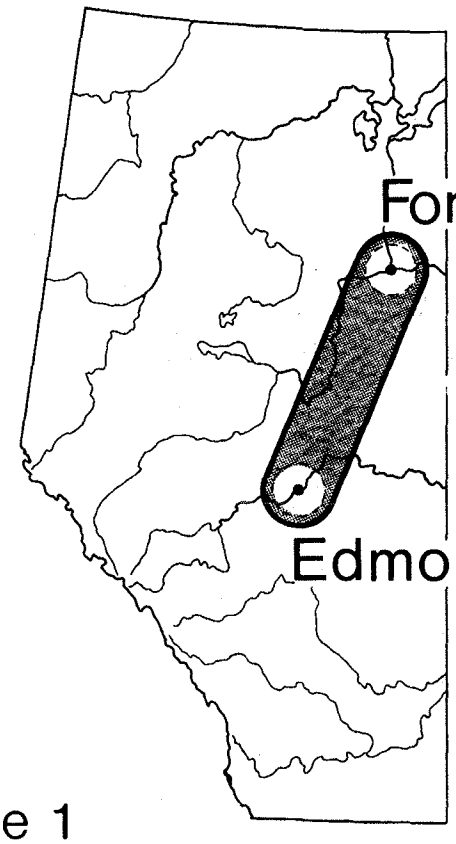
Athabasca Tar Sands Corridor Study



Volume 1

Report~Part 1

Corridor Concept

prepared for

IRONMENT

by

Athabasca Tar Sands
Corridor
Study Group

1974

edmonton, alberta

Athabasca Tar Sands Corridor Study

Volume 1 Report - Part 1

Corridor Concept

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Alberta
ENVIRONMENT

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Corridor
Study Group

april, 1974

edmonton, alberta

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PUBLIC MEETINGS

Phase I

Boyle, Nov. 5/73
Thorhild, Nov. 6/73
Athabasca, Nov. 7/73
Lac La Biche, Nov. 8/73
Fort Saskatchewan, Nov. 9/73
Conklin, Nov. 12/73
Fort McMurray, Nov. 29/73

Phase II

Calgary Technical, Nov. 22/73

Calgary Industry, Dec. 18/73

Edmonton Study Group, Jan. 21, 22/74

Edmonton Study Group, April 8/74

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PREFACE

The prospect of impending rapid development of the Athabasca Tar Sands which will generate an unprecedented demand for a wide variety of transportation facilities makes it imperative that the future linkage of the resource area with its markets and supply centres be planned in a comprehensive and logical manner. There has been much discussion and considerable debate regarding the feasibility of combining multiple pipelines, electric-power transmission lines, highways, railroads and communication systems in a single right-of-way or corridor. The general consensus is that in the past there could have been considerable financial saving and less detrimental effect on the total environment had more planning and positive action been undertaken in this regard. However the development of multi-purpose transportation corridors has not taken place due to the inability of a user of such a corridor to initiate the organization and then administer the diverse factors and interests implicit therein.

On June 12th, 1973, the Honorable W. J. Yurko, Minister of Alberta Environment signed an agreement authorizing the Athabasca Tar Sands Corridor Study. The purpose of the study was to make recommendations regarding the feasibility and desirability of combining pipelines carrying synthetic crude oil and other products in the same corridor with existing or future utilities and transportation systems, then to select the desired corridor route and the preferred location of a terminal. The recommendations were to be based upon the objective of achieving a realistic balance between minimum social and environmental disturbance and economic cost. In addition, consideration was to be given to the opinions of the various people and organizations who would be affected by the resultant facilities. To this end, representatives from citizen organizations, rural and urban municipalities, industry and the consultant group were involved in the study.

This report is the first of a two part report and it deals with the "Corridor Concept", its feasibility, application and implementation. Part Two of the report will deal with the location of the corridor and pipeline terminals. This report is the work of many people as indicated in the appendix volumes which contain most of the background information gathered during the study. It is hoped that this report will be used in formulating transportation corridor policy and that legislation covering this aspect will become a reality.

Preserving and enhancing the quality of our environment and the quality of life is a continued activity. It is hoped that the co-operation that was evident in the preparation of this report will continue and prevail throughout the much larger and more complex problems involving the development of the full potential of the Athabasca Tar Sands.

C. H. Weir, Project Manager

CHAPTER 1

CORRIDOR CONCEPT

1.1
DEFINITION & INTRODUCTION

A Transportation Corridor can be defined as a continuous strip of land of varying width connecting two geographically separate points and containing two or more facilities for the conveyance of people, energy and/or materials.

For the purpose of this report the word "corridor" means transportation corridor as defined above. Such a corridor may contain highways, railways, canals, multiple pipelines, powerlines, communication systems, water lines, sewer lines, other utilities and other transportation facilities. These facilities may be cooperatively or individually owned and operated.

The corridor may also contain several adjacent rights-of-way, each occupied either singly or jointly by the various modes of transport. Should one mode of transport predominate and become the main purpose of the corridor, for example, pipelines then the corridor might become known as a "pipeline corridor."

The "Corridor Concept" implies comprehensive planned development of the corridor defined above.

The planning and design will take into consideration many factors such as: the number of transportation modes, environmental and social safeguards, engineering and design considerations, safety and security, topography, land use, economics, zoning, legal factors, future expansion and the location parameters of the various modes of transport. The components and the design of a corridor may vary throughout its length, being dependent upon many factors, some of which have already been mentioned. The total width will likewise vary from several hundred meters to several kilometers being dependent upon many of the same factors.

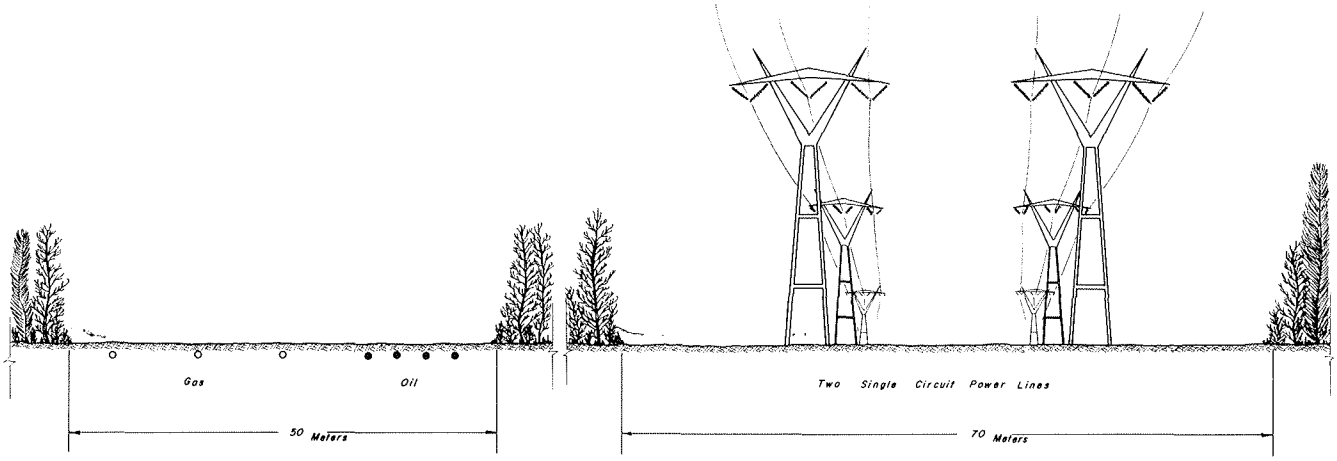
The use of the corridor is not limited only to transportation facilities but could also include other specialized land uses compatible with its operation such as hiking trails, hunting reserves, sports fields, golf courses, gardens, picnic sites, service centers, maintenance centers, agricultural uses, wildlife habitat, etc. A corridor is not "strip development" but rather a continuous strip of land designed to accommodate linear land uses and applies both in the urban and rural environment.

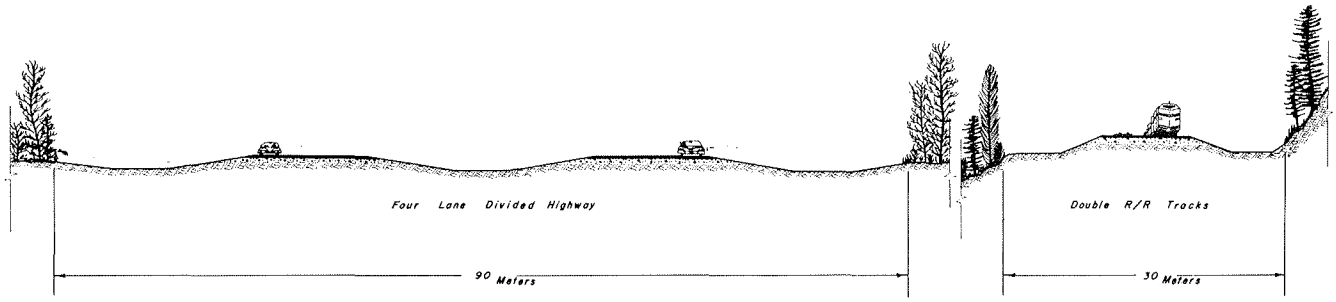
This report deals with power transmission lines, pipelines, highways and railroads. The statements and recommendations made herein can, for the most part, be applied generally to any area but in particular they apply to the study area. For example, recommendations regarding legislation may not apply in other jurisdictions. Also, some of the statements involving the physical environment may not apply in heavy permafrost or rugged mountainous regions.

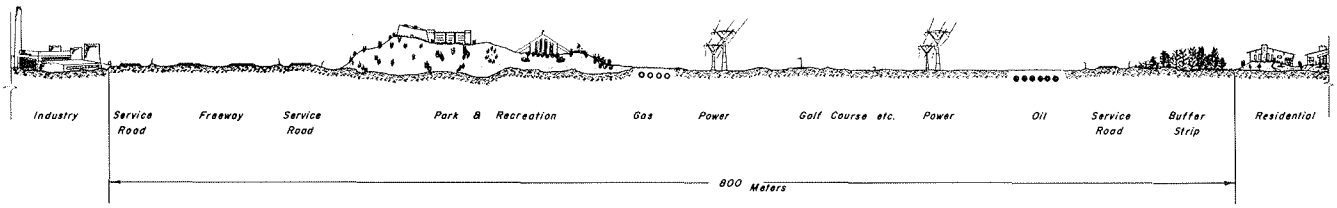
This study area, comprising northeast Alberta south of Fort McMurray encompasses a variety of topographic, hydrologic, climatic, geologic, floral and faunal regions.

