the PRCSF, on the other hand, are anxious to see a development plan implemented. Other citizens also attach an importance to oil and gas development within the PRCSF. Opportunities for public input are summarized in Appendix 6. The controversy is unresolved. Further opportunities for public input on the proposed action will be available. Public Hearings are set for December and a summary of oral comments and written statements will be available for review at DNR offices in Lansing.

The Otsego County Road Commission does not allow pipelines to be placed under county roads. Surface disturbance from pipeline placement would be reduced if pipelines could be placed under and not alongside roads. This issue is unresolved, but the DNR will work with Otsego County to reach an agreement.

Figure 1

LOCATION OF THE PIGEON RIVER COUNTRY STATE FOREST IN NORTHERN LOWER MICHIGAN.

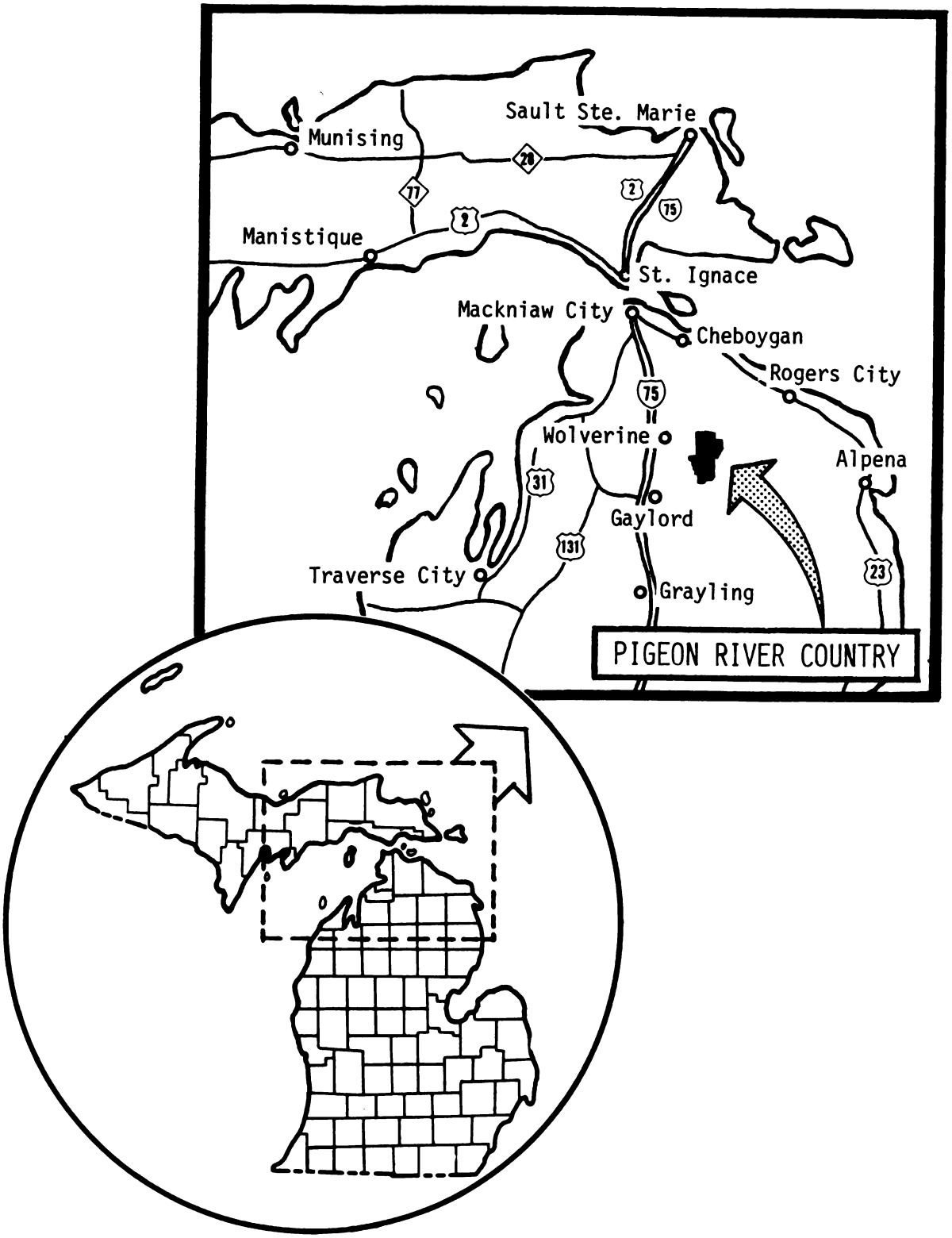
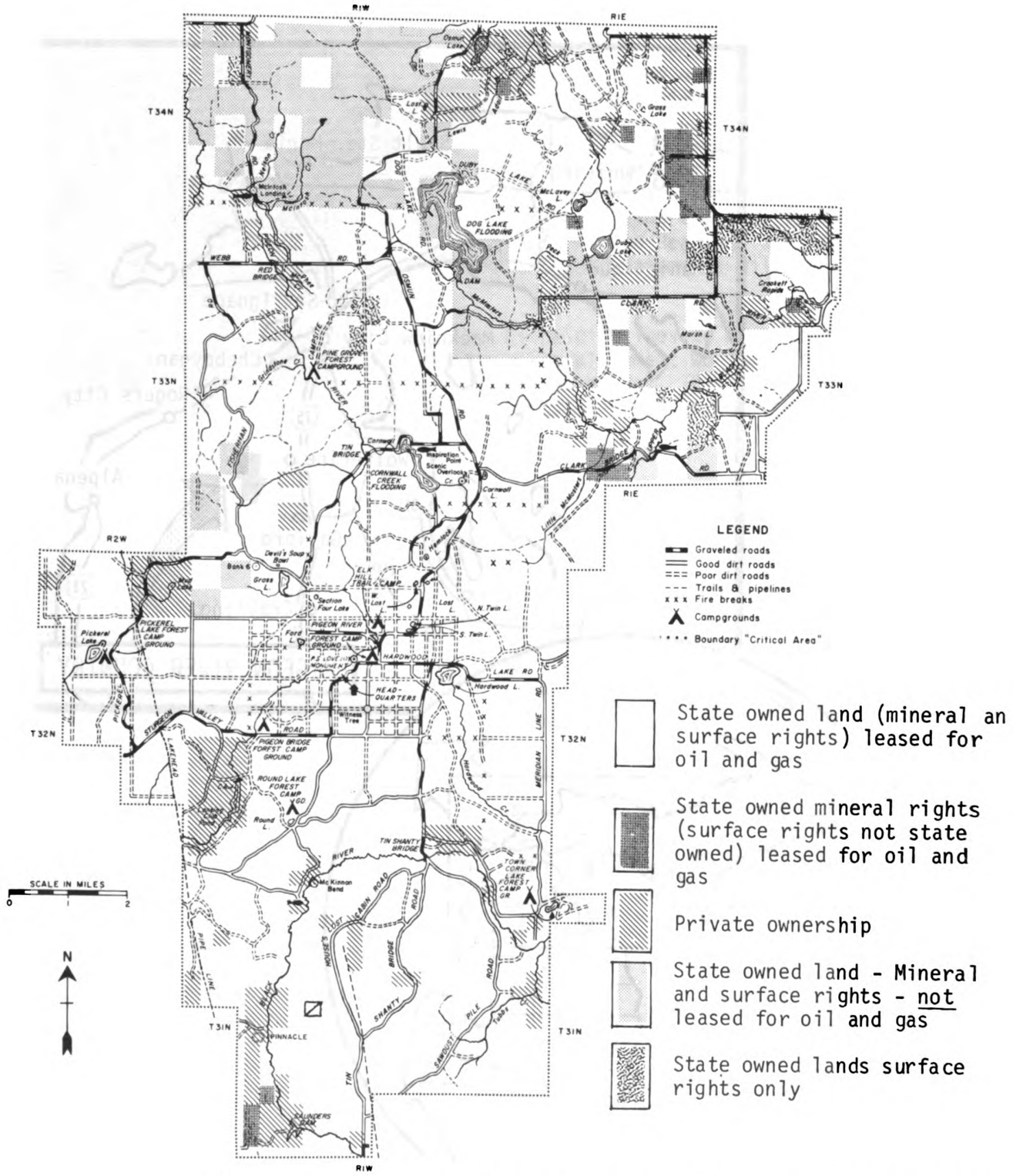


Figure 2

STATE LANDS LEASED FOR OIL AND GAS WITHIN THE PIGEON RIVER COUNTRY STATE FOREST.



