

ENVIRONMENTAL MANAGEMENT AND PIPELINE CONSTRUCTION:
THE FOOTHILLS (SOUTH B.C.) EXPERIENCE

by

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Environmental Management and Pipeline Construction: The

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ABSTRACT

Evaluation of the environmental management system in place during construction of the Alaska Highway Gas Pipeline pre-build segment in southeastern British Columbia in 1980 indicates there was failure to meet many specified administrative goals and objectives. The principal problems identified are the lack of formal agreements between the governments of Canada and British Columbia on administrative arrangements; inadequate terms and conditions, design review procedures, and surveillance arrangements by the Northern Pipeline Agency and the province for planning and construction; and an ineffective system for implementing environmental requirements on the part of Foothills Pipe Lines (South B.C.) Ltd. Although these shortcomings were identified as potential problems early in the regulatory planning phase they developed in spite of efforts to avoid them by the Northern Pipeline Agency. Long term environmental impacts resulting from construction appear negligible in spite of the administrative difficulties. Recommendations are made for improving environmental management of future pipeline projects, specifically the North B.C. segment of the Alaska Highway system.

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A great many people contributed to this research by providing access to records and supplying studies and publications on related projects. Particular thanks must go to Bob Hornal and Laurie McNeil of the Northern Pipeline Agency in Vancouver and Dr. G.A. Yarranton in Calgary for their considerable assistance. Dr. Bob Langford of the E.C. Ministry of Environment provided first hand insight into construction events and guidance throughout the research. Alan Ferguson did much to clarify the regulatory planning process. Denis O'Gorman and Jamie Alley of the B.C. Ministry of Energy, Mines, and Petroleum Resources were generous with time and information. Associates at Westcoast Transmission and Foothills Pipe Lines contributed significantly by discussing theory and sharing experiences. Family and friends provided constant incentive to get the job done.

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LIST OF ACRONYMS

ANG	Alberta Natural Gas Company Ltd.
EMPR	B.C. Ministry of Energy, Mines, and Petroleum Resources
ELUC	B.C. Environment and Land Use Committee
EPS	Canada, Environmental Protection Service
FASC	B.C. Foothills Assessment Steering Committee
JFWAT	Alaska, Joint Fish and Wildlife Advisory Team
MOE	B.C. Ministry of Environment
NEB	Canada, National Energy Board
NPA	Canada, Northern Pipeline Agency (also referred to as the agency)
TAPS	Trans Alaska Pipeline System

CHAPTER I
INTRODUCTION

1.1 Environmental Management

In the 1970's, environmental planning in British Columbia for major construction or resource development projects ostensibly followed a standard process. This consisted of identification, inventory, and analysis of environmental components and systems potentially affected; assessment of alternative locations, schedules, and designs; and selection of, and planning for, preferred alternatives which balanced environmental, social, and economic considerations. Control by regulatory authorities was exercised through the process of permits and approvals with spot checks for compliance carried out by agency field personnel. In recent years there has been a movement by industry beyond environmental planning toward environmental management: from the documentation of project intent and probable effects for regulatory approval toward the implementation of environmental controls in the field during construction. This change primarily reflects strengthening of the regulatory environment. But increasingly it is supported by industry's recognition that economic benefits are gained when confrontations with government are reduced and construction delays are avoided. Both senior levels of government and some

segments of industry are now actively involved in developing environmental management systems and testing environmental management theory. Environmental planning will be improved if greater efforts are made to monitor project effects, evaluate environmental design, and refine designs or procedures for subsequent projects. Similarly, environmental management can be improved with systematic post-project analysis of environmental protection programs and their implementation.

Resource development in British Columbia is expected to increase in coming decades with exploitation of northeast coal reserves and continued development of southeast deposits. Other projects pending include hydroelectric schemes in the northeast and northwest as well as various gas pipeline proposals with associated LNG, fertilizer, and petrochemical plants. Given the extent of planning required for this development by industry and government, it is essential that the effectiveness of current planning and environmental management methods be evaluated to improve their efficiency and cost-effectiveness.

The purpose of this study is to evaluate the adequacy of the environmental management system for construction of the pre-build section of the Alaska Highway Gas Pipeline Project in southeast British Columbia. This section was to be completed prior to mainline construction to enable short-term exports of Alberta gas to American markets. It was subject to new administrative arrangements and regulatory requirements developed by the federal and provincial governments specifically

for the Alaska Highway Project.