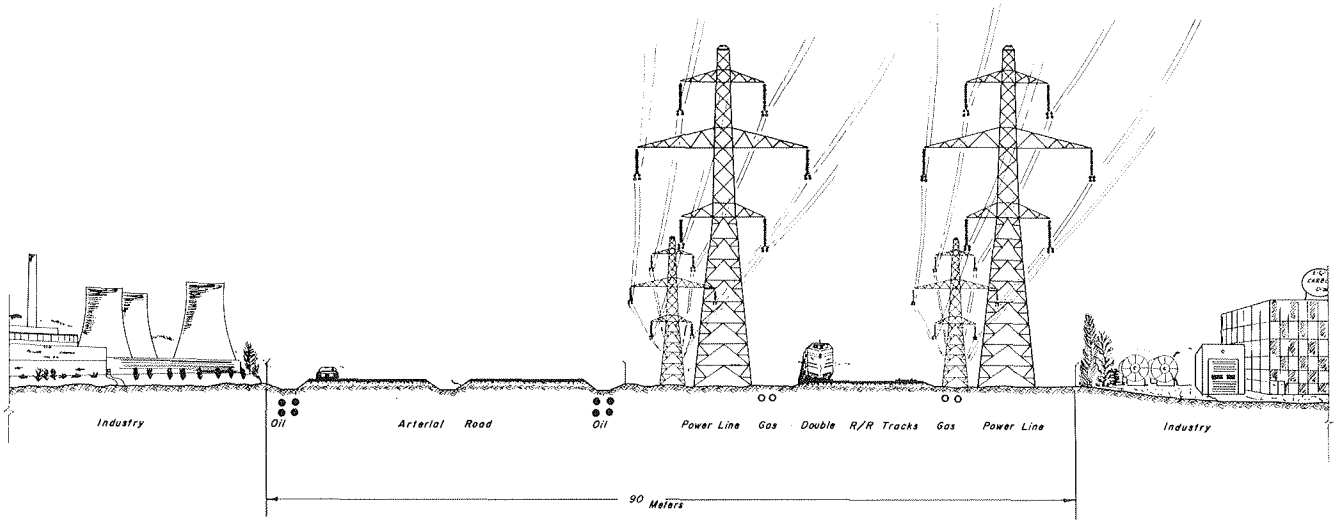
The area north of Lac La Biche may be distinguished by; upland areas arising to 900 meters in elevation; localized annual precipitation amounts in excess of 50 centimeters; very few settlements; aspen poplar forest with stands of jackpine and large areas of muskeg; little cultivation,

NOTES & REFERENCES










High Level
Fort Chipewyan
Fort McMurray
Peace River
Grande Prairie
Grande Cache
Edmonton
Lloydminster
Camrose
Wetaskiwin
Jasper
Red Deer
Drumheller
Banff
Calgary
Medicine Hat
Lethbridge
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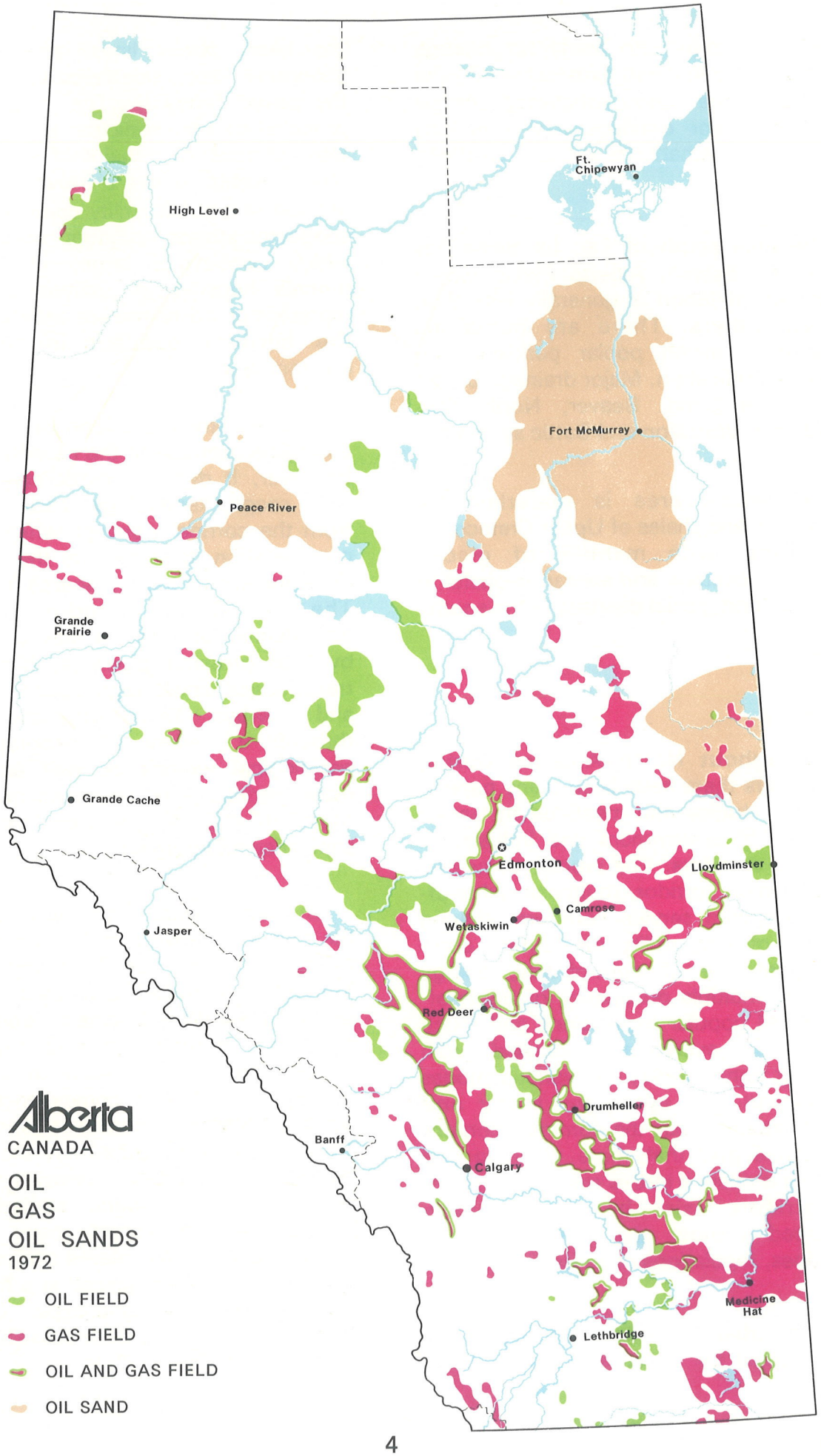
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Banff
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Medicine Hat
Lethbridge
Alberta
CANADA
OIL
GAS
OIL SANDS
1972
OIL FIELD
GAS FIELD
OIL AND GAS FIELD
OIL SAND

abundant wildlife with many fur bearing animals; game fish and birds; all within the Lac La Biche and Athabasca Forest Reserves. Major drainage basins include the Christina, Athabasca and Lac La Biche systems.

The area south of Lac La Biche lies within the Eastern Alberta Plains where annual precipitation is generally less than 45 centimeters. There are numerous settlements, aspen poplar parkland and extensive cultivation. Major drainage basins include the Sand, Beaver, North Saskatchewan, Vermilion and Battle systems.

The whole area is underlain by sandstones and shales of Upper Cretaceous formations, with mantles of glacial outwash, lacustrine and aeolian deposits in the north, and glacial deposits in the south.

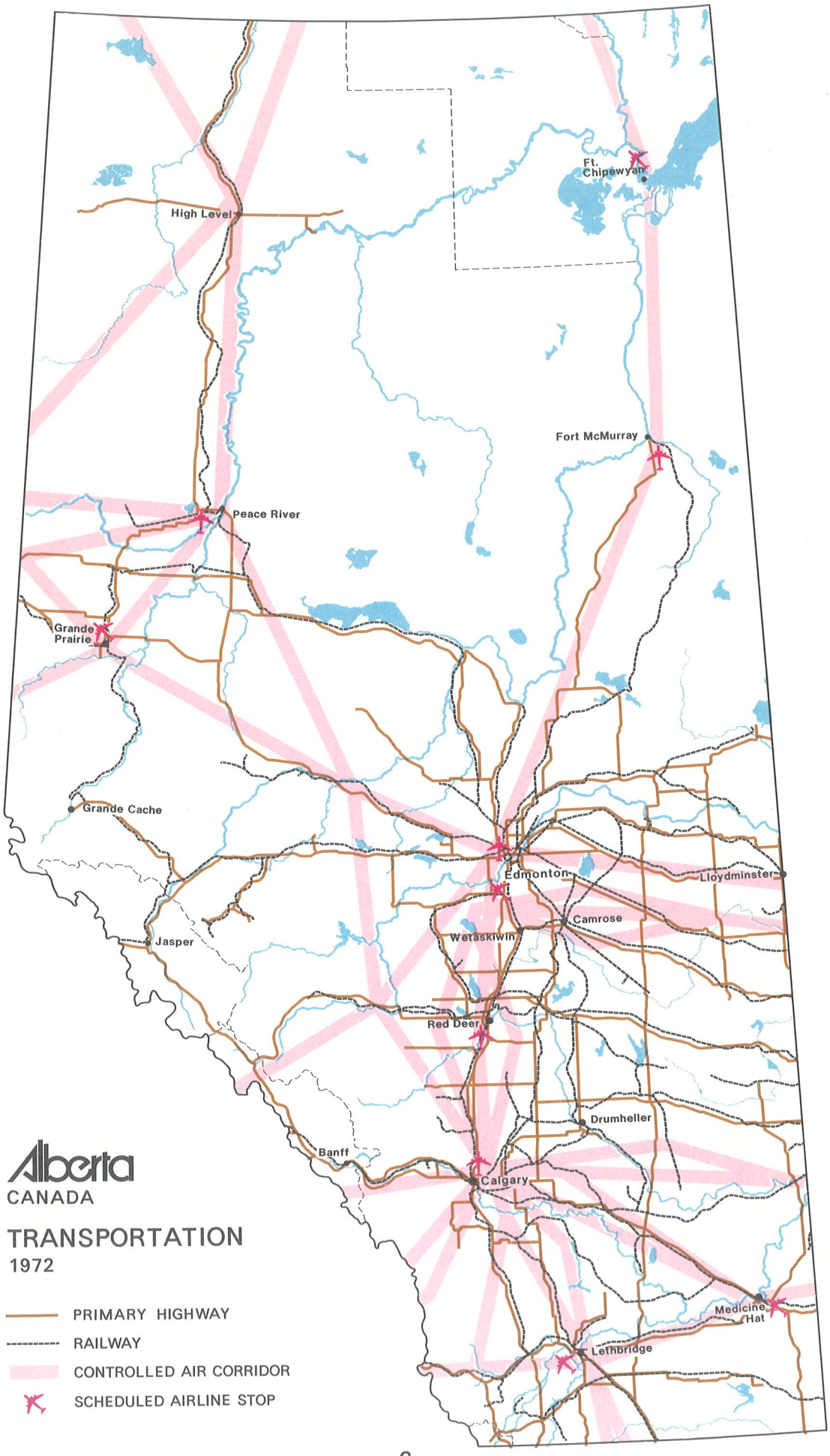
1.2 HISTORY

Throughout North America during recent years there have been many papers, seminars, studies and meetings by senior personnel of government and industry in regard to corridors. The words; combined transportation corridor, multi-use rights-of-way, integrated service corridors, sharing of rights-of-way, utility distribution corridors, joint use of right-of-way, energy corridors, multiple occupancy of rights-of-way are all popular expressions and much in use by everyone associated with obtaining rights-of-way for various modes of transport. **All agree for many and varied reasons** that the common corridor is desirable and that more planning and direction is needed in this regard. Examples of corridors exist but have largely developed without the benefit of firm guidelines, regulations or legislation.

In the urban environment, many streets are occupied by water lines, powerlines, gas lines, sewer lines, street railways, telephone lines, sidewalks in addition to the paved roadway. The right-of-way is provided by the municipal authority which also operate and maintain most of the utilities except where a franchise has been granted to a public utility company. In very congested streets "utilidors" are being built which consist of large, concrete box tunnels housing all utilities and which represent an advancement or refinement of the corridor concept in the urban environment.

The city street is a form of corridor and a tangible example of the corridor concept. However, it differs considerably, both in size, scope, technology, and magnitude, from the corridor concept which is under consideration to assist in the organized development of the Athabasca Tar Sands. The Tar Sands corridor will cover considerable distance, it may be occupied by high pressure pipelines, high voltage transmission lines, high speed highways, and railways. These facilities will pass through a variety of geographic and sociological regions as well as through many variations of environment. Such a corridor requires a new and more sophisticated approach.