Note 1: 1/32 interest in minerals is state owned, balance is in 3rd party. Surface is state owned. State's interest is leased for oil and gas.

Figure 3

WETLANDS OF THE PIGEON RIVER COUNTRY STATE FOREST.

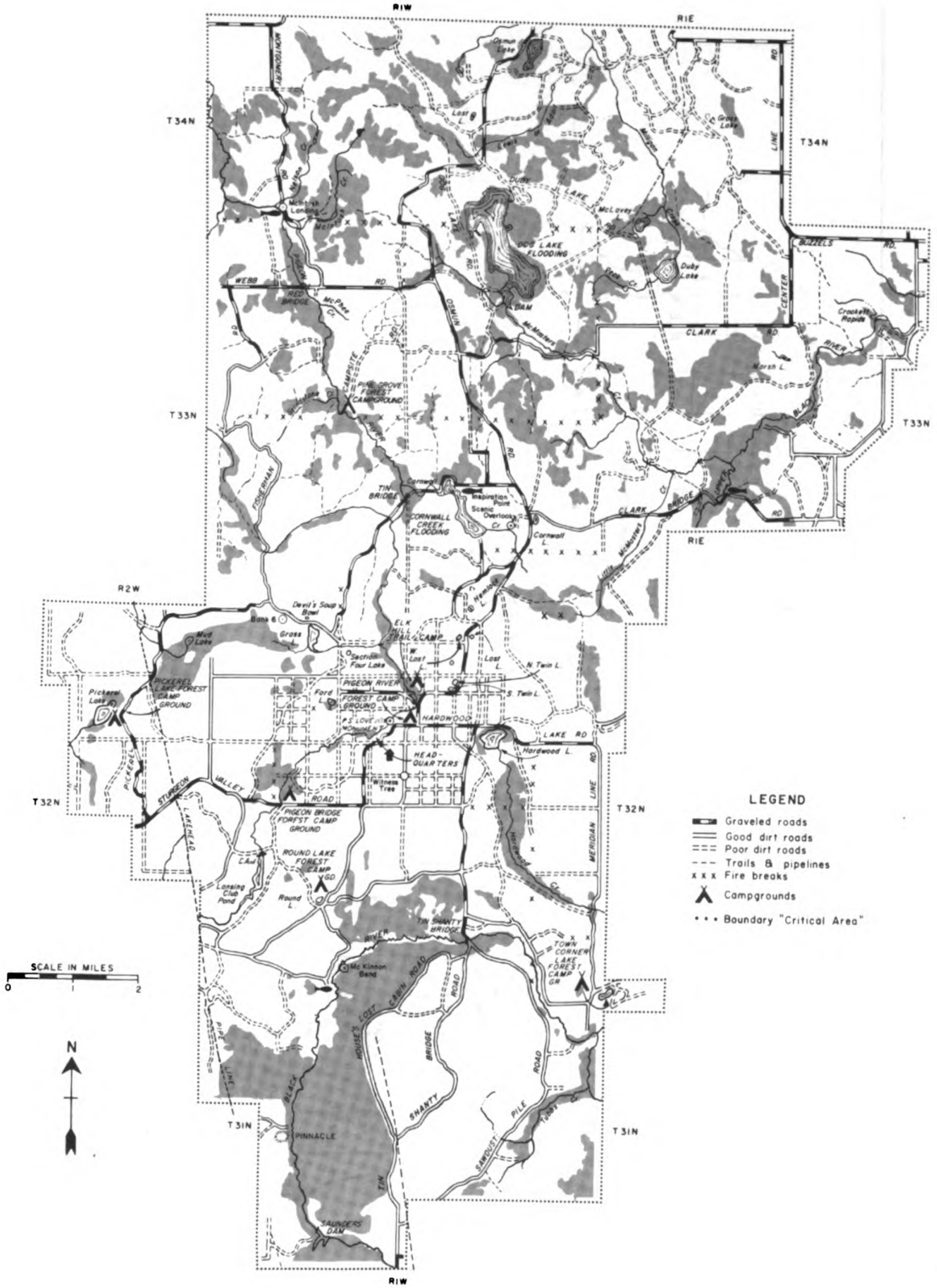


Figure 4.

SALINA-NIAGARAN TREND IN NORTHERN LOWER MICHIGAN.

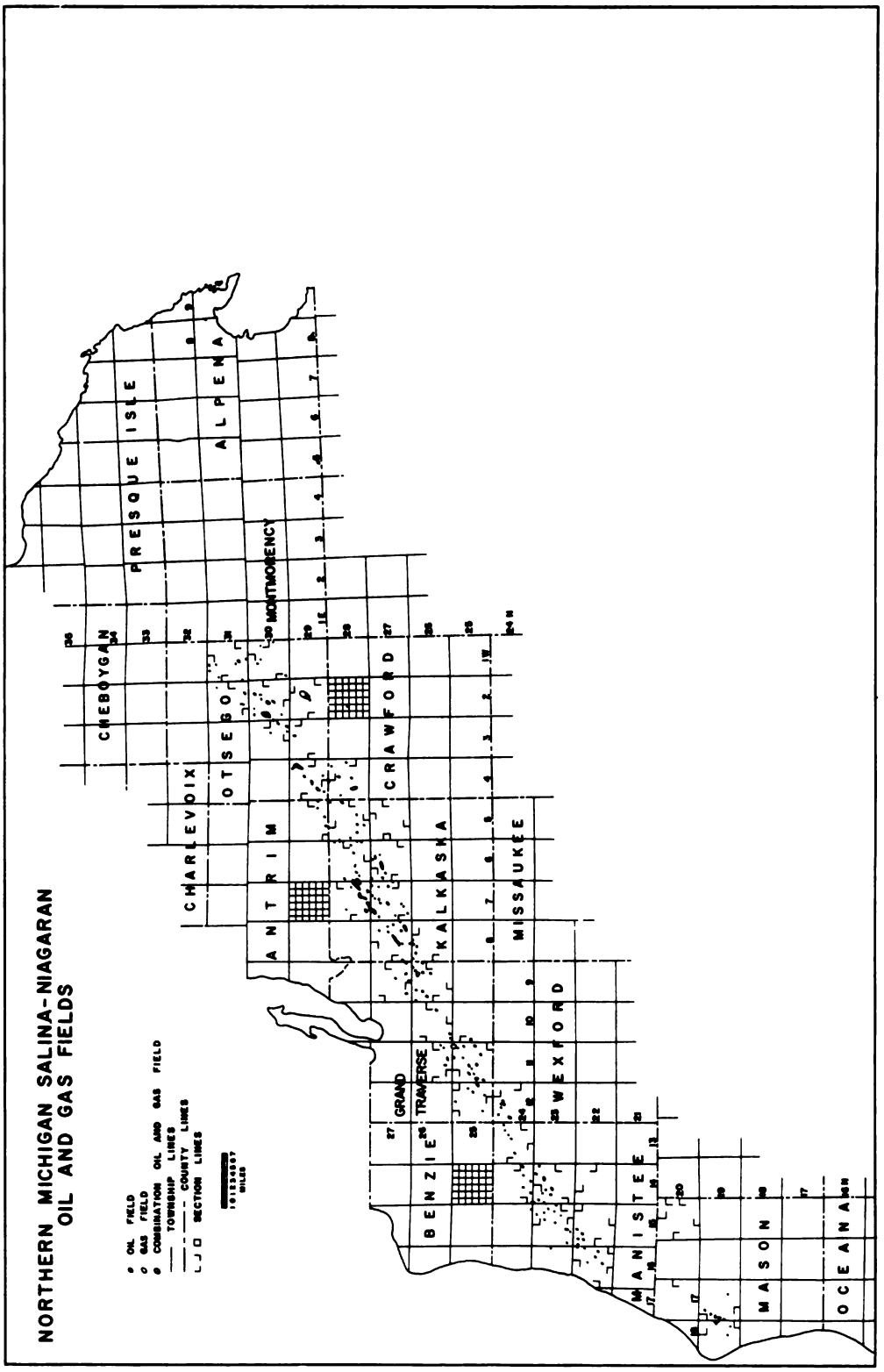


Figure 5

WELLS AND PIPELINES ON THE PIGEON RIVER COUNTRY STATE FOREST.