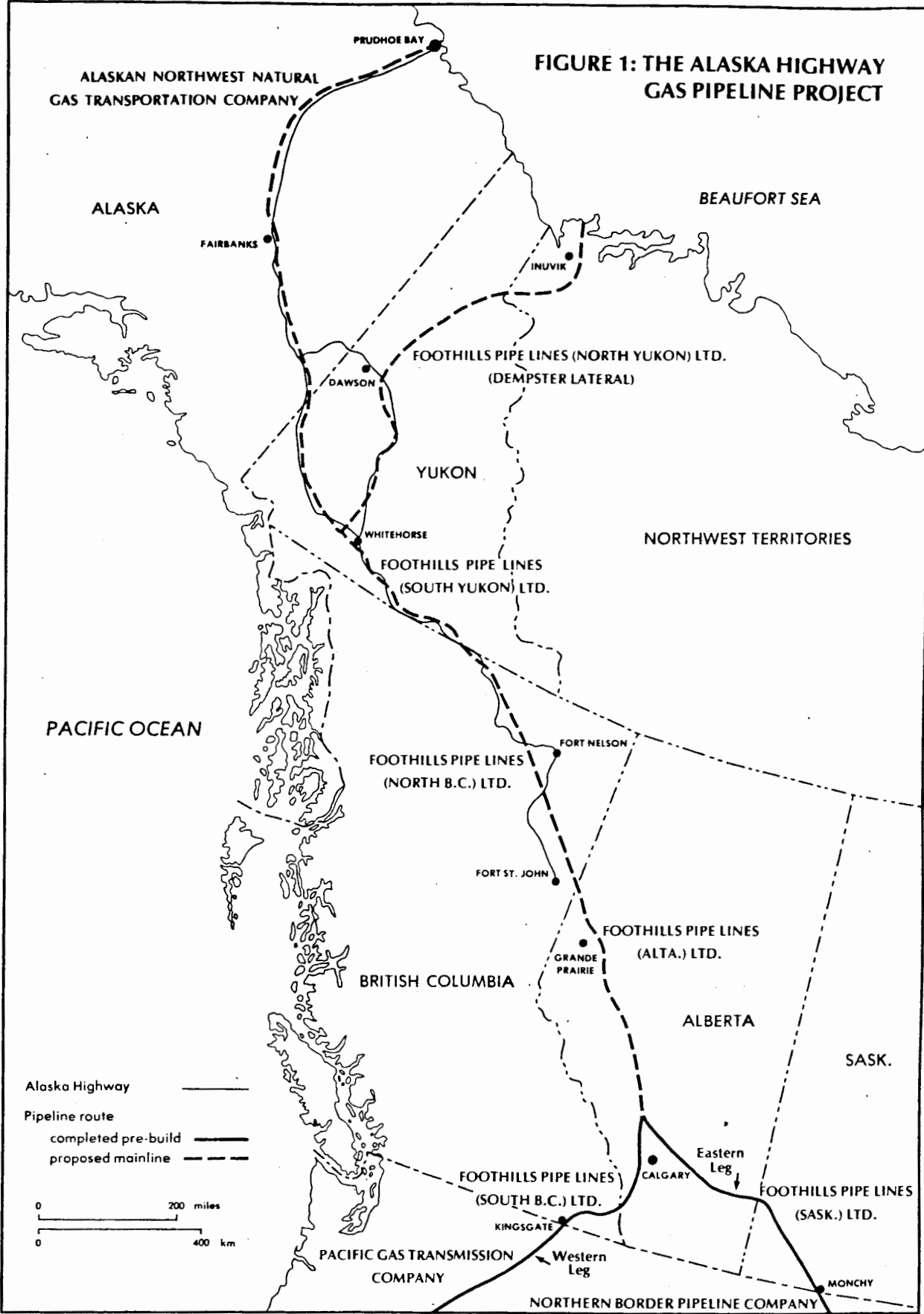
1.2 Foothills Project Description

The Alaska Highway Gas Pipeline Project is a large diameter pipeline system intended to transport north slope Alaskan natural gas through Canada to the lower 48 states (fig. 1). A second phase of the project, the Dempster Lateral connection, will provide access to Canadian gas reserves in the Mackenzie Delta and Beaufort Sea. The project was originally scheduled for completion in 1983 but due to regulatory delays, decreasing demand for expensive northern gas, and financing problems in the United States, target dates have been set back indefinitely. The future of this project is uncertain.