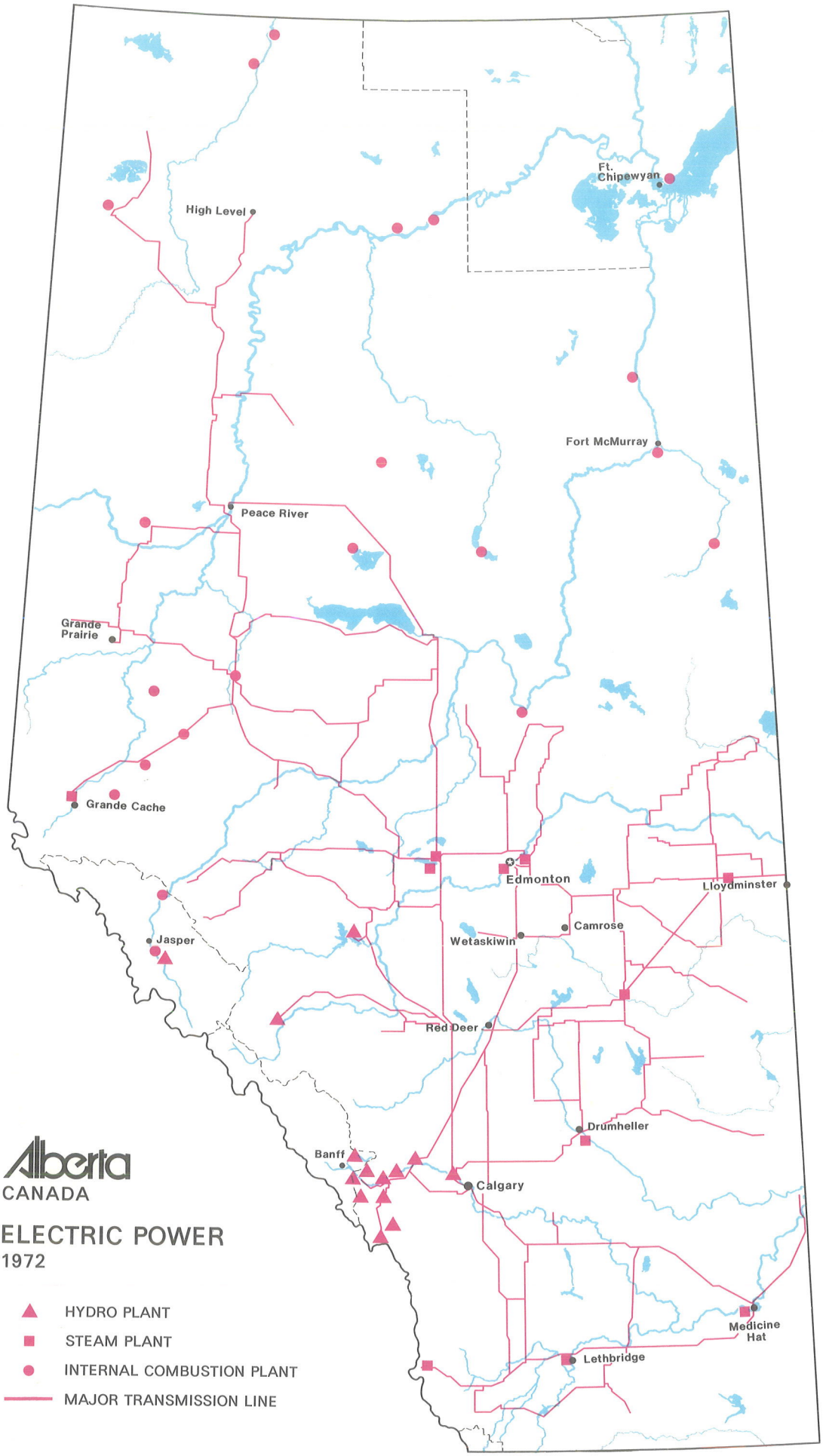
In many instances throughout Alberta, the highway, railway and other modes of transport occupy adjacent rights-of-way forming a corridor. But each utility is largely planned, designed, constructed, operated, maintained and terminated independently. They occur in a corridor chiefly on account of convenience and for obvious practical considerations. These quasi-corridors illustrate that the corridor concept is workable. However, these facilities can be found spread, in an irregular fashion, across many parts of Alberta, and for all intents and purposes, appear to have been placed in a haphazard manner over the landscape. Obviously planned corridors are both desirable as well as more utilitarian.



Alberta
CANADA

TRANSPORTATION
1972

PRIMARY HIGHWAY
RAILWAY
CONTROLLED AIR CORRIDOR
SCHEDULED AIRLINE STOP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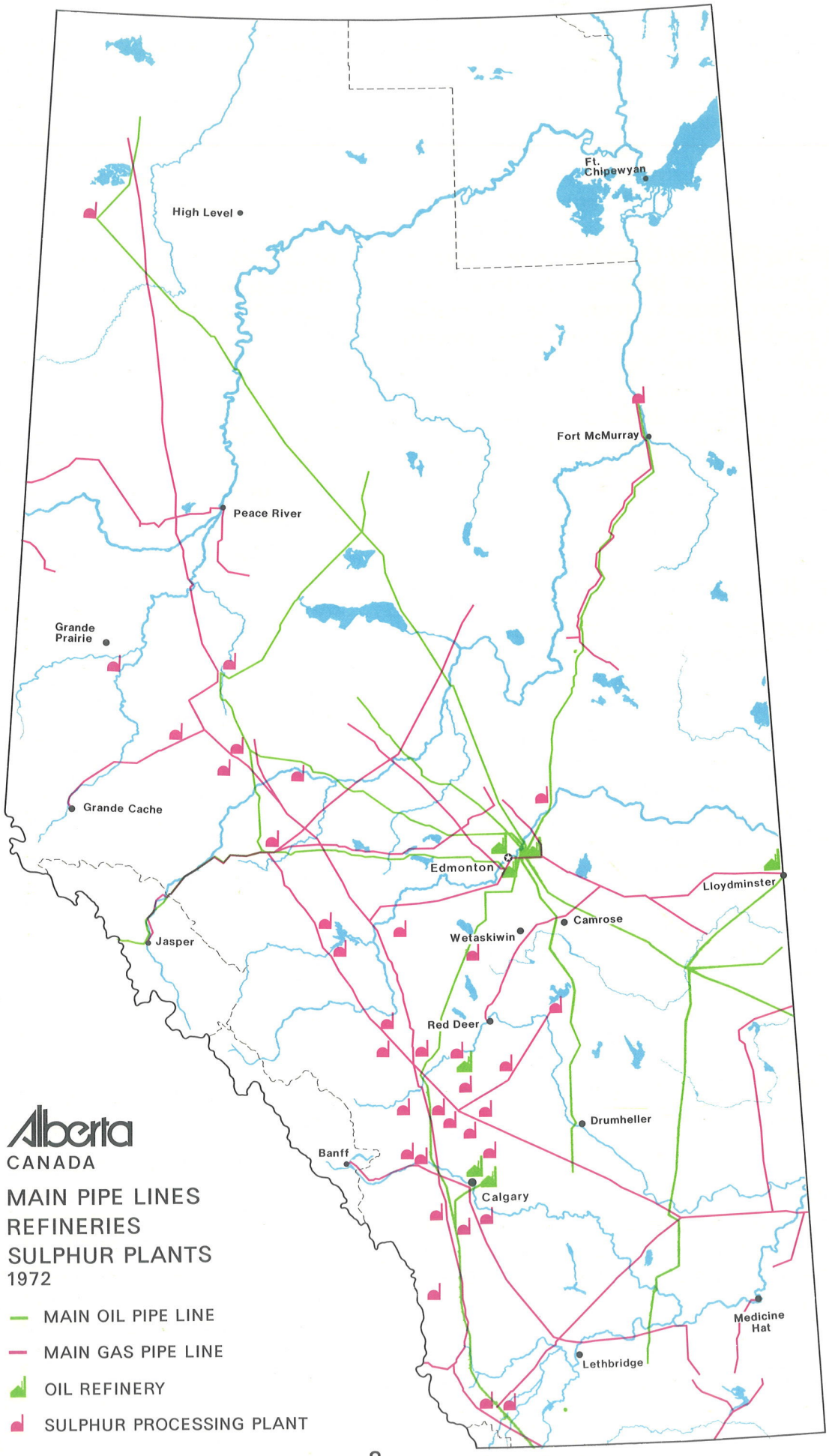
Grande Cache
Edmonton
Lloydminster
Camrose
Wetaskiwin
Jasper
Red Deer
Drumheller
Banff
Calgary
Medicine Hat
Lethbridge
Alberta
CANADA
ELECTRIC POWER
1972
HYDRO PLANT
STEAM PLANT
INTERNAL COMBUSTION PLANT
MAJOR TRANSMISSION LINE



Alberta
CANADA

MAIN PIPE LINES
REFINERIES
SULPHUR PLANTS
1972

- MAIN OIL PIPE LINE
- MAIN GAS PIPE LINE
- OIL REFINERY
- SULPHUR PROCESSING PLANT

Starting in 1947 with the development of the Alberta oil and gas industry and the terminal facilities east of Edmonton, pipelines came into this area from all directions. As a result, some minor, partially defined "pipeline corridors" exist. Between 1966 and 1970, studies were made by the City of Edmonton and the Edmonton Regional Planning Commission in regard to the location of pipeline corridors. This endeavour focused attention on the matter but produced no legislative action toward establishing, defining or regulating of corridors. An examination of this area leaves no doubt about the benefit which derives from an early definition, design, and acquisition of corridors.

1.3 APPLICATION PARAMETERS

Wherever there is a requirement to convey people, energy and materials between two terminals by various means the corridor concept can be applied. If one or more methods of transport are firmly in existence, then it is a question of whether the additional facilities can and should follow the existing facilities or form a new corridor. There are certain basic principles and parameters which apply to whichever combination of associations, corporations or individuals, own, operate and/or maintain the various facilities within the corridor.

1.3.1 ENVIRONMENTAL IMPACT (Referring to Study Area)

1.3.1.1

The impact on the social and physical environment is reduced when all modes of transport come together in a corridor.

In overall ecological and environmental terms, the corridor concept is without a doubt the most acceptable solution. However there are specific areas or instances when this statement may not apply. At this time a valued judgment must be made whether or not to have a corridor. This judgment will be affected by the relative importance of the impact of a given activity on an environmental characteristic or condition. Such a judgment will also be affected in many instances by the lack of researched data.

1.3.1.2

The impact on the environment of the construction activities associated with all modes of transportation requires special attention.

The presence of the facility may have a large or small impact on the environment but to minimize the environmental disturbance, the construction activity requires special attention. This applies throughout, but in a corridor the same piece of ground will be disturbed more often, thus in some instances requiring that special procedures be taken. The presence of other nearby facilities during the construction period also requires specialized knowledge and procedures. Thus the construction phase is particularly critical when applying the corridor concept.

1.3.2 SOCIAL AND ORGANIZATIONAL

1.3.2.1

Application of the Corridor Concept must include public involvement.

In addition to the traditional parameters of technology and economics, successful application of the corridor concept must involve the general public. The maturing public attitude of preserving and enhancing the quality of our environment and quality of life has in recent years halted some large projects even after construction has started.

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Power Transmission Line across farm land.

HIGHWAY 46

1.3.2.2
Corridor occupants must be prepared to relinquish some of their independence and individuality.

There must be interaction, dependency and responsibility between corridor occupants and between corridor occupant and the corridor authority in addition to the usual interchanges and associations. Each occupant must have an appreciation and knowledge of all the facilities within the corridor especially during the construction period. Compensation for this loss of independence is accomplished through improved economic efficiency in land acquisition, construction, maintenance, etc.

1.3.2.3
Corridor occupants and users must be responsible citizens.

Any individual, association, authority or corporation must be able to guarantee the design, construction, reliability, operation, maintenance and termination of their facility and use of the corridor. This applies throughout but a particular example is in the granting of rights to ad-hoc groups for specialized corridor uses such as snowmobiling, riding trails, motorcycle racing, golf, agricultural pursuits, hunting, etc.

The presence of several modes of transportation in one corridor magnifies the possible consequence of negligence, faulty materials and malfunctioning.

1.3.2.4
Implementaion of the corridor concept can be best achieved by vesting responsibility in a single authority.

There must exist a central authority charged with the responsibility of assisting corridor occupants to overcome the difficulties and to resolve the conflicts which occur. A single administration owning, and, in part, maintaining, operating and policing the corridor could mean a considerable economic saving to each of the corridor occupants.

1.3.3
TECHNICAL

1.3.3.1
Location of the corridor will be limited by the transportation facility with the most rigid location parameters.

For example: gradients are of primary importance in railway routing, thus, if a railway is included in the corridor, gradients become a major influence in locating the corridor in rolling country.

Another example (looking into the future): a limiting restraint on a vehicle system for moving people is acceleration, thus, if a 300 km/h ground transportation facility is included in the corridor, the smallest radius of curvature for the corridor would be in the order of 3 km.

A corridor has to accommodate a compromise route which all utilities are able to accept.