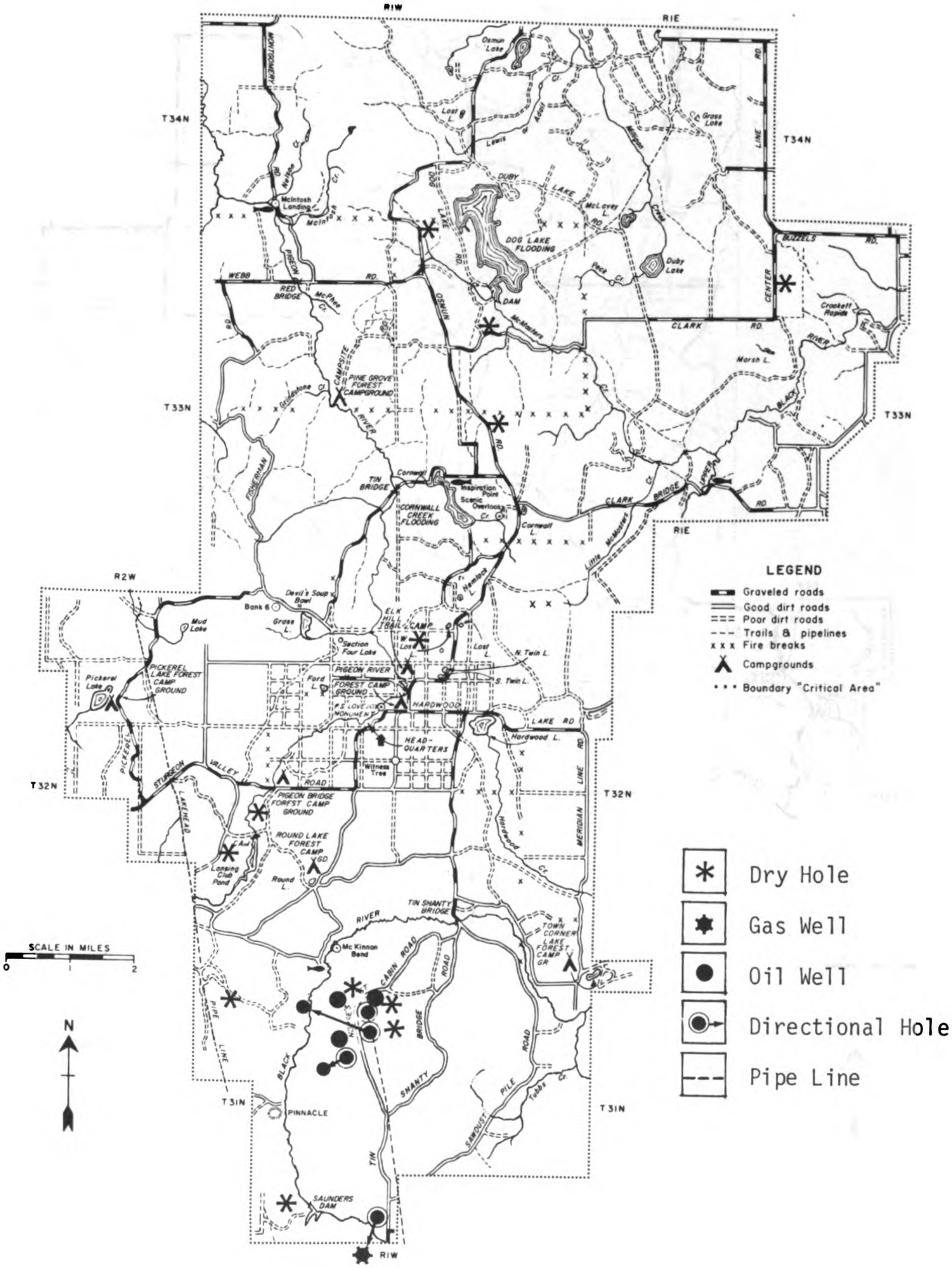


Figure 6

BASE MAP OF THE PIGEON RIVER COUNTRY STATE FOREST.

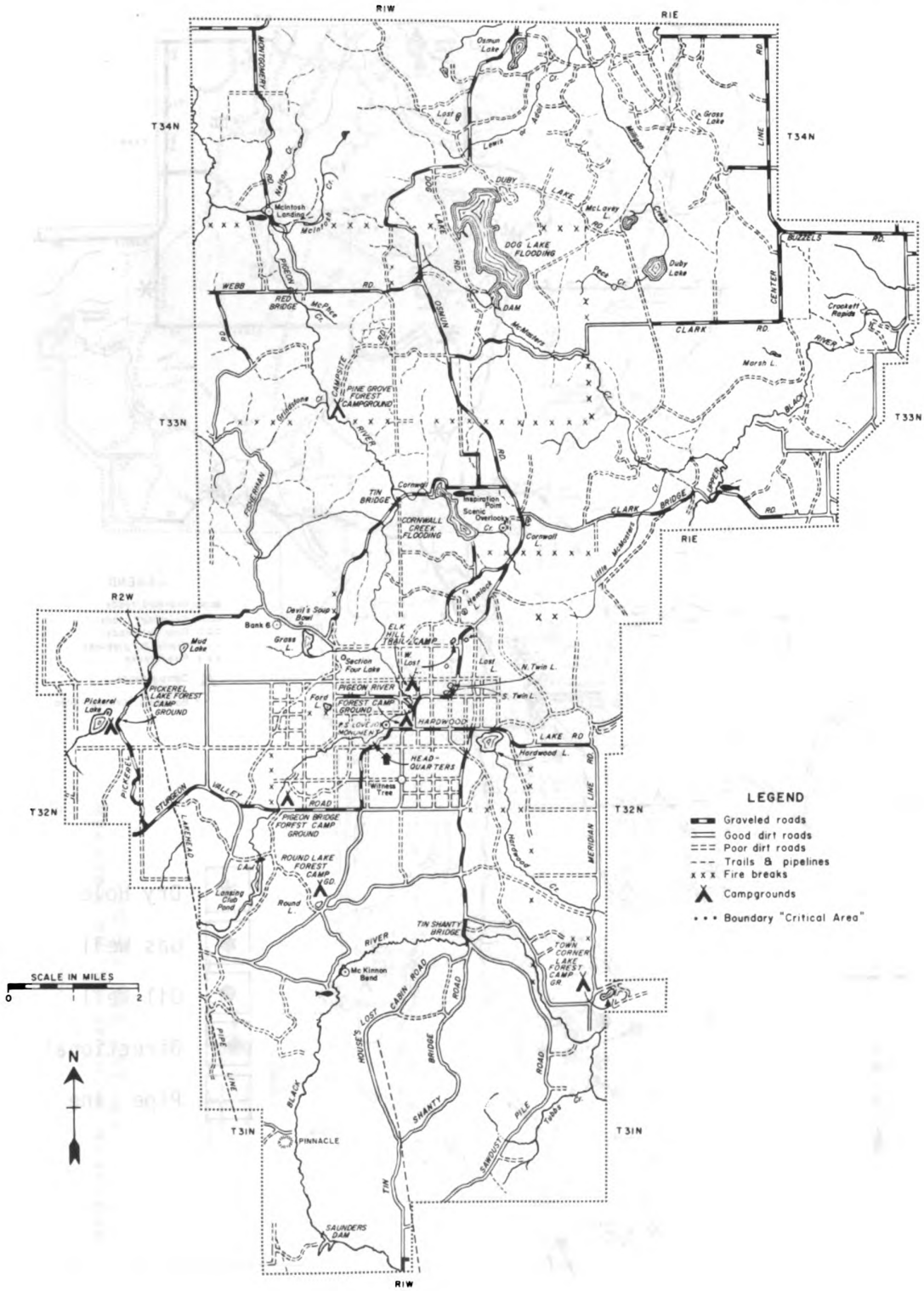


Figure 7

FOUR UNIT AREAS ON THE PIGEON RIVER COUNTRY STATE FOREST.