Prior to mainline construction through Alaska and northern Canada, approval was given by Canadian and American governments for construction of southern segments of the pipeline. This pre-build line would transport gas surplus to Canadian needs until Alaskan gas was ready to flow. It was believed that early construction of southern segments would facilitate scheduling for the entire system by spreading out the construction period thereby reducing pressure on material and labour supplies and by increasing the time necessary to raise and invest capital.

The Canadian pre-build consists of two segments: the Eastern and Western Legs. The Eastern Leg is a 635 km segment of 1067 mm (42 in) pipe stretching southeasterly from the point of bifurcation of the mainline at James River Junction, Alberta,

FIGURE 1: THE ALASKA HIGHWAY GAS PIPELINE PROJECT



to the border point at Monchy, Saskatchewan. Here the line joins the U.S. Eastern Leg running across Montana and North Dakota to Ventura, Iowa. This line will eventually be extended to Dwight, Illinois. Construction of the Eastern Leg in Canada began in May 1981 and was completed in September 1982.

The Western Leg is a 215 km segment of 914 mm (36 in) pipe extending from Caroline, Alberta across the southeast corner of British Columbia to Kingsgate, B.C. on the Idaho border. Here it joins with facilities of Pacific Gas Transmission Company running to Stanfield, Oregon and eventually to San Francisco.

Foothills Pipe Lines (Yukon) Ltd. of Calgary is the parent company responsible for the Canadian portion of the project. It is owned equally by Nova, An Alberta Corporation and Westcoast Transmission Company Limited of Vancouver. The mainline system in Canada is to be built in five segments by five subsidiary companies:

Foothills Pipe Lines (South Yukon) Ltd.

Foothills Pipe Lines (North B.C.) Ltd.

Foothills Pipe Lines (Alberta) Ltd.

Foothills Pipe Lines (South B.C.) Ltd.

Foothills Pipe Lines (Saskatchewan) Ltd.

A sixth subsidiary, Foothills Pipe Lines (North Yukon) Ltd. will build the Dempster Lateral if it is approved.

Foothills (South B.C.) is jointly owned by Foothills (Yukon) and Alberta Natural Gas Company Ltd. (ANG) of Calgary. Construction of the south B.C. segment consisted of "looping" or

twinning sections of an existing 914 mm ANG pipeline installed in 1961. For this project ANG is acting as agent for Foothills (South B.C.) in the design, construction, operation, and maintenance of the pipeline.

Four loops, totalling 89.1 km, were constructed between August 1980 and May 1981 to transport the Alberta gas (fig. 2). Three more loops will be required when Alaskan gas comes on stream.

Table 1

South B.C. Loop Locations

<u>Approximate Location</u>	<u>Length (km)</u>
1. From Alberta-B.C. border near Crowsnest to ANG Compressor Station No. 1 (km post 0.0 to 4.6)	4.6
2. From south of Sparwood Sales Tap to Flathead Ridge (km post 15.2 to 48.6)	33.4
3. From Kootenay River to east of Moyie Lake (km post 89.6 to 114.0)	24.4
4. From northeast of Yahk to B.C.-Idaho border near Kingsgate (km post 144.0 to 170.7)	26.7
TOTAL	89.1