1.3.3.2.
Design of the corridor requires an expanded multi-disciplinary approach.

The technical design of the corridor must integrate and meet the requirements of all potential users. Each mode of transportation has its own design requirements, its own changing technology and new developments to minimize environmental impact. Therefore, when applying the corridor concept all potential users of the corridor must have input into the design. This input should come from the engineers, environmentalists, legal repre-

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TRAPPER'S CABIN

Northern Alberta Railway provides a link to communities between Lac La Biche and Fort McMurray.

CONKLIN

sentatives, economists, etc. associated with each mode of transport along with input from potential specialized users, adjoining property owners and the general public.

1.3.3.3
The corridor must be declared, acquired and designed as to the placing of the utilities well ahead of development.

Predicting future corridor users and the extent of their requirements will be the most difficult element in defining a corridor. The ideal corridor will not only meet presently foreseeable demands but also long term future transportation demands.

In urbanized areas the existence of a corridor would allow some future service to be built that otherwise would have been denied.

The approval and acquiring of a right-of-way is becoming the most delaying and involving problem in the construction of any utility. Thus one of the greatest incentives to a potential corridor user will be the availability of an approved route.

Thus, if the corridor concept is to be applied and be successful, it must be planned and space allotted to the various utilities many years ahead of development.

1.4 POTENTIAL ADVANTAGES AND DISADVANTAGES

The corridor concept introduces a large number of possible arrangements of the various facilities which may be place in a corridor. There are many factors (already mentioned) which will affect its design. Assuming that the corridor has been properly designed there are potential advantages and disadvantages which apply to whatever combination is selected.

1.4.1 POTENTIAL ADVANTAGES

1.4.1.1
Conservation of land and space.

The corridor represents a more concentrated and efficient land use. Many facilities are using the same strip of land on, above and/or below the surface.

1.4.1.2
Environmental disturbance restricted to a limited area.

Proliferation of separate rights-of-way across the landscape generally increases the total environmental impact. Bringing all the facilities into a narrow strip of land limits the area disturbed and at the same time reduces the total impact. The caution outlined under 1.3.1.1 applies.

1.4.1.3
Can be used as a positive force in shaping land use pattern.

A corridor may be employed to shape the overall land use pattern of the region through which it passes, especially in urban and urban fringe areas. A corridor may be used to separate incompatible uses of land and it may also serve as a perimeter or boundary for the development of communities.

On a regional scale the presence of a corridor containing all the facilities might be used to encourage or inhibit development in certain areas.

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Conklin (main street)

NAR Mile 168.2

1.4.1.4
Administrative and operative efficiencies, assuming a single authority.

Much duplication of services can be avoided if the owners and operators of the various utilities within the corridor agree to a single authority managing and looking after areas of common interest. Specialists associated with each utility would still be required. The savings would occur in areas of administration, general maintenance, inspection and surveillance.

1.4.1.5
Economic and social advantages of a single land acquisition program.

The alarming escalation of land prices, especially near urban areas is well known. The purchase of a corridor for present and future utilities will most certainly represent a large saving.

A single purchase reduces the number of dealings and possible confrontations between landowner and purchaser which would occur if many separate rights-of-way were acquired over a period of time. The single purchase would also prevent complications among potential users who sometimes have different criteria for acquisition and compensation.

1.4.1.6
Economic and social advantage of an established and approved right-of-way.

Adjoining owners and communities will know in advance of future utilities and can plan accordingly. They will not be surprised by some utility suddenly wishing to cross their domain.

Future corridor users will not have to go through the long process of approvals and locating the rights-of-way.

1.4.2
POTENTIAL DISADVANTAGES

1.4.2.1
Reconciliation of conflicting interests created by the corridor concept.

When many modes of transport, similar or different, come together in a corridor, problems in planning, design, law, insurance, timing, ownership, engineering, construction, etc. are created. For the most part they can be easily resolved and, once the facility is constructed and in operation, they are of little concern. However reconciliation of these problems must take place and cannot be ignored, thus the reconciliation process is a major disadvantage.

1.4.2.2
Potentially higher intensity of environmental disturbance in a restricted area.

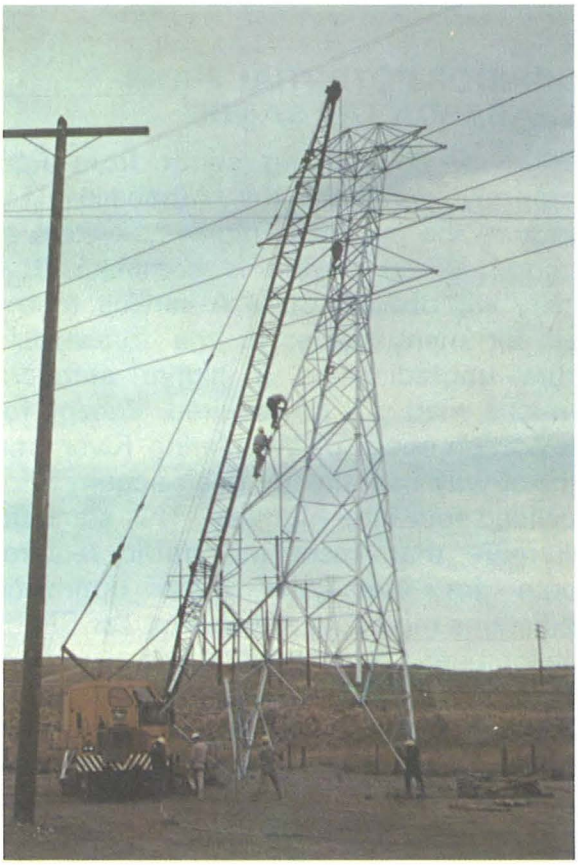
With all modes of transport confined to a narrow strip of land, the environmental disturbance within this strip may be very high. Thus environmentally sensitive areas within the corridor could be completely destroyed.

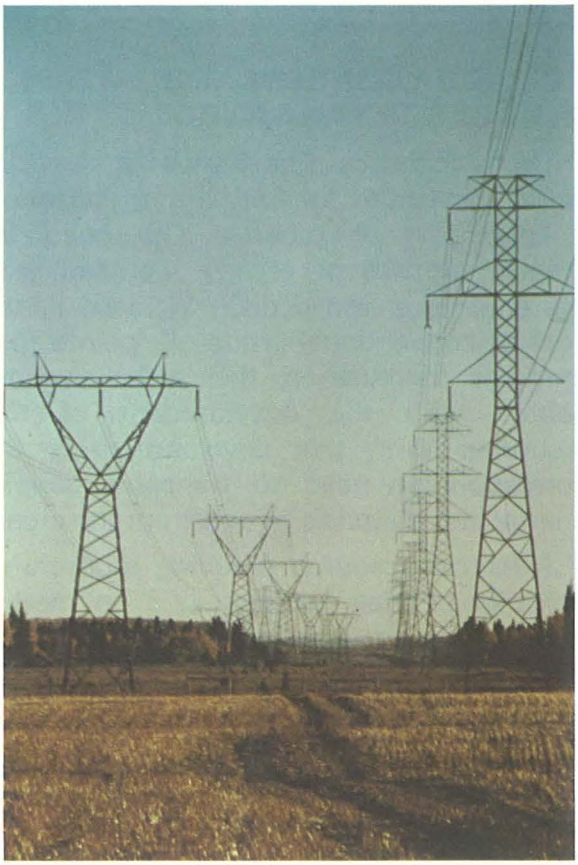
1.4.2.3
Complications in engineering design within the corridor.

Each user within the corridor may have to make some adjustments in design to accommodate the other occupants.

1.4.2.4
Vulnerability to major catastrophes.

Major catastrophes resulting from war, vandalism, subversive activities, landslides, floods, earthquakes, etc. can be more serious as all utilities could be devastated at one time in one place.





Power Transmission Line Corridors

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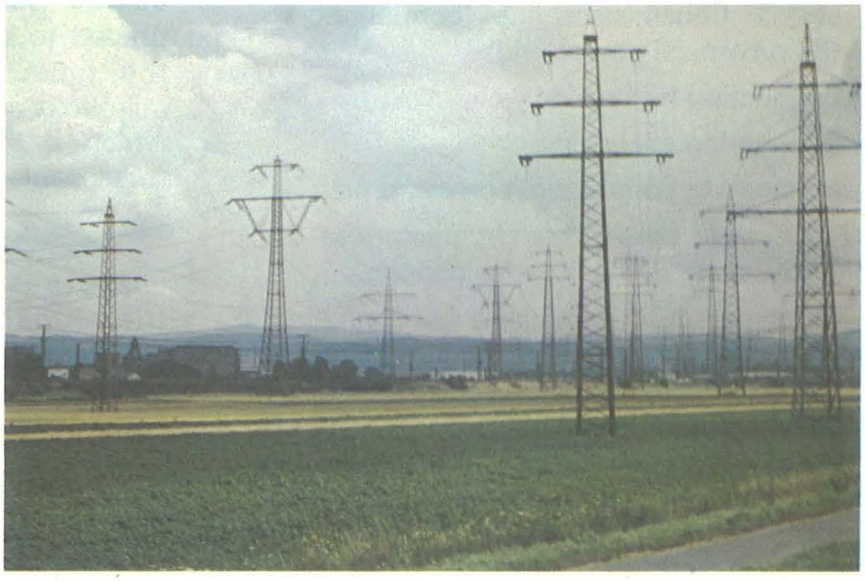


CHAPTER 2

CORRIDORS

2.1 CORRIDOR CONCEPT AND ATHABASCA TAR SANDS

The Athabasca Tar Sands is a major world resource located in a relatively isolated part of Alberta. The need for greater supplies of energy, coupled with the enormous and sudden increase in the cost of conventional crude oil, points to a dramatic increase in the activities connected with the development of this resource. With this development is the corresponding need to transport people, energy and materials to and from the area.

A remote resource requiring multi-transportation modes connecting it to market and supply centres offers an ideal situation in which to implement the corridor concept. The development of the Athabasca Tar Sands requires:

—several synthetic crude oil pipelines connecting it to markets;

—several products pipelines (this will depend upon the extent of refining carried out in the Athabasca Tar Sands Area);

—gas lines bringing in gas used in the processing;

—several transmission lines connecting to the provincial power grid;

—connecting highways;

—connecting railways;

—connecting communication systems;

all of which create the circumstances for consideration of the corridor concept.

In order to minimize environmental impact and to prevent the unnecessary proliferation of separate rights-of-way radiating out of the Athabasca Tar Sands the corridor concept should be applied. In part two of this report we hope to recommend corridor locations and the facilities it could contain.

2.2 CORRIDOR POTENTIAL FROM ATHABASCA TAR SANDS

Highway 63 running south from Fort McMurray connects the Athabasca Tar Sands to the provincial highway system at Atmore. When paving is complete, this facility will provide Class A service to the area for many years. In the foreseeable future upgrading to a higher standard two-lane road will be required. Except for the portion south of Wandering River, the right-of-way has already been acquired for a divided four-lane highway. This standard will more than meet the traffic requirements for even the most optimistic predictions regarding Athabasca Tar Sands development. South of Atmore, where factors other than Tar Sand development affect the system, some upgrading of the provincial highway system is already required.

The Northern Alberta Railway, running south from Fort McMurray, connects the Athabasca Tar Sands with the total railway network. This railway is presently underutilized but, nevertheless, is being upgraded to a higher standard. Again using the most optimistic predictions, this railroad is adequate to supply all the service which it may be asked to give in the foreseeable future.

The present pipeline system in and out of the Athabasca Tar Sands will not accommodate additional plants which have been proposed. The number of pipelines required is still in question and will depend upon a number of factors which will be more fully discussed in part two of the report. However, there is little doubt several pipelines will be required.

GCOS Pipeline
—Athabasca River Crossing

GCOS Pipeline
—Pine Creek Crossing

GCOS Pipeline
—House River Crossing

The Athabasca Tar Sands area is not presently connected to the provincial power grid. A power transmission line from the grid at Mitsue into the area has been recently approved. Predictions from industry seem to indicate three lines at the most and more likely two lines into the area. There is also the possibility of reversing the energy flow sometime in the future.

Micro-wave communication systems service the area at present.