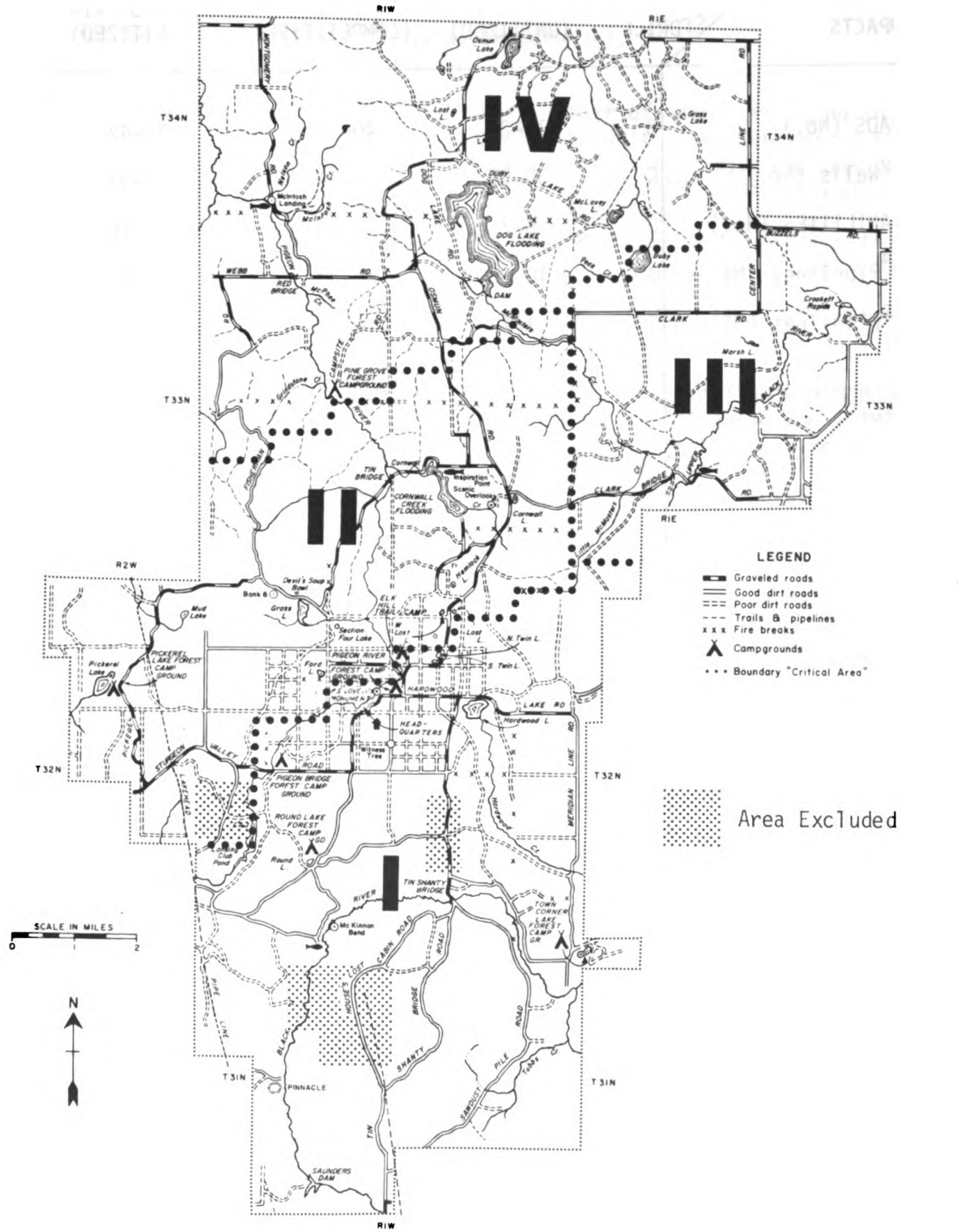


FIGURE 8 - A COMPARATIVE MATRIX FOR ALTERNATE DEVELOPMENT PLANS ON THE PRCSF.

IMPACTS \ ALTERNATES	NO DRILL	REVISED UNIT I (UNITIZED)	UNIT I (COMPETITIVE)	UNITS I-IV (UNITIZED)	(UNITS I-IV (COMPETITIVE
[1] PADS (No.)	0	13-21	40-80	13-47	40-100
[2]Wells (No.)	0	30-56	75-147	30-97	75-250
[3]FACILITIES (No.)	0	5-7	19-39	5-16	19-50
[4]Pipelines (Miles)	0	10-15	20-30	10-80	20-150
[5]Flowlines (Miles)	0	9-14	18-28	9-75	18-140
*ECONOMIC BENEFITS ($Millions) (for 25 years of production)					
[6]Gross Value	0	452-904	453-904	452-1686	452-1686
[7]Royalties	0	57-113	57-116	57-211	57-211
[8]Local Taxes	0	.49-1.00	1.34-2.40	.49-3.04	1.34-6.56
[9]Severence Tax	0	9-18	9-18	9-34	9-34
[10]Surveillance	0	4.5-9	4.5-9	4.5-17	4.5-17
SOCIAL GAINS (no. employees/year)		210-392	525-1029	210-679	521-1750
[11]Temporary Jobs (One year)	0	210-392	525-1028	210-679	521-1750
[12]Permanent Jobs (25 years)	0	5-9	13-25	5-16	13-41
**[13]State-wide Jobs (excluding retail sales)	0	1400	1400	2620	2620

*See Appendix 4 for Prospective Oil and Gas.

** Mean values

Index: Matrix of Development Alternates (Figure 8).

[1]For the high number, as based on the highest number of anomalies found in a township in the Niagaran trend and projected to Unit I and descreased by about 50% for unitization. Since the prospects of finding hydrocarbons decrease as one moves north and east, Units II, III and IV combined could have any where from no pads to approximately double that found in Unit I. The low number is the best approximation based on townships in the trend with few anomalies.

[2]For unitized development, about two wells per pad. Competitive development, almost one well per pad.

[3]Based on other townships in the Niagaran trend and decreased by about one-half for unitization and decreased as one moves out northeast in the trend.

[4]Based on other townships in Niagaran trend and decreased for unitization and for movement northeast.

[5]Flowlines are usually less than one-half the miles of pipelines, but with unitization and fewer facilities, flowline miles may equal pipeline miles.

[6]An optimistic estimate based on 20 producing reefs per township in Unit I plus 15 reefs in Units II, III and IV, times the observed oil and gas production (high for the Niagaran trend) of the existing Charlton wells on PRCSF, times $11.00 per barrel and $.75 an MCF (Appendix 4). The top estimates are considered maximum and the low estimates were arbitarily set at one-half the maximum.

[7]State royalties for Unit I are 91% of the total royalties where 9% are private. Of the total royalties, 33.3% goes to the State General Fund and 57.8% goes to the State Fish and Game Fund. For all Units, the state royalties are 90%. Of the total 35% is General Fund and 55% Fish and Game Fund monies.

[8]Local taxes computed on $450 per well per year and $1,000 per pipeline mile per year times 25 years. (Current tax rate).

[9]Two percent of the gross value, Act 48, 1929 as amended by Act 299, 1965. Accrues to the General Fund.

[10]One percent of the gross value, Act 61, 1939; may be used by the DNR for surveillance of hydrocarbon activities.