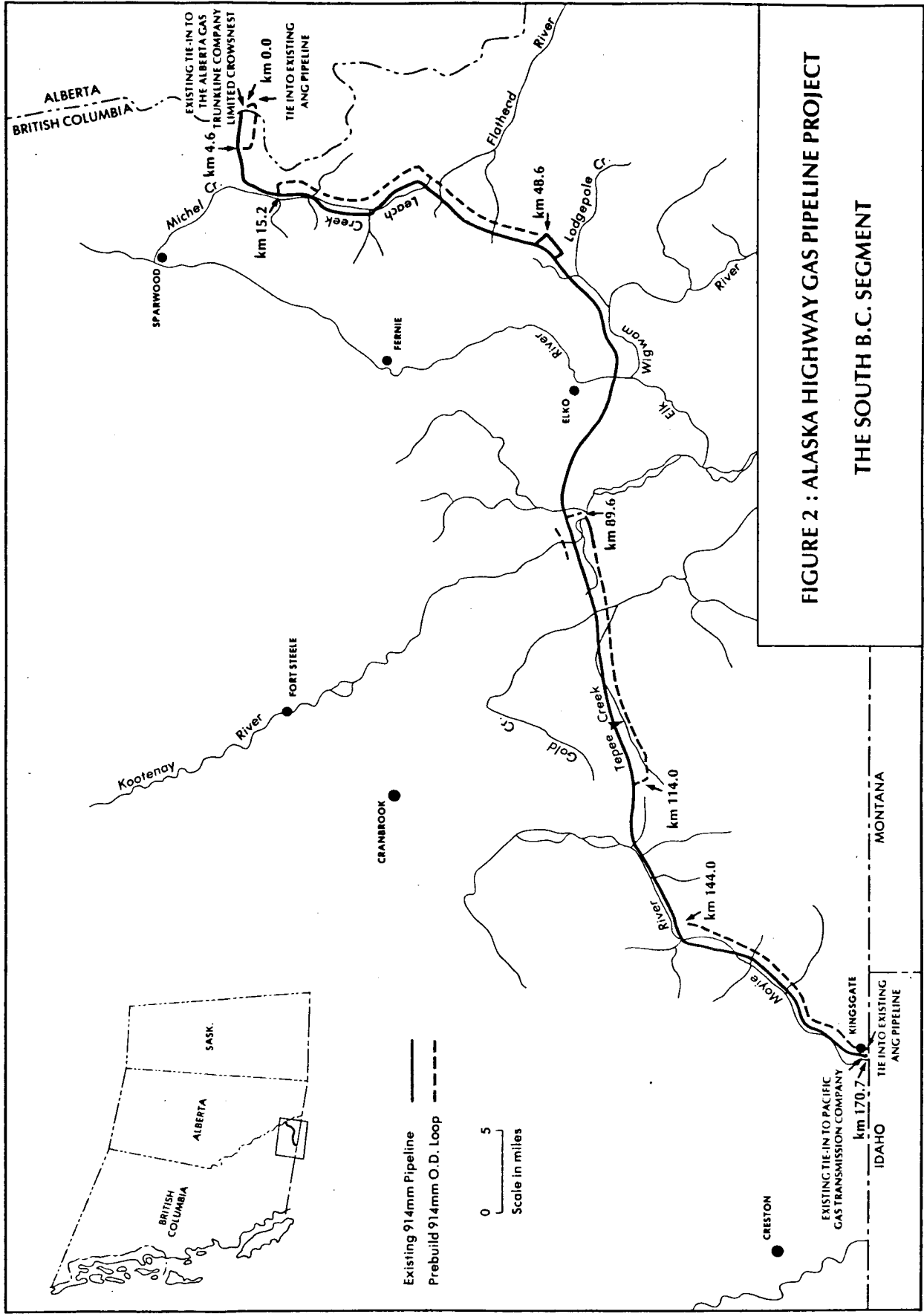


FIGURE 2 : ALASKA HIGHWAY GAS PIPELINE PROJECT
THE SOUTH B.C. SEGMENT

1.3 Related Research

A number of studies have been published in recent years on many aspects of environmental management. These include: Dorney (1977) on hindsight evaluation; Brown (1978) on the evolution of pipeline technology, environmental impacts and planning; Hollings (1978) on adaptive assessment and management; and Bankes and Thompson (1980) on monitoring. Projects evaluated include highways (Canada 1978), railways (Canada 1978a), transmission lines (Dohrenwend (1973), and pipelines (Canada undated; Dome Petroleum (1978). Other research has focused on specific aspects of construction management for environmental purposes such as inspection (Mutrie 1979) and contract documentation (Boyle 1982). Considerable constructive criticism of environmental management methods has been published in the American Society of Civil Engineers Construction Division Journal (Koehn 1976; Borg 1976; and Henningson 1978).

It was the Trans Alaska Pipeline System (TAPS) experience perhaps more than any other project which focused attention on the need for greater coordination in environmental management between governments and proponent. Evaluations of Alyeska project administration by Kavanaugh (1977), Skinnarland(1977), Wright (1978), Morehouse (1978), and others contributed to the design of an environmental management system for the Alaska Highway Gas Pipeline Project. This included the formation of the Northern Pipeline Agency (NPA). Mitchell's (1980) study of the Foothills (Alberta) environmental quality management program

provides an interesting analysis of one response by industry to the new requirements. This evaluation of the Foothills (South B.C.) experience and other studies are intended to advance environmental management methods by promoting improvements in components and linkages within increasingly integrated management systems.