Moving the highway or railway is not considered feasible, thus, the potential for a corridor from the Athabasca Tar Sands is limited to additional pipelines and power transmission lines. Depending upon location factors, these additional facilities may or may not follow the existing facilities then an enlarged corridor must be considered. However, if a major pipeline - transmission line corridor is located away from the highway or local road system, it may necessitate a service road being built along with the corridor.

It is therefore concluded that consideration should be given to a "pipeline corridor", a "transmission line corridor" and/or a combined "pipeline - transmission line corridor" to accommodate the facilities which development of the Athabasca Tar Sands will generate. Although these components are the only new facilities which can presently be foreseen, the application of the corridor concept should not preclude additional future components, nor should it preclude the integration of existing facilities such as the highway, pipeline and/or railway within the corridor.

2.3 CORRIDOR DEVELOPMENT

2.3.1 REGIONS

Corridors coming out of the Athabasca Tar Sands area will pass through four general regions, each requiring a different approach. Some pertinent factors are mentioned about each and in general refer to pipeline and transmission line corridors. The general factors concerning corridors and the potential advantages and disadvantages already mentioned apply to each area.

2.3.1.1 ATHABASCA TAR SANDS AREA

The corridor will extend to terminals inside the Athabasca Tar Sands area and should be integrated with the gathering system.

In the mineable areas the corridor should be as narrow as possible to prevent the locking in of tar sand reserves. In these areas there will probably be almost total destruction of the present environment thus, the primary consideration should be given to how the corridor may fit into the area after its rehabilitation and restoration.

Present information and indications are that in the areas where the in-situ processes are to be applied the surface stability will not be affected and that approximately 50% of the surface area will be totally disturbed. However, this should be confirmed when more information becomes available as to the surface facilities and the surface stability associated with "in-situ" development.

In the overview, the effect of the locking in of tar sand reserves and the disturbance of the environment will probably be of minor importance when compared to the confusion and delays that will result if transportation corridors are not immediately defined within this area.

2.3.1.2 WILDERNESS-FORESTED AREAS

Placing all the facilities in a single right-of-way will mean much less clearing of trees.

In our study, consideration was given to 252 species of birds and 60 species of mammals. The overall summation favored the single corridor. In some areas where a species is predominant and this species finds the wide clearing a barrier, then buffer zones should be designed into the corridor.

Volume 4 appendix
Volume 6 appendix
Athabasca Tar Sands Gathering System — Tottrup et al.

GCOS Pipeline Right-of-way south of Fort McMurray.

Power Transmission Lines

Along Highway 63 there are some areas with scenic qualities requiring buffers if the corridor is to be integrated with the highway.

2.3.1.3 AGRICULTURAL FARMING AREA

The establishment of pipelines and powerlines in a corridor would cause some temporary disruption to the physical and social environment of the farm community during the construction periods of each facility but once operating the impact is relatively small. With ample notice, fair compensation and proper construction practices, very little opposition would be expected from the farming community. The multi-purpose corridor is recommended rather than many single rights-of-way in the agricultural farm community.

Some general observations regarding establishing a corridor in the farming community are as follows:

- —Strong preference for a multi-purpose corridor is indicated.
- —Corridor location preference is along existing pipelines, railways and/or highways.
- —Consideration of the attraction of urban and other uses such as hiking trails, youth hostels, skidoo trails is not favored in agricultural areas but is recommended for non-agricultural areas.
- —Soil conservation and total property restoration are of a major concern.
- —Development of a service road along the corridor and/or fencing of the corridor area is favored only where it benefits the farm operation.
- —Compensation for total property damage and injurious affection is a major concern which can be resolved only in the acquisition process.

The farm residents have a serious interest and concern in the corridor concept and should be consulted throughout its development.

2.3.1.4 URBAN AND FRINGE AREAS

The advantages of the corridor concept becomes most obvious in the urban and urban fringe areas. In these areas special consideration should be given to accommodating utilities other than those that may be directly concerned with the Athabasca Tar Sands.

2.3.2 COMBINATIONS

The various transportation modes can be combined in a variety of ways to form a corridor. The following corridors are some that may be useful to serve the Athabasca Tar Sands area. Salient factors concerning each facility are discussed within the context of the corridor concept. It should be recognized that the general factors discussed previously are relevant in the case of each potential corridor.

2.3.2.1 POWER TRANSMISSION LINE CORRIDOR

A. Environmental Impact

1. Creates least physical disturbance.
2. The restoration of a transmission line right-of-way when it has served its useful life is a simple and complete operation.
3. Aesthetics — significantly objectionable to some people and is related to existing land uses.
4. The open space created may be an asset. (1)
5. The facility is clean, odorless and normally silent.
6. Several lines in a common right-of-way greatly decrease the clearing required in forested areas.

B. Location

1. The location parameters are flexible. (2)

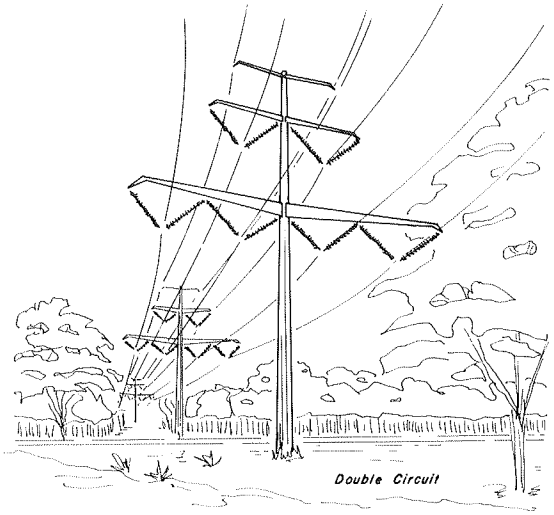
NOTES & REFERENCES

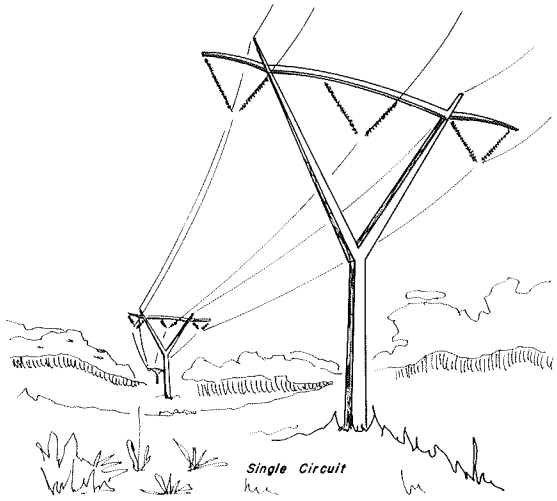
[1] *Existence of Right-of Way does not adversely affect adjoining property value.*
1958. Cloyce Carll. P55, Vol. 2.
1960. Charles Leytor. P56, Vol. 2.
1963. Peter Brennan, S.C. Edison, etc.
See P60 re: agree impact.

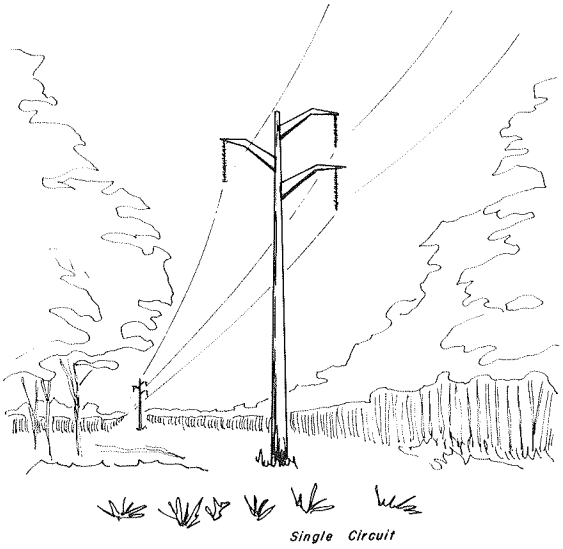
[2] *Route Selection based on environmental and visual considerations and land use. P76, Vol. 2.*

[3] *Library on burial of underground H.T. line in England.*

[4] *Reference Calgary Technical Meeting.*
P12, Vol. 7B—Appendix.







2. A straight line location is preferred. Every bend creates considerable additional expense.
3. The number of lines is reduced by using higher voltage and/or two circuit single towers.
4. Underground location is not feasible for high voltage lines due to the excessive cost. (3)

C. Spacing

1. The minimum spacing in a corridor is determined by wire contact distances. (4)
2. The desired spacing is the tower height fallover distance where parallel lines are in the same right-of-way.
3. For reliability powerlines to an area where feasible are separated by 50 to 70 kilometers to minimize storm damage risks.

D. Comments

1. Reliability of service is the overriding consideration since disruption of service is an immediate problem over a large area.
2. High voltage lines are to transmit power over long distances and tapping the line at intermediate points involves heavy expenditures and is generally not practical.

2.3.2.2 PIPELINE CORRIDOR

A. Environmental Impact

1. Much of the damage occurs during the construction phase. With proper workmanship this will not be severe.
2. During the operational phase there is limited pollution from diesel powered pumping stations at 50 to 200 kilometer intervals.

B. Location

1. Location parameters are flexible. Gas line gradients are not important whereas oil line grades have an effect on pumping costs.
2. Straight line locations are required since up to 70% of the cost lies in the cost of the pipe.

C. Spacing

1. Oil pipeline spacing in firm soil — 3 meters.
2. Gas line spacing in firm soil — 10 meters.

These are minimum distances dictated by construction practices when constructing a new line next to a hot line. Under unstable soil conditions this spacing will need to be altered. Lines built simultaneously may be laid side by side.

D. Comments

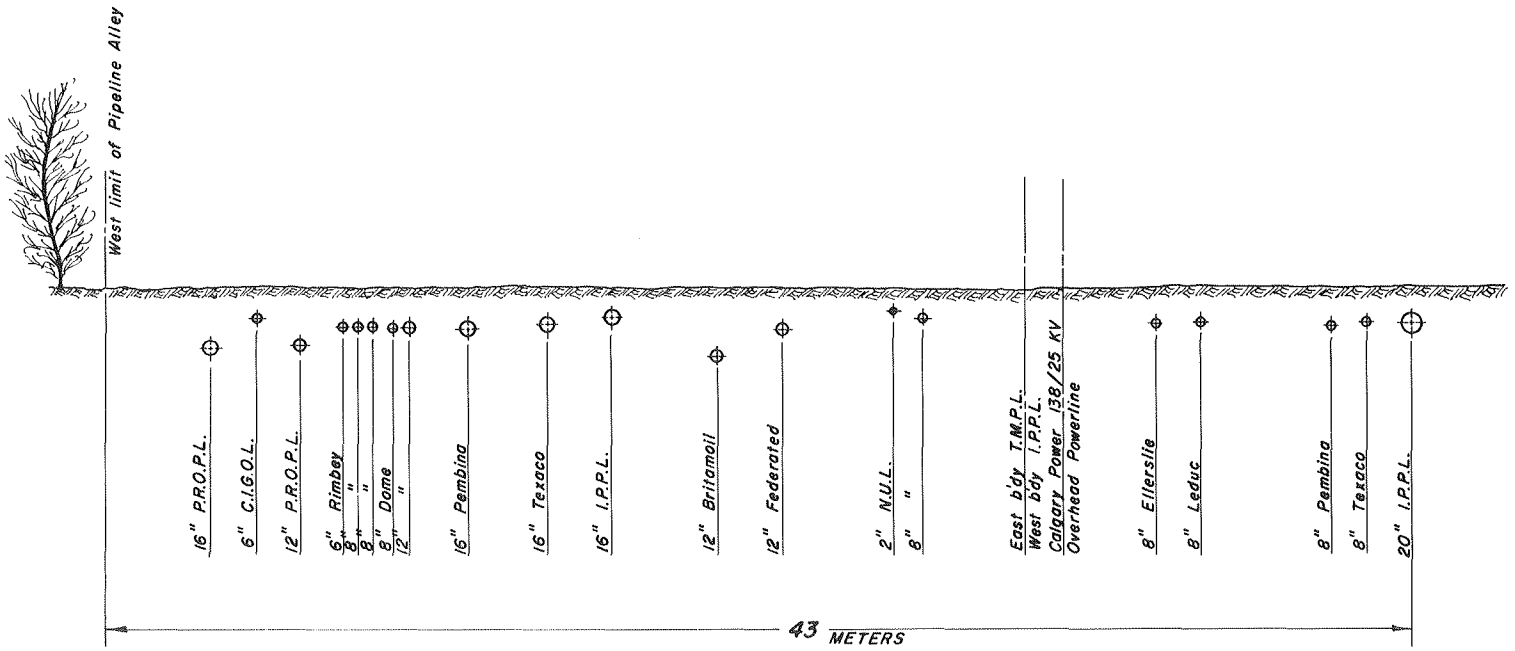
1. The economic benefits to small communities near a pipeline corridor are very limited and temporary.