[11]Approximately 82 men per well and pipeline connection for about a month or seven man years (Northern Michigan Exploration).

[12]One man per six wells during operation for 25 years (Northern Michigan Exploration).

[13]Based on 100,000 total jobs (including retail) per 16 million barrels of oil equivalent and adjusted by subtracting the Michigan percentage of these jobs that are retail (70%) and in all likelihood would not all occur in Michigan. (Independent Petroleum Association of America, 1975.)

Figure 9

PROPOSED WILDERNESS AND NATURAL AREAS ON THE PIGEON RIVER COUNTRY STATE FOREST.

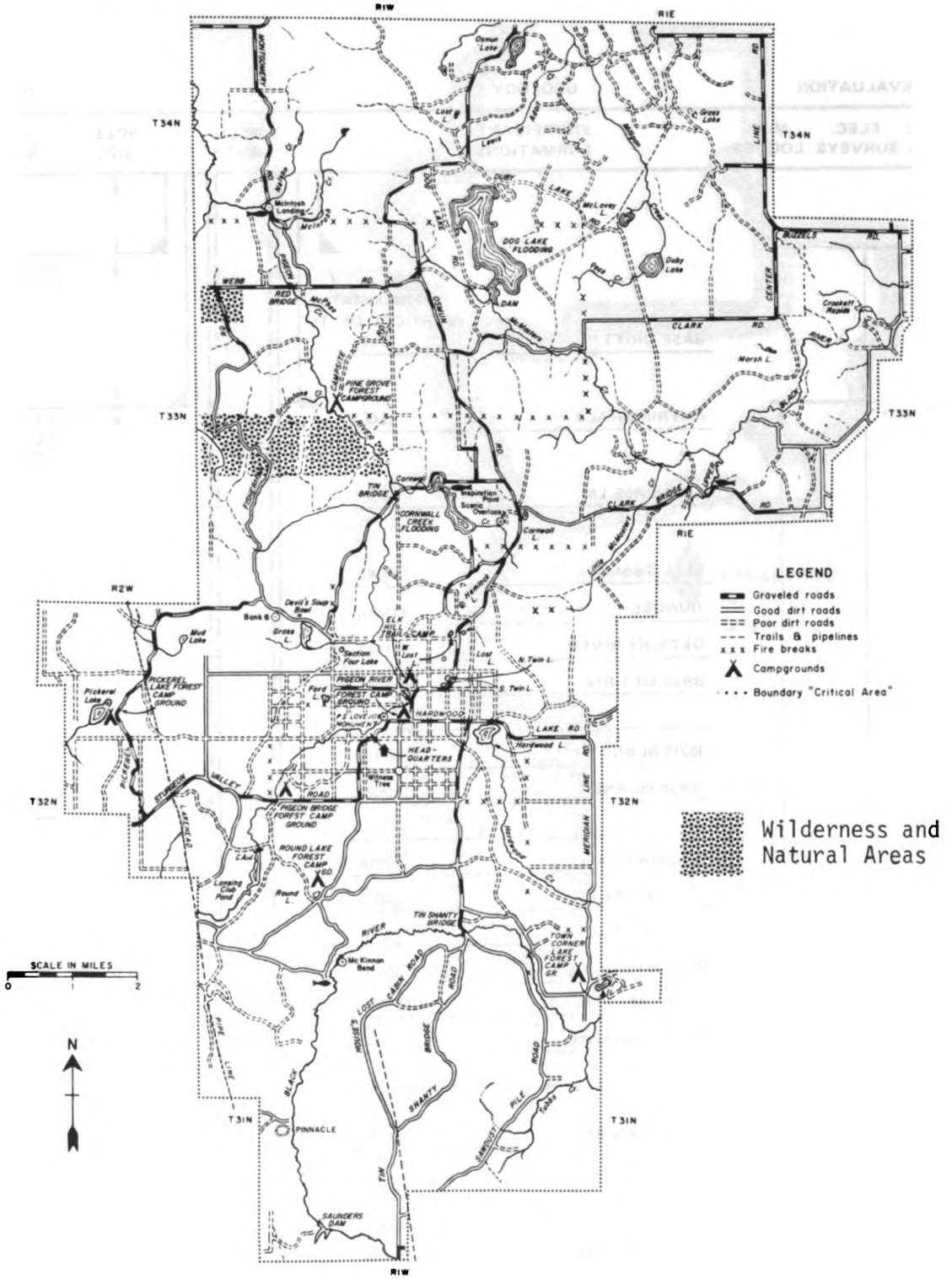


Figure 10

TYPICAL DRILLING PROGNOSIS
PIGEON RIVER COUNTRY STATE FOREST

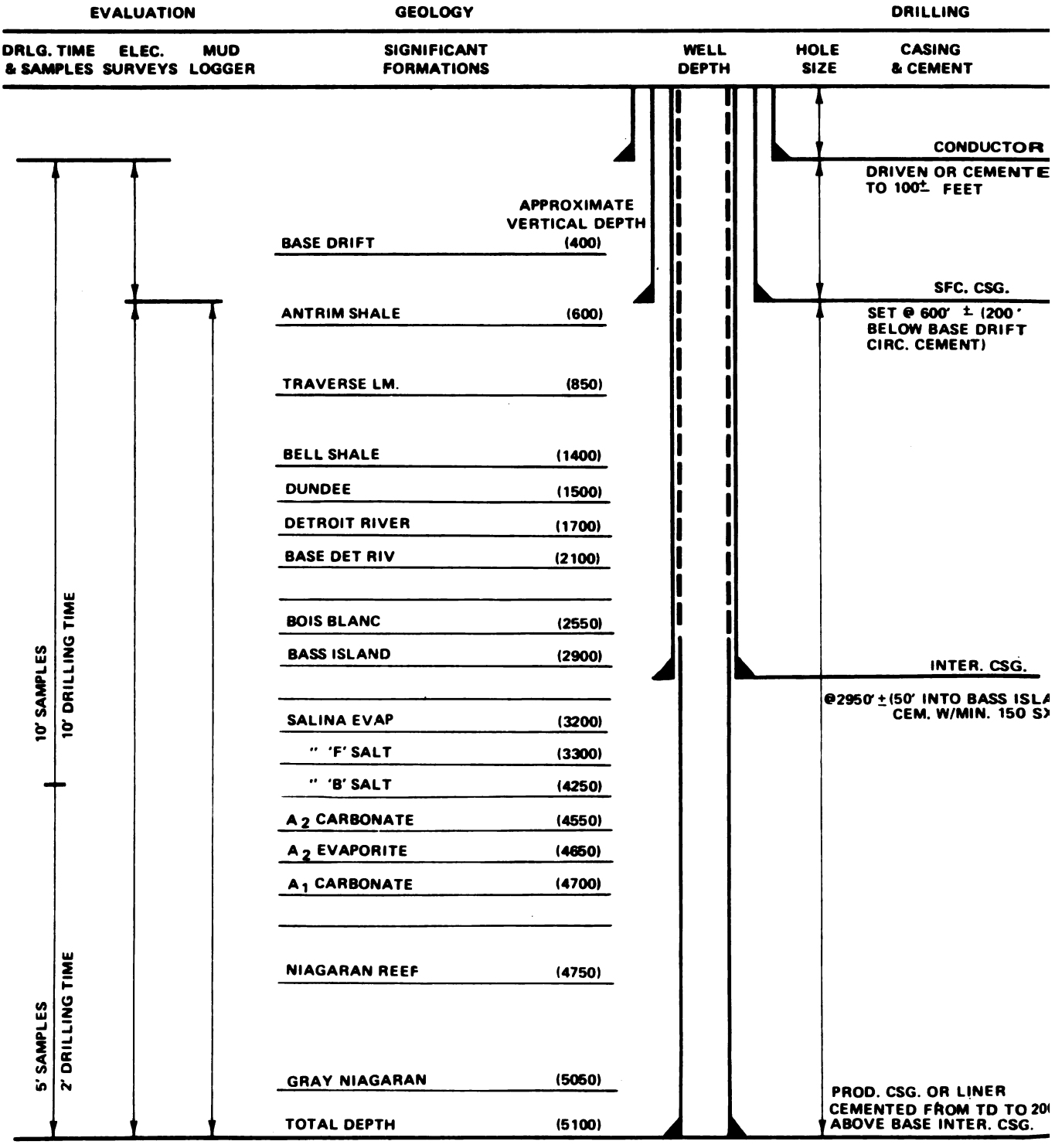


Figure 11

AREAS WITHIN ONE-HALF MILE OF ROADS IN UNIT I AND ONE-QUARTER MILE UNITS II-IV.