   Pipelining requires highly trained men with specialized skills, hence the use of local labor is not a major factor. Major pipe materials are not a significant portion of overall costs.
2. Pipelines may be readily tapped at intermediate points for extraction of products but the converse is not true. It is difficult to add products to the lines at intermediate points.

NOTES & REFERENCES

Volume 6 appendix

Volume 7B appendix



TYPICAL SECTION OF PIPELINE ALLEY
EAST EDMONTON

2.3.2.3

POWER TRANSMISSION LINE AND PIPELINE CORRIDOR

A. Environmental Impact

1. The environmental impact of the combination in a common corridor is less than the impact of the components taken singly. In forested areas the clearing is reduced and a common service road would take care of both facilities during construction and for the maintenance period.
2. In crowded urban areas pipelines may be placed in the same corridor nearly halving the impact of the individual parts.
3. Both pipelines and power transmission lines have minimal impact once they have been properly constructed.

B. Location

Normally there is almost complete compatibility between the physical location parameters of these two facilities. Both require straight line locations — Both are almost independent of gradients — Both have minimal after-effects on the environment except in the event of failure. Power transmission lines have much less restriction and problems at river crossings.

C. Spacing

1. In forested areas the spacing between the two facilities will be in the order of 30 meters.
2. In agricultural or urban areas oil lines may be in the same right-of-way and even along the same centerline, but pipelines carrying dangerous products should not be crowded together with other facilities.

D. Comments

Voltage and resultant current flows can be induced in a pipeline from adjacent powerlines by conductance, capacitance or induction. These currents may be lethal. In order to minimize the hazards, the following steps must be taken.

1. Construction schedules, procedures and locations must be carefully planned in order to minimize conflict of interest, damage to facilities and danger to workmen. The greatest hazard occurs when pipelines are constructed close to energized powerlines. Construction of a powerline adjacent to a pipeline is less hazardous.
2. Pipelines must be grounded during construction and have built in cathodic protection for regular operation.
3. Safety rules for the use of equipment near powerlines should be publicized and enforced.

2.3.2.4

PIPELINE AND HIGHWAY CORRIDOR

A. Environmental Impact

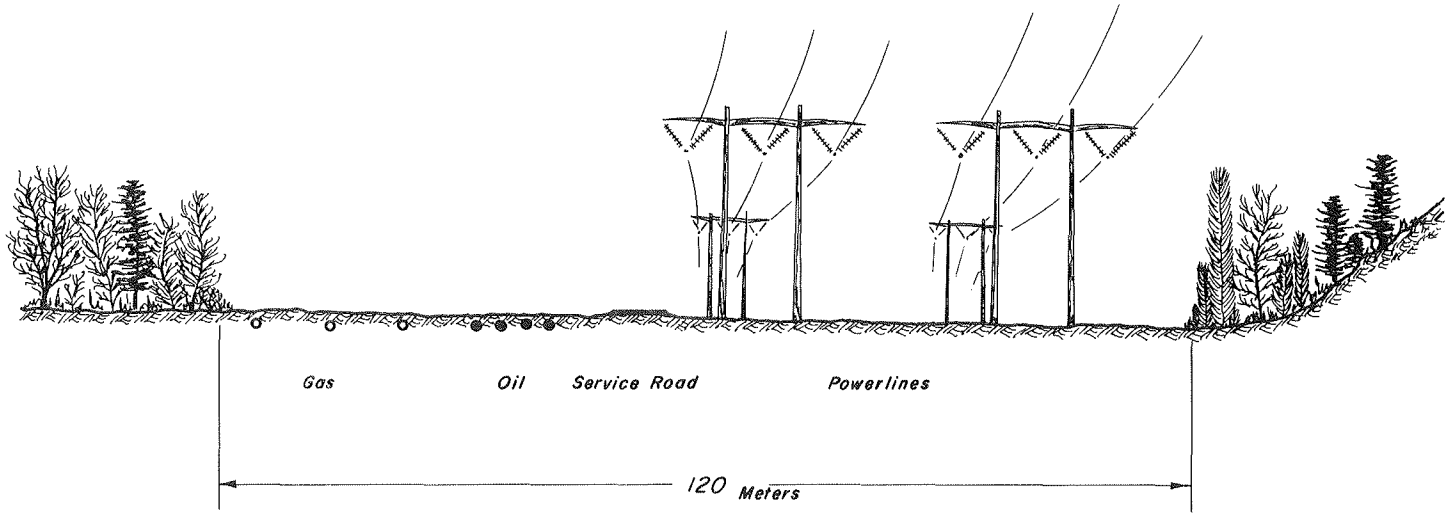
The impact of the highway is so great that the addition of pipelines to the corridor would not significantly increase the environmental impact.

B. Location

1. Location parameters for the highway will govern.
2. Pipelines may be located in the highway ditches provided that the highway is in its final location and has been constructed before the pipelines are laid.
3. There is a reluctance on the part of highway officials to permit the location of pipelines within the highway right-of-way.

C. Spacing

The decision regarding permission to locate pipelines within the highway right-of-way must be made. Otherwise, the pipelines within the highspacing regulations for pipelines and be contained in an adjacent right-of-way.



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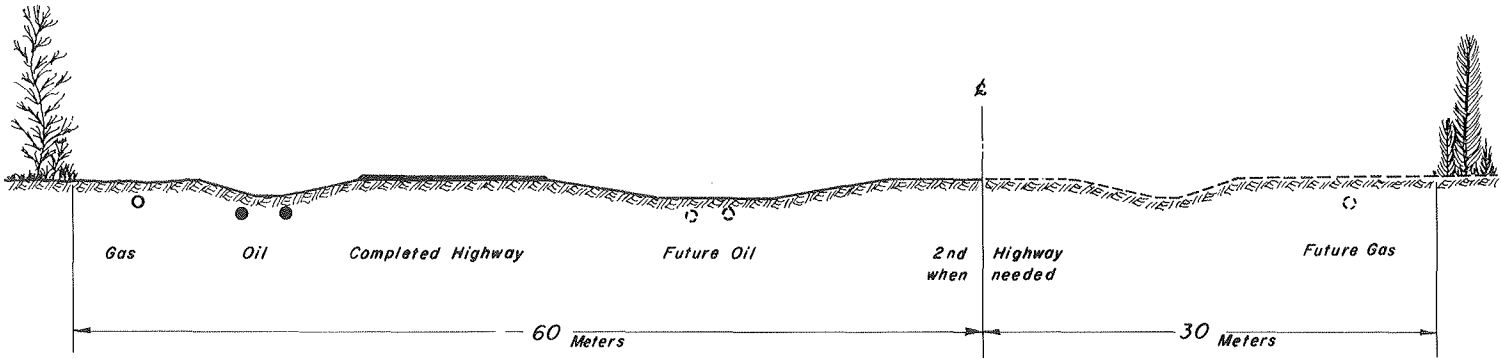
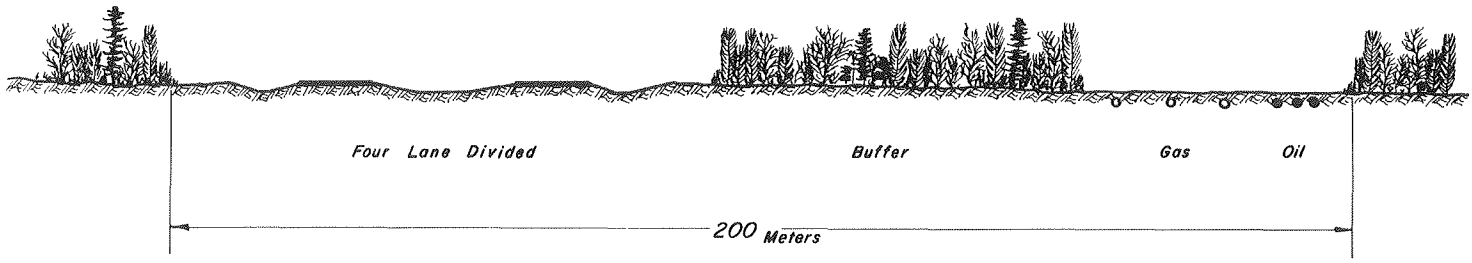




D. Comments

1. Highways of the future may be designed to include pipelines within the construction zone.
2. Effects of pipeline failure would be minimized if the pipelines were placed close to the highway since early detection of trouble would take place.
3. The chief problems would involve proper scheduling of pipeline construction.
4. Highway intersections cause some difficulty with the subsequent construction of pipelines.

2.3.2.5
POWER TANSMISSION LINE AND HIGHWAY CORRIDOR

A. Environmental Impact

1. The combined corridor would have less clearing in forested areas and hence would have less impact on the physical environment.
2. Aesthetic problems would arise which might be resolved through judicious use of buffer zones, attractively designed towers, by the avoidance of scenic areas and by taking advantage of the topography.

B. Location

The highway location parameters would govern.

C. Spacing

Power transmission lines will be placed immediately adjacent to the highway right-of-way or as dictated by aesthetics or excessive highway curvatures, etc.

D. Comments

There are definite advantages to the power transmission line when it is adjacent to a highway. They are:

1. a reduction in construction costs;
2. lower maintenance costs;
3. an increase in reliability of service;
4. lessened environmental impact.

The disadvantages are: aesthetic problems, extra length, possible interference with communication systems and car radio reception.

2.3.2.6
PIPELINE AND RAILWAY CORRIDOR

A. Environmental Impact

1. The railway has a continuing impact on the environment and may act as a barrier to other forms of life.
2. Pipelines may be placed within the railway right-of-way thus lessening the environmental effects.
3. Aesthetically there is little conflict since the railway follows the natural contours as closely as it is practical to do.

B. Location

The location parameter of allowable grades for the railway governs. This causes more curvature and hence greater length when crossing rolling topography and heights of land.

C. Spacing

There are no significant problems involving spacing.

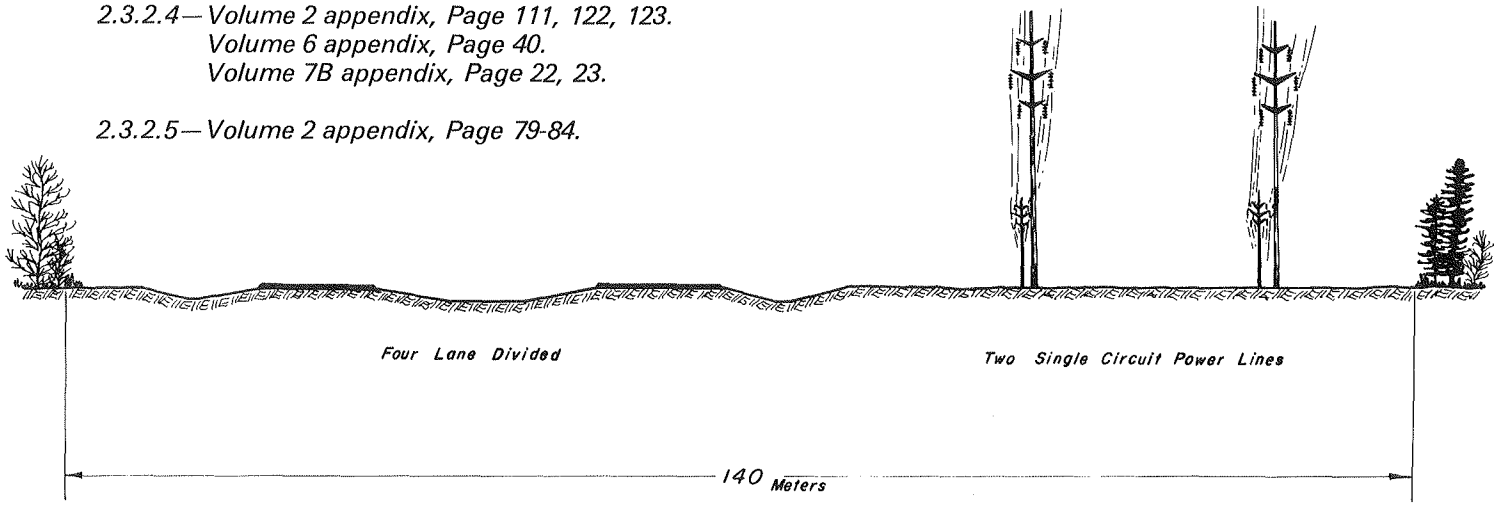
D. Comments

If many pipelines are involved, the right-of-way of the corridor would be widened to accommodate the pipelines.