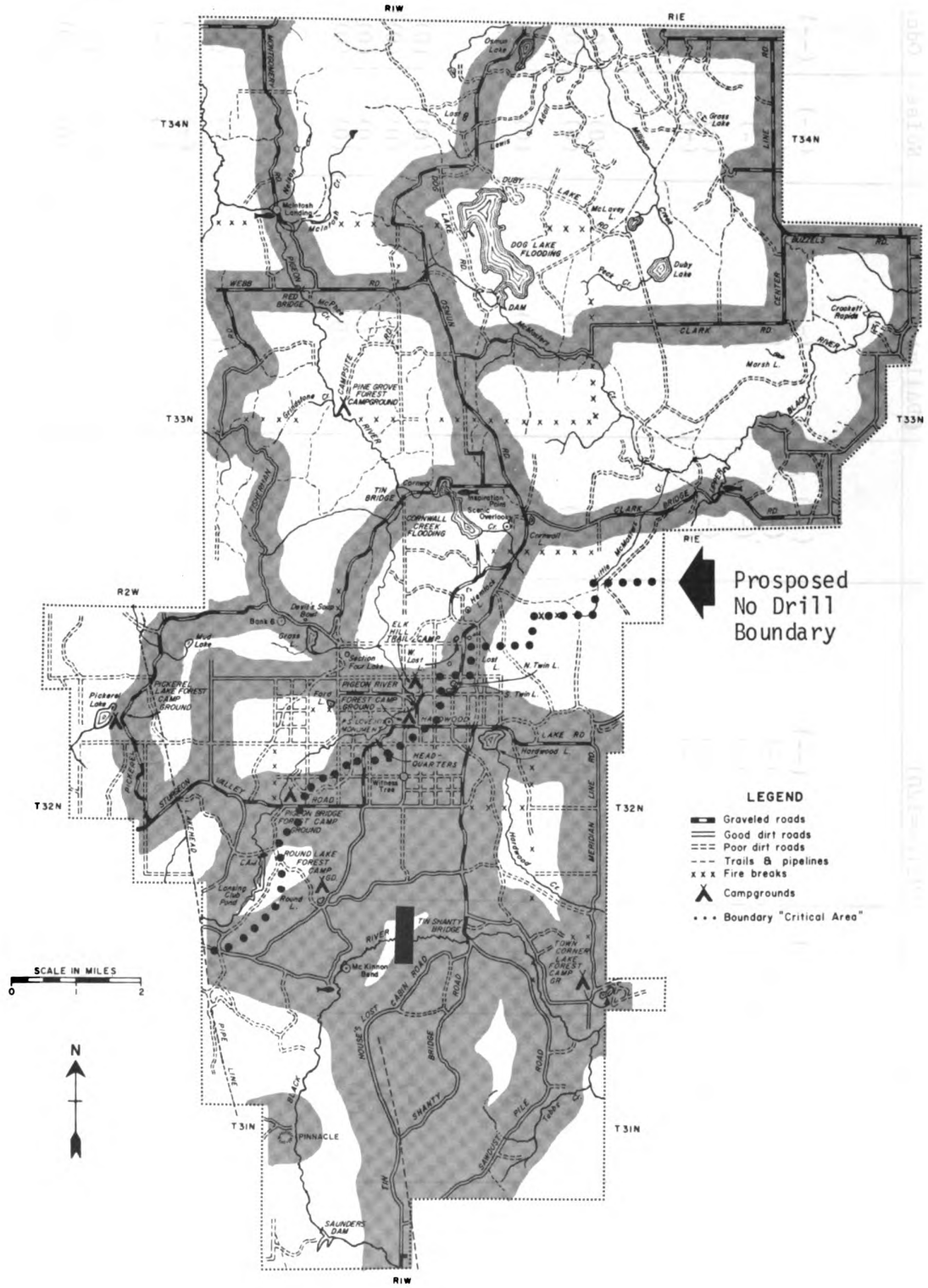


Figure 12. Environmental Impact Matrix for proposed hydrocarbon development in the southern portion of the PRCSF.

Natural Environment	ACTIVITIES AND ELEMENTS OF ACTION: Development (Time Frame: 4 yrs. max.) Roads (Miles=5.5)	Pads (No.=17)	Pipelines (Miles=16.0) Flowlines+Electric lines (Miles=120)	Facilities (No.=7)	Operation (Time Frame: 25+yrs.) Servicing of Wells and Facilities (Daily: 7men)	Noise	Odor	Visual
Wildlife								
Elk	(--)	(--)	(--)	(--)	(--)	(--)	(--)	(--)
Bear	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Bobcat	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Endangered & Threatened	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Other	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Plant Communities								
Uplands	(-)	(-)	(-)	(-)	(0)	(0)	(0)	(0)
Swamps	(0)	(0)	(--)	(0)	(0)	(0)	(0)	(0)
Endangered & Threatened	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Interrelated Systems								
Streams	(-)	(0)	(-)	(0)	(-)	(0)	(0)	(0)
Lakes	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Groundwater	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Wetlands	(0)	(0)	(-)	(0)	(0)	(0)	(0)	(0)
Use of Natural Resources								
Hunting	(0)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Fishing	(0)	(0)	(--)	(0)	(-)	(-)	(-)	(-)
Camping	(0)	(0)	(0)	(0)	(-)	(-)	(-)	(-)
Hiking, Picking, Scientific Study, X-country skiing	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Timber Harvest	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
Sand & Gravel	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
SOCIAL *Quality of Life	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)
Archaeological &	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)

Index for environmental impact matrix for proposed hydrocarbon development PRCSF.

0 equals no effect

(-) equals a slight adverse impact

(--) equals a significant adverse impact

* For users of the PRCSF

A significant adverse impact is a change in the element that is impacted from its present status to a status that may take a long time for recovery, at least the duration of the project. A significant adverse impact results from the element being very susceptible to change and/or from the element possessing an inherently slow recovery time.

A slight adverse impact represents a change in the element that is impacted to a status that can quickly return to normal after the initiating agent for change (oil and gas activity) has ceased.

No effect means that a project action on the environmental element causes no change or in some cases causes a slight positive and slight adverse impact which cancel each other out.

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Appendix 1. Animals of the Pigeon River Country State Forest

Mammals

Badger
Beaver
Black Bear
Bobcat
Coyote
Cottontail
White-Tailed Deer
Elk
Gray Fox
Red Fox
Mink
Muskrat
Otter
Porcupine
Raccoon
Skunk
Snowshoe Hare
Gray Squirrel
Fox Squirrel
Least Weasel
Short-Tailed Weasel
Long-Tailed Weasel
Woodchuck
Red Squirrel
Northern Flying Squirrel
Southern Flying Squirrel
Little Brown Bat
Silver-Haired Bat
Keen Bat
Striped Ground Squirrel
Eastern Chipmunk
Deer Mouse
White-Footed Mouse
Bog Lemming
Red-Backed Vole
Meadow Vole
Pine Vole
Meadow Jumping Mouse
Woodland Jumping Mouse
Prairie Mole
Star-Nosed Mole
Masked Shrew
Water Shrew
Short-Tailed Shrew
Pigmy Shrew

Birds

Common Loon
Red-Necked Grebe
Pied-Billed Grebe
Great Blue Heron
Black-Crowned Night Heron
American Bittern
Canada Goose
Mallard
Black Duck
Pintail
Green-Winged Teal
Blue-Winged Teal
Wood Duck
Scaup
American Goldeneye
Buffle-Head
Old Squaw
Hooded Merganser
American Merganser
Red-Breasted Merganser
American Coot
Turkey Vulture
Goshawk
Sharp-Shinned Hawk
Red-Tailed Hawk
Red-Shouldered Hawk
Broad-Winged Hawk
Rough-Legged Hawk
Bald Eagle
Marsh Hawk
Osprey
Pigeon Hawk
Ruffed Grouse
Virginia Rail
Sora
Piping Plover
Semipalmated Plover
Killdeer
American Golden Plover
Black-Bellied Plover
Ruddy Turnstone
Woodcock
Common Snipe
Upland Sandpiper
Spotted Sandpiper
Solitary Sandpiper
Greater Yellowlegs
Lesser Yellowlegs
Knot
Pectoral Sandpiper
White-Rumped Sandpiper
Least Sandpiper
Red-Backed Sandpiper
Dowitcher
Semipalmated Sandpiper
Buff-Breasted Sandpiper
Sanderling
Herring Gull
Ring-Billed Gull
Bonapartes Gull
Common Tern
Caspian Tern
Black Tern
Mourning Dove
Yellow-Billed Cuckoo
Black-Billed Cuckoo
Barred Owl
Screech Owl
Great Horned Owl
Long-Eared Owl
Saw-Whet Owl
Whip-Poor-Will
Nighthawk
Chimney Swift
Ruby-Throated Hummingbird
Black-Capped Chickadee
White-Breasted Nuthatch
Red-Breasted Nuthatch
Belted Kingfisher
Yellow-Shafted Flicker
Pileated Woodpecker
Yellow-Bellied Sapsucker
Hairy Woodpecker
Downy Woodpecker
Eastern Kingbird
Great Crested Flycatcher

Appendix 2. Camping use on Pigeon River Country State Forest 1974*

	No. of Camps	No. of campers	Total camper days of use
Pickeral Lake	949	3,745	14,865
Pigeon River	443	1,440	5,311
Pigeon Bridge	241	700	2,274
Round Lake	278	680	1,913
Pine Grove	126	409	1,230
Town Corner Lake	73	258	1,071
Elk Hill Trail Camp	88	515	1,448
Camping at undesignated sites	1,218	1,643	4,911
Totals	3,416	9,390	33,023

*All data is from camper registration cards.

Appendix 3. 1974 Hunter-Use of Pigeon River Country State Forest
Based on Postcard Poll Survey

Species Hunted	No. of Hunters	No. of Hunter Days
Big Game		
Deer		
Firearms	1,890	11,490
Archers	120	1,210
Bears	est. 100	est. 300
Bobcats	est. 40	est. 210
Big Game Total	2,150 hunters	13,210 days hunted
Small Game		
Ruffed Grouse	1,030	8,380
Woodcock	350	4,580
*Waterfowl	130	890
Hares and Rabbits	690	6,520
Squirrels	270	1,850
*Raccoons	100	1,370
Small Game Total	2,570 hunters	23,590 days hunted
Big Game and Small Game Total	4,720 hunters	36,800 hunter days

*Sample too small for accuracy

Appendix 4

PROSPECTIVE VALUES OF OIL AND GAS IN THE "PIGEON RIVER STATE FOREST"

Within the framework of the premises employed this report will provide an estimate of the dollar values that might be realized from development of the prospective oil and gas resources underlying the Pigeon River Country State Forest.

The Pigeon River Country State Forest is an area covering slightly less than 150 square miles in Otsego, Cheyboygan and Montmorency counties. Although there has been some oil and gas exploration and development within its boundaries there has been considerable controversy over the past several years whether any oil and gas development should be allowed at all. Currently under review is a plan for extraction of the hydrocarbon resources prepared by the 3 major lease holders of the area. It is from this plan that certain assumptions were drawn to develop the accompanying production estimates and values.

Assumptions:

1. That the areas I, II, III and IV on the map consist of a number of square governmental sections made up of even 40 acre blocks, and that the mineral rights within each area are divided proportionally between Private minerals, State General Fund minerals and State Game Fund minerals on a basis of 40 acre blocks.

2. That the existing belt of producing reefs running Southwest - Northeast will pass directly through area I (see exhibit 1) and should provide an average of 20 reefs per governmental township (36 square sections). This can be further supported by the fact that a new gas well, the Stella Maris 1-29A, has just been completed as a producing well in Montmorency County. This well is in direct line with the trend, East of Area I in Sec. 29, T.31N., R.1E.

3. That based on experience the number of reefs lessens considerably in a Northwesterly direction from the trend. It would then be a safe assumption to expect approximately 10 reefs per township in Area II and III and 5 reefs per township in Area IV.

4. That development of a particular reef could take from 1 to 4 wells with 2 wells per reef as an average. This would mean 40 wells per township or 1.1 wells/section in Area I, 20 wells per township or .55 wells/section in Area II and III and 10 wells per township or .27 wells/section in Area IV.

5. That the average reef will be as productive as the average reef in the close proximity to the area concerned, that being 3.1 million barrels of oil and 1,000 cubic feet of gas per barrel of oil. (See exhibit 2)

6. That the average well will produce daily what the average well in close proximity produces, that being 147 bbls. of oil per day and 309 Mcf of gas per day (based on actual production in Otsego County in January 1975).

7. That new oil will sell for $11.00 a barrel and gas for $.75 an Mcf.

	AREA				
	I	II	III	IV	TOTAL
Total Area (Twps.)	1.24	.96	.56	1.25	4.01
Total Reefs (2)	24.8	9.6	5.6	6.25	46.25
Total Recoverable Oil (Million Bbls.) (5)	76.9	29.8	17.4	19.4	143.5
Total Recoverable Gas (MMCF) (5)	76,900	29,800	17,400	19,400	143,500
Total Value Recoverable Oil (Millions $) (7)	845.9	327.8	191.4	213.4	1578.5
Total Value Recoverable Gas (Million $) (7)	57.675	22.350	13.050	14.550	107.625
Total Value Recoverable Hydrocarbons (Million $) (7)	903.575	350.150	204.450	227.950	1686.125
Value of Royalties (Million $)	112.947	43.769	25.556	28.494	210.7660

% OF					
Private Minerals	8.9	4.2	21.4	11.9	9.9
State General Fund Minerals	33.3	22.4	62.9	36.3	35.0
State Game Fund Minerals	57.8	73.4	15.7	51.8	55.1

SHARES OF ROYALTIES IN MILLION DOLLARS

Private Minerals	10.052	1.838	5.469	3.391	20.750
State General Fund Minerals	37.612	9.804	16.075	10.343	73.834
State Game Fund Minerals	65.283	32.127	4.012	14.760	116.182

CALCULATED OIL IN PLACE BY THE VOLUMETRIC FORMULA

FOR: Charlton 4-31N-1W Reef
Charlton 5-31N-1W Reef
Charlton 9-31N-1W Reef

APRIL 30, 1974

Formula - $N = \frac{7758\ Ah\emptyset\ \ (1-Sw)}{Bo}$

WHERE AS:

N = Oil in place bbls.
7758 = Bbls. in one acre one foot deep
A = Total number of acres in reef
h = Total thickness of pay
Ah = Acre feet or the number of acres one foot thick contained within the reef
Ø = Porosity
1-Sw = Oil saturation
Bo = Formation Volume Factor

DATA FOR CALCULATION OF OIL IN PLACE

CHARLTON 4-31N-1W

A = 140 acres
h = 196 feet
Ø = 11%
1-Sw = 85%
Bo = 1.5 (initial)

CHARLTON 5-31N-1W

A = 91 acres
h = 188 feet
Ø = 5.3%
1-Sw = 77%
Bo = 1.5 (initial)

CHARLTON 9-31N-1W

A = 103 acres
h = 267 feet
Ø = 11%
1-Sw = 92%
Bo = 1.513

CALCULATION OF OIL IN PLACE

CHARLTON 4-31N-1W

$$N = \frac{7758 \times 140 \times 196 \times .11 \times .85}{1.5} = 13,269,490 \text{ BOIP}$$