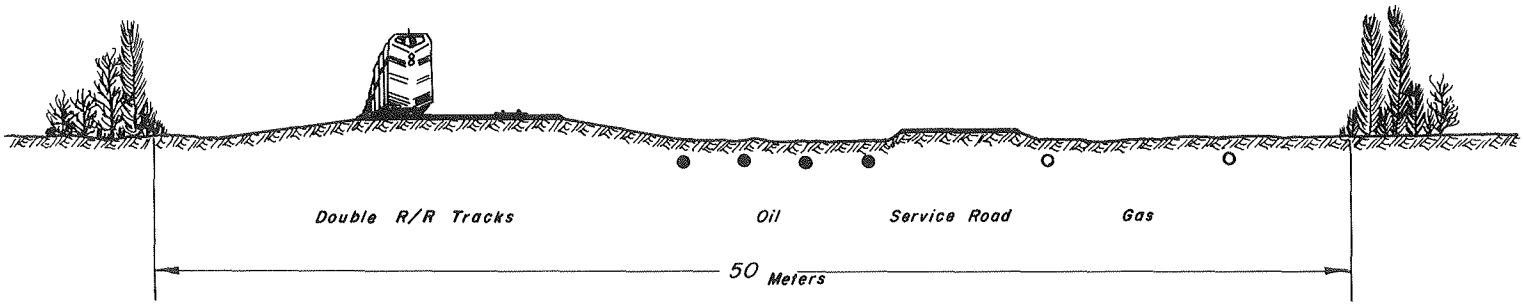
For economic reasons the pipeline will not want to follow the railway where the railway winds excessively to maintain the ruling grade. This is the major conflict in this type of corridor.

2.3.2.4—Volume 2 appendix, Page 111, 122, 123.
Volume 6 appendix, Page 40.
Volume 7B appendix, Page 22, 23.

2.3.2.5—Volume 2 appendix, Page 79-84.



2.3.2.6—Vol. 6 appendix, page 87.
This condition exists in the railway right-of-way immediately east of Edmonton.



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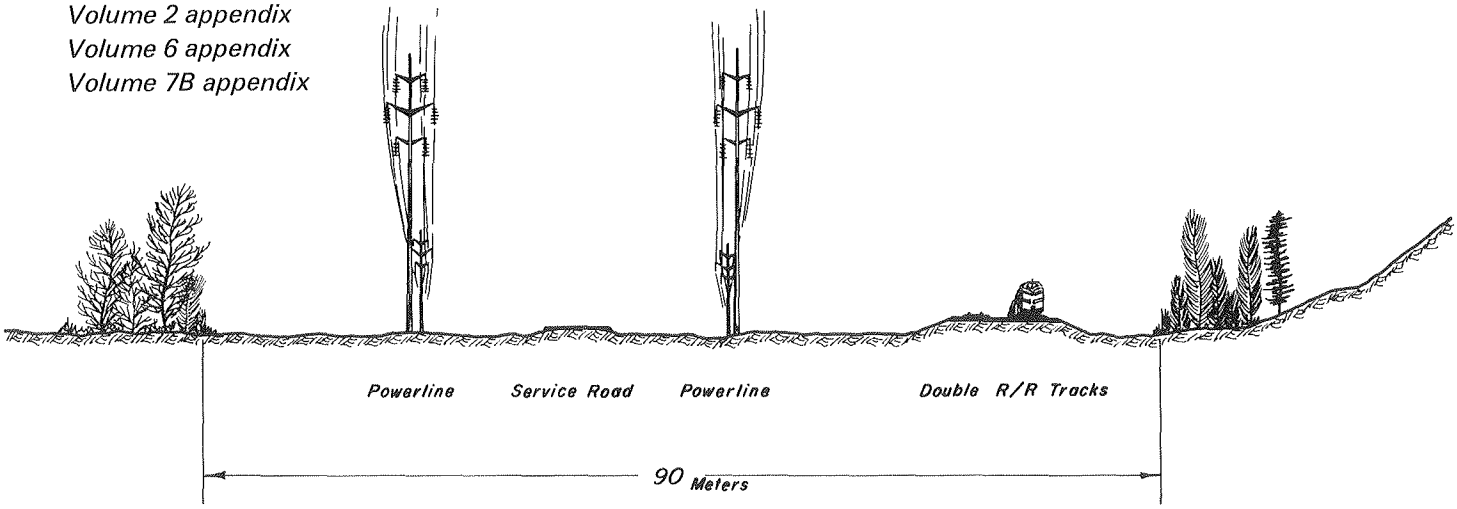


2.3.2.7
POWER TRANSMISSION LINE AND RAILWAY CORRIDOR

A. Environmental Impact

The close association of these two facilities has no significant or specially noteworthy effects on the physical environment.

B. Location

The railway location grade parameter governs.

C. Spacing

The interference which takes place between high voltage AC lines and the railway telephone communication system may be a problem. This problem indicates that the railway would be happy to remain isolated from the power transmission lines. The power transmission line has no objection to close proximity to the railway.

D. Comments

The combination may require a service road for a major power transmission line corridor in wilderness areas which may be a temporary road insofar as the transmission line is concerned, but it might be upgraded to become a development road.

Where rolling topography is traversed the transmission line will want to deviate from the railway due to the usually excessive curvature of the railway. As with the Pipeline-Railway Corridor, this is a major conflict in this type of corridor.

2.3.2.8
PIPELINE, POWER TRANSMISSION LINE AND HIGHWAY CORRIDOR

A. Environmental Impact

1. The combination would have less impact than if each were in separate widely spread rights-of-way.
2. In forested areas buffer zones may be utilized to lessen the adverse effect.
3. Proper planning and scheduling of activities would lessen the impact.

B. Location

The highway parameters would govern and the corridor would develop along the highway location.

C. Spacing

Spacing would be governed by:

1. Safety considerations;
2. Reliability of service;
3. Economy;
4. Construction priorities;
5. Aesthetic values;
6. Environmental factors.

D. Comment

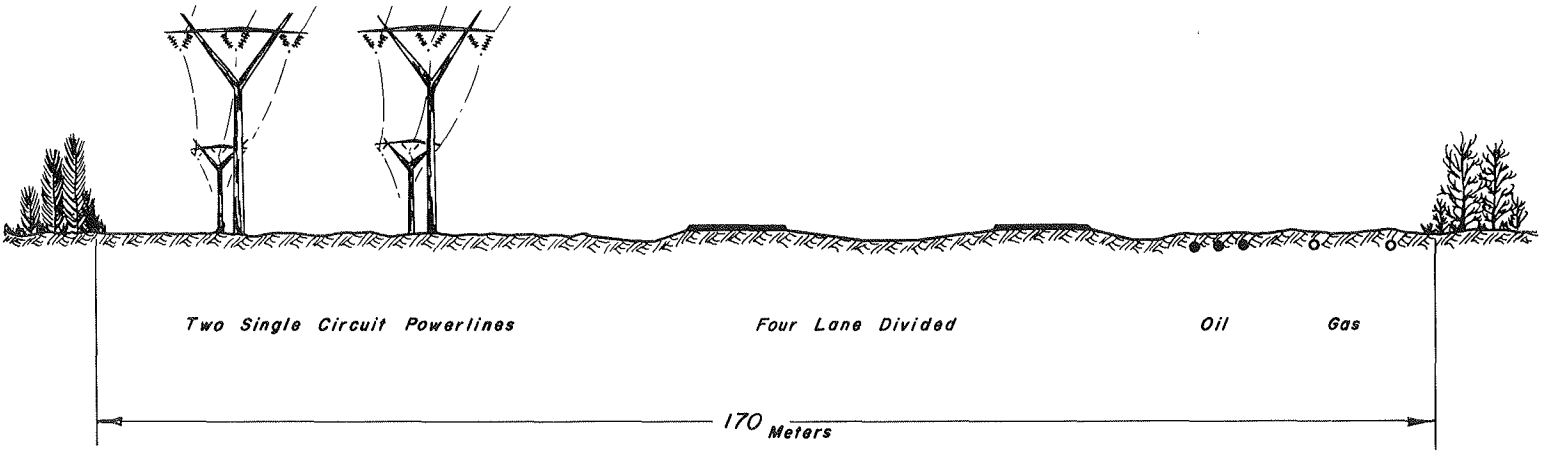
1. In a new development the highway location should be finalized and at least constructed to meet the initial service requirements of the other two facilities.
2. The wide ranging and long lasting impact of the highway on the total environment makes the additional impact of the pipelines and transmission lines relatively unimportant.
3. With the highway between the powerlines and the pipelines, the conflicts between pipelines and power transmission lines would be reduced.

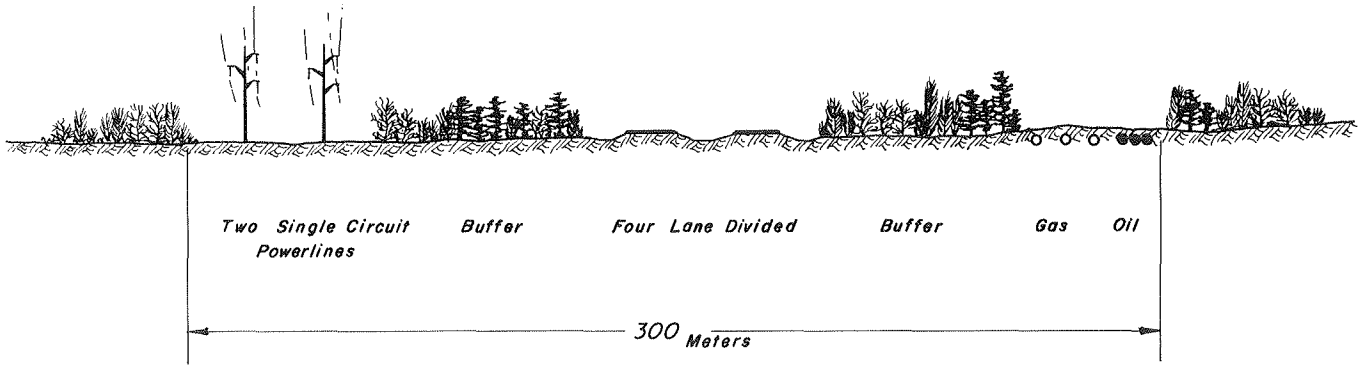
2.3.2.9
PIPELINE, POWER TRANSMISSION LINE AND RAILWAY CORRIDOR

A. Environmental Impact

1. The railroad has a continuing impact.

Volume 2, appendix
Volume 6, appendix
Volume 7B, appendix





2. The addition of a powerline(s) and pipeline(s) may require a service road in wilderness areas located between the pipeline(s) and the power transmission line(s).

B. Location

The location parameters of the railroad would govern so we would expect that as previously noted, the pipelines and the power transmission lines would want to deviate from a closely knit corridor whenever the topography dictates a serious curvature.

C. Spacing

1. In order to minimize the interference of the powerline with the railway communication system the arrangement would seem to be: **Railway, Pipeline, Service Road, Powerline.**
2. Spacing would be as previously mentioned.

D. Comments

In agricultural or urban areas the special service road would be unnecessary.