CHARLTON 5-31N-1W

$$N = \frac{7758 \times 91 \times 188 \times .053 \times .77}{1.5} = 3,610,974 \text{ BOIP}$$

CHARLTON 9-31N-1W

$$N = \frac{7758 \times 103 \times 267 \times .11 \times .92}{1.513} = 14,270,522 \text{ BOIP}$$

At a 30% recovery factor this would equal a recovery of:

Charlton 4-31N-1W	=	3,980,847 BO
Charlton 5-31N-1W	=	1,083,292 BO
Charlton 9-31N-1W	=	4,281,156 BO
Total	=	9,345,295 BO

CONVERSION OF PRODUCTION TO PRODUCT EQUIVALENTS

FROM ONE BARREL CRUDE

Gasoline 48.5% = 20.37 gallons
Distillate (fuel oil) 17.5% = 7.35 gallons
LPG 7.5% = 3.15 gallons
Residual fuels 6% = 2.52 gallons
Kerosine Jet fuel 4.5% = 1.89 gallons
Asphalt, Lubricants, etc. 16% = 6.72 gallons

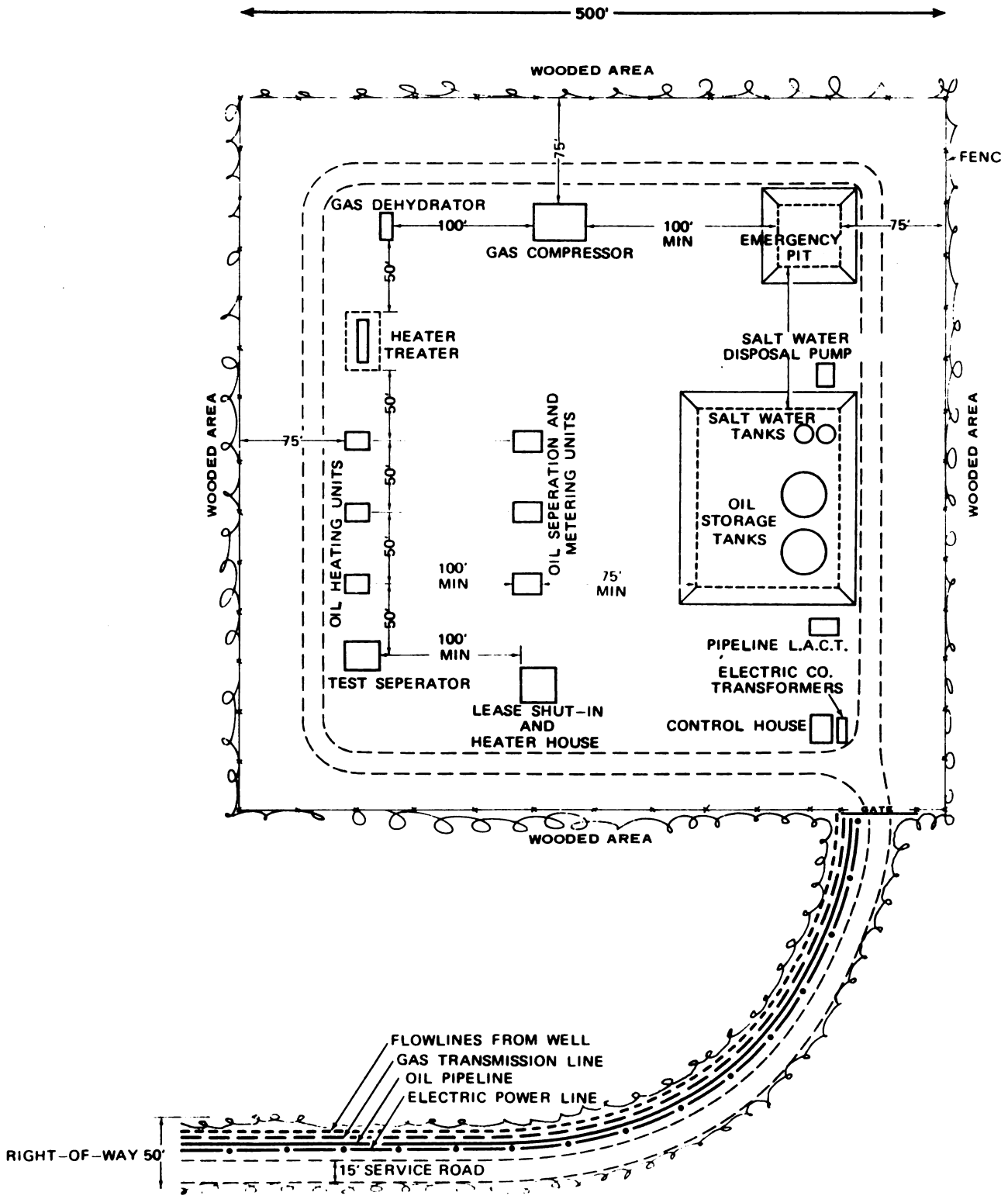
Converting 143.5 Million barrels oil recoverable from Pigeon River Country State Forest then:

Gasoline	2,923,000,000 Gallons
Fuel Oil	1,055,000,000 Gallons
LPG	452,000,000 Gallons
Residual Fuels	362,000,000 Gallons
Kerosine Jet Fuel	271,000,000 Gallons
Other uses	964,000,000 Gallons
Total product	6,027,000,000 Gallons

Based on the average use per home for heating at 169 Mcf natural gas per year and 1377 gallons of fuel oil the home heating capacity of the Pigeon River area would be:

Natural gas	849,112 homes for 1 year or 84,911 homes for 10 years
Fuel Oil	766,158 homes for 1 year or 76,616 homes for 10 years

Total homes heated 1,615,270 homes for 1 year or 161,527 homes for 10 years.



Appendix 5

TYPICAL MICHIGAN OIL PRODUCTION FACILITY

FOR SERVING THREE REEFS

Appendix 6.

PIGEON RIVER COUNTRY STATE FOREST

OPPORTUNITIES FOR PUBLIC INPUT

1973 - 75

Following is a listing of opportunities that have been provided for public input into planning for the Pigeon River Country State Forest. These opportunities initially related to the general plan: "A Concept of Management for the Pigeon River Country State Forest, Policies and Guidelines." Since early 1975 they have dealt progressively with the more specific topic of possible hydrocarbon development.

MEETINGS RELATED TO THE GENERAL PLAN

Public Meetings:

November 12, 1973 - at Gaylord:	Afternoon session -	43 attended
	Evening session - -	36 attended
November 13, 1973 - at Lansing:	Afternoon session -	7 attended
	Evening session - -	5 attended

Natural Resources Commission:

December, 1973 -- This plan was presented to, discussed by, and approved by the Natural Resources Commission.

MEETINGS RELATED TO HYDROCARBON PLANS

Pigeon River Country State Forest Advisory Council:

Monthly meetings were held from July, 1974 to date. These meetings dealt first with the general plan, then progressively, with the hydrocarbon plans. The most recent meeting was on August 18, 1975, in which they discussed the revised hydrocarbon plan.

Public Meetings:

January 31, 1975 -- Two meetings at Gaylord, attendance totaling 260-280.

Meetings with Landowners:

January 31, 1975 -- at Gaylord: attendance 50-60.
February 15, 1975-- Two meetings at Ann Arbor, total attendance 100-120.

Natural Resources Commission:

January 9, 1975 -- The first draft of "Plan of Development for Hydrocarbon Resources" in Pigeon River Country State Forest was presented and made public.

August 14, 1975 -- The revised plan for "Management of Hydrocarbon Resources of the Pigeon River Country State Forest" was presented to the Natural Resources Commission.

LETTERS RECEIVED

Fifty letters were received, primarily concerning the first hydrocarbon plan (i.e. joint proposal, DNR, and oil companies).

28 individuals, and one organization (Petoskey Lost Pine Club) were in favor.
20 individuals and two organizations (Aubudon Society and Northland Sportsman's Club of Gaylord) were opposed to the plan.