2.3.2.10 PIPELINE, POWER TRANSMISSION LINE, HIGHWAY AND RAILWAY CORRIDOR

A. Environmental Impact

1. The highway and railway impact would be the sum effect of each taken separately except that the barrier created by placing these two facilities in a common corridor would appear to have a greater effect than the sum of the effects of each component.
2. The concentration of environmental disturbance in a restricted corridor appears to be more desirable and less harmful than the effect on the environment which accompanies the uncoordinated activities of individual operators.
3. Aesthetically the following of the railway alignment might produce a more pleasing overall effect.
4. The highway and/or railway causes a severence and barrier while the effect of pipelines and powerlines is negligible in this regard.

B. Location

1. The location parameters of the railway and the highway will govern. The main parameters are the grade restrictions of the railway and the allowable horizontal curvature of the highway. In rolling country these two parameters might be incompatible.
2. Generally the power transmission lines and pipelines could follow the highway more closely than they could the railway.
3. In reasonably flat country all of the facilities could be in adjacent rights-of-way due to the ability to increase excavation and to build up embankments. Under these conditions the highway would follow the railway since railroad grades are less flexible.

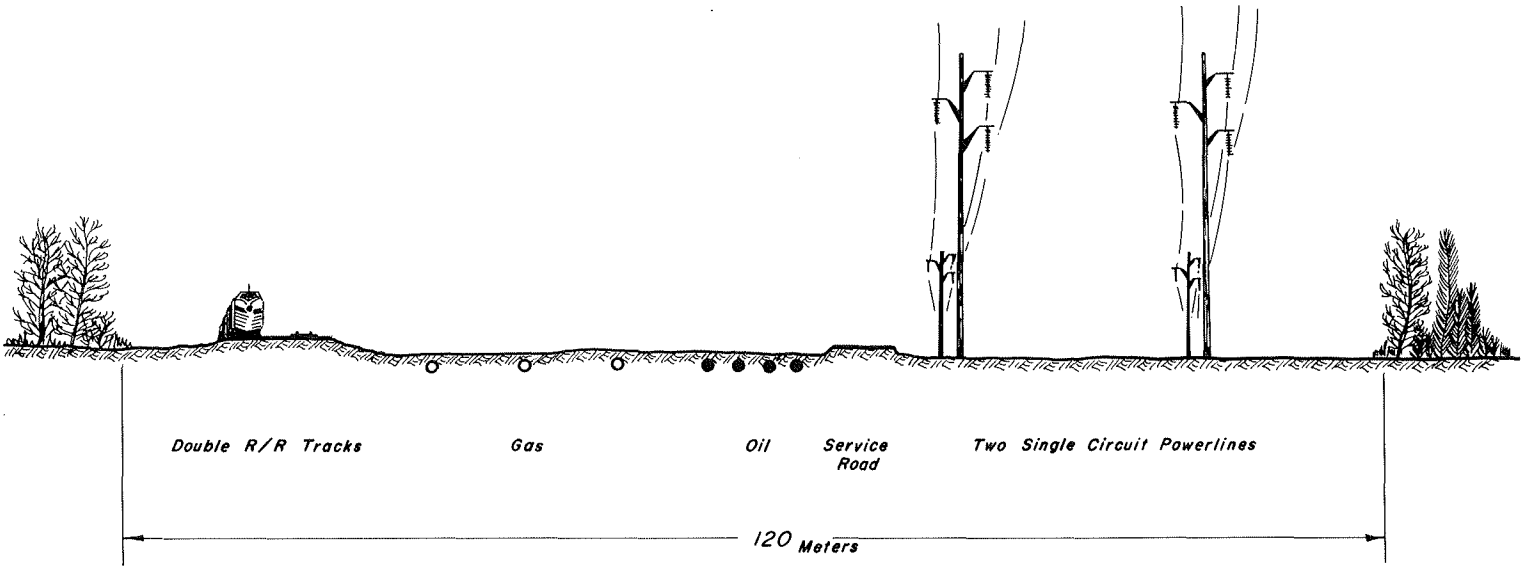
C. Spacing

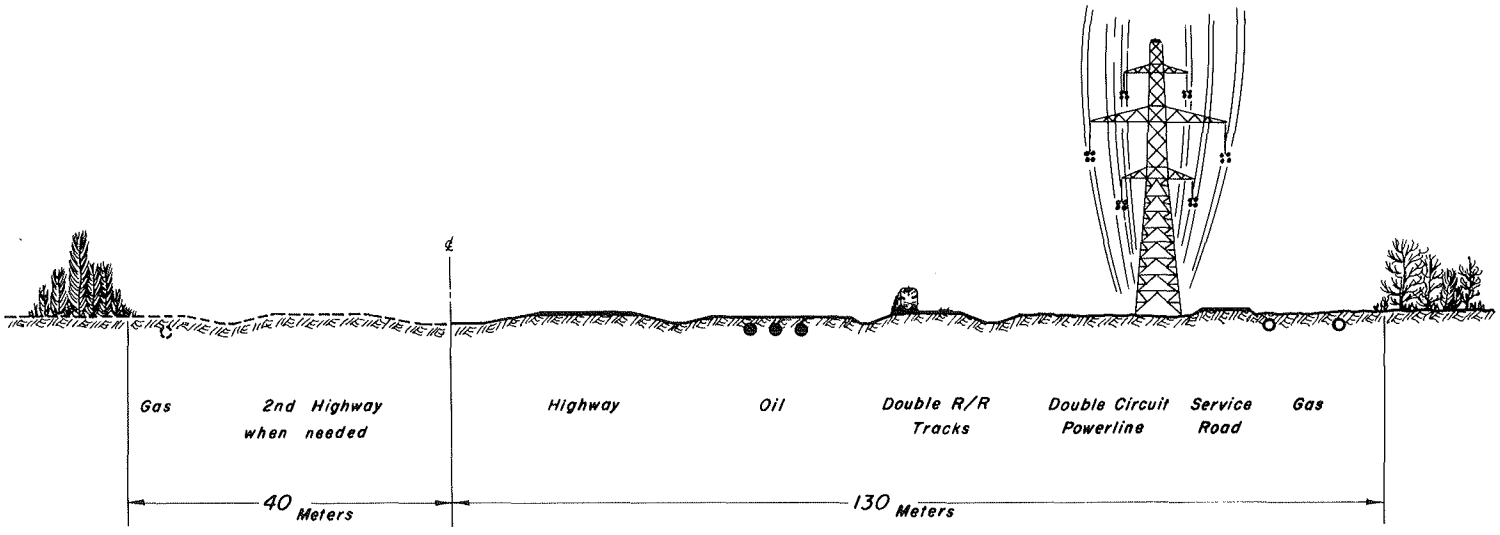
Spacing would be dictated by many factors such as:

1. the topography being traversed;
2. the value of land alienated by the corridor;
3. the incompatibility of location parameters;
4. construction and maintenance problems;
5. the reliability of service;
6. the problems of maintenance;
7. the aesthetic values;
8. protection of the environment.

D. Comments

In relation to transportation out of the Athabasca Tar Sands this particular combination may have only minimal application because of the existing highway and railway.


Double R/R Tracks
Gas
Oil
Service Road
Two Single Circuit Powerlines
120 Meters


Gas
2nd Highway when needed
Highway
Oil
Double R/R Tracks
Double Circuit Powerline
Service Road
Gas
40 Meters
130 Meters

CHAPTER 3

IMPLEMENTATION

The implementation of the corridor can best be accomplished by effective legislation. The legislation proposed will take the form of a model Bill entitled, "The Transportation Corridor Act".

The Act should reflect in general terms the following principles:

—empower the minister or corporation to designate and then zone or acquire actual transportation corridors and provide for the mechanics of so doing, (inclusive of its autonomy from The Planning Act and The Municipal Government Act).

Such powers of zoning or acquisition should include the power to expropriate, and the Act should further provide for the mechanics of such expropriation.

—provide for the creation by statute of a crown corporation to act in accordance with the powers of the Act as the purchasing authority for the land and interest in lands comprising the corridor, as well as for the disposal thereof.

—provide the corporation with all of the powers of a private and public corporation to borrow monies, invest monies, hold lands, hold interest in lands, hold other interests and otherwise accomplish the purposes for which it will be created.

—provide for the mechanics of disposition of interests in the corridor either by lease, license, creation of condominium title or otherwise, including though not so as to restrict the generality of the foregoing, the specification of consideration to be charged to prospective occupants and users.

—provide for the incorporation of existing facilities and transportation modes into the corridor in such areas where such incorporation is deemed advisable by the authority (corporation); such incorporation to be in whole or in part.

—provide for the regulation of occupants once their entry into the corridor has itself been approved, including the specification of such standards as the legislature shall consider appropriate regarding actual engineering, construction and location details.

—provide for the orderly administration of any designated corridor once the corridor itself is occupied and shall provide (as an option) for the conversion of the corridor at any time to a condominium corporation, and administration thereof, by directors as appointed by the user occupants and representatives of the government.

—provide for the settlement of inter-occupant disputes as well as extra-corridor disputes with non-occupants, including the mechanics of such administration and settlement.

—provide for the details and mechanics of co-insurance and condominium insurance (if required).

—provide for required changes in all the other acts of the Province of Alberta affected by its terms and provisions.

Volume 2 appendix
Volume 3 appendix
Volume 6 appendix

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

4.1.1

Advantages of the "Corridor Concept" outweigh the disadvantages.

The development of a multi-use single corridor for several transportation facilities does present some problems and conflicts. However when the total social, economic and physical environments are considered, there is no doubt that the combined corridor is preferable. During the study this concept received unanimous approval and support from the public, industry, government and the consultant group.

4.1.2

Combined Corridors can only be achieved when initiated and encouraged by government legislation and action.

There are many diverse factors and interests to be reconciled before the corridor concept can be realized. In our view government legislation and action is the only way efficiently to implement the corridor concept. Action by an individual company or person, however commendable, would encounter too many obstacles.

4.1.3

The necessity of providing adequate transportation facilities to accommodate the future development of the Athabasca Tar Sands affords an excellent opportunity to apply the corridor concept.

Minimizing environmental impact, economic savings, provision of an approved right-of-way, reduction of delays, minimizing possibility of work stoppages and many other factors as outlined in Chapter 2 all indicate a corridor.

4.1.4

The corridor concept can be implemented using two basic techniques.

(A) Restrictive zoning with covering regulations and government inspection and approval services.

The restrictive zoning technique contemplates reservation of land required for corridor purposes. Included would be provisions for use of existing rights-of-way and compensation. Regulations and guidelines would be required and an authority to administer the corridor or corridors.

(B) A single authority owning and managing the corridor.

The ownership technique contemplates a single authority owning and managing the corridor. Legislation would have to provide for the formation of the authority with corridor occupants sharing in the control in some manner. In addition the legislation would have to provide the authority the right to plan, design, acquire (buy or expropriate), construct, operate, maintain and terminate the corridor either by itself or in partnership with others.

It is probable that some combination of these techniques will prove to be the most effective means of implementing the corridor concept.

4.1.5

Additional Legislation is required in Alberta to encourage and implement the corridor concept.

Under present legislation the authority for implementation of the corridor concept might come from the stretching and integration of a variety of different acts and regulations. Implementation would require the cooperation and initiative of many individuals employed in several levels and

sections of government and industry. It may be remotely possible for a corridor with very few similar components and participants but not for the anticipated corridors out of the Athabasca Tar Sands.

4.2
RECOMMENDATIONS

4.2.1

Enabling legislation and regulations be enacted providing for the zoning of corridors and/or the formation of corridor authorities which could acquire (buy or expropriate), own, lease, design, manage, operate, maintain and/or terminate corridors.

4.2.2

In relationship to the impending development of the Athabasca Tar Sands it is recommended:

(A) Immediately upon determination of an acceptable corridor location that any land which may be required be temporarily zoned for corridor purposes.

(B) Detailed planning and design be carried out to accurately define the limits of the corridor.

(C) A Quasi-Governmental authority be formed to acquire, own, lease and manage the corridor or corridors for the various organizations which may operate transportation facilities in relation to development of the Athabasca Tar Sands.

4.2.3

The potential application of the corridor concept should be examined as a solution to multi-transportation problems in other parts of the province.