1.4 Research Scope and Objectives

The environmental management system in place during pipeline construction is evaluated by examining the regulatory arrangements which applied to the project and assessing the design and implementation of the company environmental management program developed in response to them. Evaluation is not made solely in terms of effectiveness in preserving environmental quality. The focus, rather, is on:

- a. the effectiveness of the federal and provincial regulatory processes in designing an environmental management system under which planning and construction were to be carried out,
- b. the effectiveness of the federal and provincial regulatory processes in informing the proponent of the environmental management requirements,
- c. the effectiveness of the federal and provincial regulatory processes in enforcing compliance with the environmental requirements, and

- d. the effectiveness of company methods in implementing the requirements during planning and construction.

By adopting this study design two major aspects of environmental management in British Columbia can be assessed: the design of terms and conditions, review procedures, and surveillance methods by the federal and provincial governments; and the methods of meeting environmental regulatory requirements in the project planning and implementation stages by industry. In addition, a better understanding of industry's requirements in administrative arrangements can be determined. Recommendations for improvements can then be made.

The principal regulatory components of the environmental management system evaluated are the terms and conditions issued by the federal regulatory agency, the joint federal and provincial design review process, and the environmental surveillance programs of each authority. Regulatory approval documentation, construction contract documentation, and the environmental inspection system are examined for the pipeline company. Measures of adequacy are based on analysis of records and documents and on the perceptions of company personnel, their consultants, contractors, and government officials.

The southeast B.C. pre-build segment of the pipeline was selected for study for three reasons:

- a. it is a manageable sized project for this study,
- b. all requirements for effective environmental management by government and the company were identified prior to

construction, and

- c. construction of the North B.C. segment of the pipeline under the same legal and administrative arrangements is still a possibility.

There is an opportunity, therefore, to evaluate the design and implementation of the environmental management system, effect necessary changes, reduce conflicts between agencies and company, and to promote more efficient and effective project construction.

1.5 Method

The evaluation method used in this study was adapted from a model designed by a University of Waterloo research group (Day et al. 1977a). It was developed in response to a need for a system which would integrate the biophysical and socioeconomic processes identified in a number of evaluation studies of natural resources policies, programs, and projects. Prior to the design of the model individual hindsight research requirements relied on partially effective appraisal techniques such as benefit-cost analysis, social audit, biophysical monitoring, and perception and attitude studies. The model has been used in a number of studies primarily to evaluate specific public resource management projects (Nelson and Jessen 1981; Nelson et al. 1980) and programs (Day et al. 1977b; Fraser et al. 1977) but is generally applicable to policy evaluation as well. Research undertaken with this model has three major

purposes:

- a. to reach judgements concerning the efficacy of social actions undertaken by comparing project expectations with measured effects,
- b. to recommend prescriptive changes which will increase returns and reduce costs of future actions, and
- c. to recommend further research needed to enable judgements on project utility (Day et al. 1977a).

The research model (fig. 3) consists of 7 components:

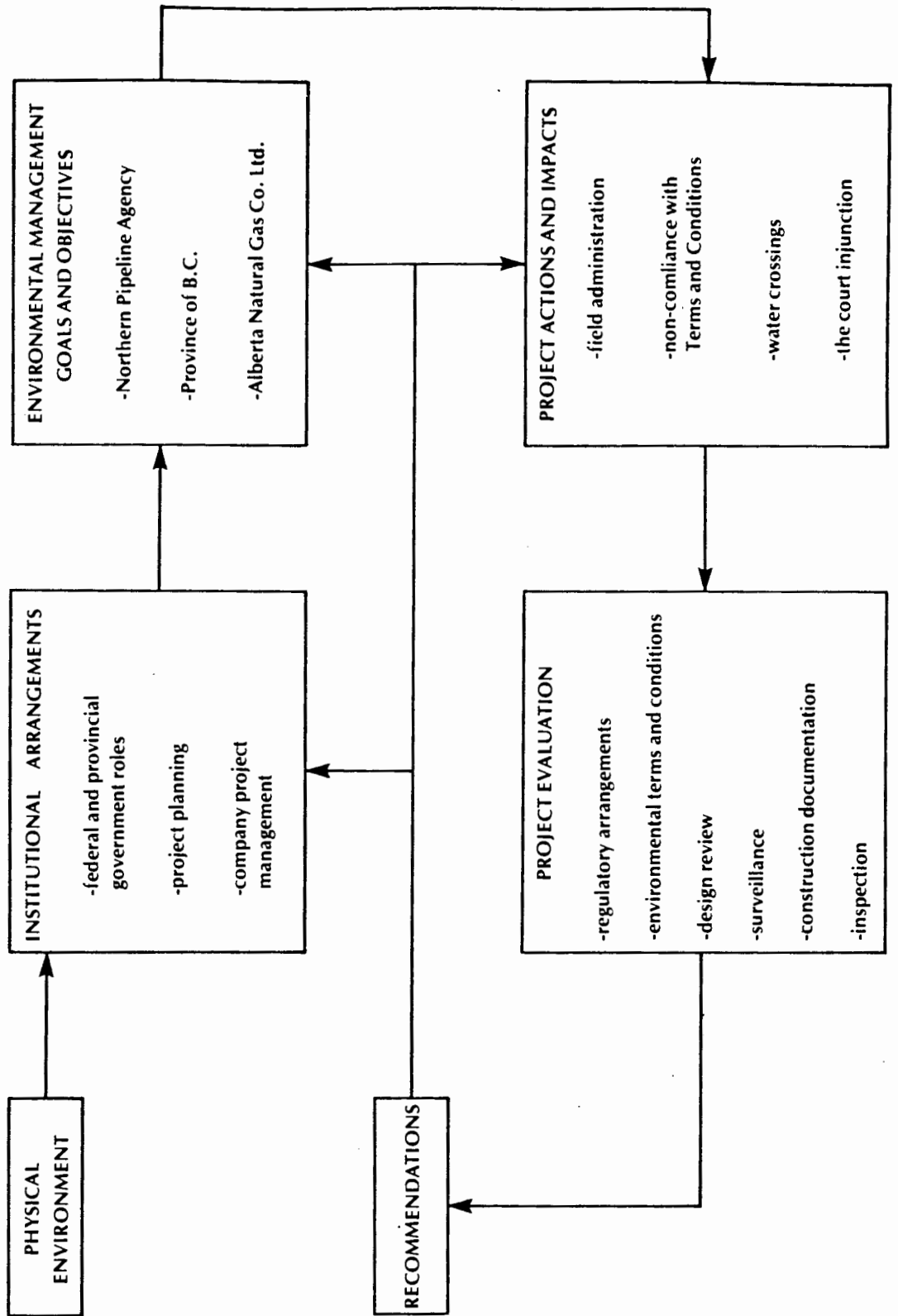
1. Project Environment

The general biophysical characteristics of the environment in which the pipeline was constructed are described in this section. Environmental concerns identified in the preliminary assessment studies are summarized.

2. Institutional Arrangements

This project, as part of the Alaska Highway Gas Pipeline, was subject to a complex set of legal and administrative arrangements. In this section the federal legislation establishing the Northern Pipeline Agency is reviewed and the administrative structure of the NPA as it relates to construction and field surveillance is described. British Columbia legislation affecting the project and the role of provincial agencies are also discussed. The administrative organization of the ANG environmental management program is

FIGURE 3: PROJECT EVALUATION MODEL



described and the formal and informal links between the company, NPA, and the province which affected implementation of environmental requirements are examined.

3. Environmental Management Goals and Objectives

The goals and objectives of the NPA, the province, and ANG are determined by reviewing relevant documents and interviews with key personnel. Where goals and objectives are not specified they are inferred from the documents, administrative arrangements, and procedures adopted during construction.

4. Project Action and Impacts

The sequence of construction activities and administrative developments are described in this section. Critical events are assessed in terms of how and why they developed. The evolution of relationships between key actors and trends in procedures are also examined.

5. Program Evaluation

The environmental management system is primarily evaluated in terms of effectiveness, that is the adequacy of system components in meeting administrative goals and objectives. Other evaluation criteria used to a lesser extent include accountability, efficiency, flexibility, and administrative simplicity. Factors affecting each of these criteria will also influence the effectiveness of the overall system. Findings are

compared with the results of other studies made of similar projects and administrative strategies.

6. Recommendations

Recommendations concerning environmental management are made based on the conclusions drawn from the evaluation. Some pertain specifically to the North B.C. segment of the pipeline assuming construction proceeds under similar regulatory and administrative arrangements. Others are of a more general nature and should apply to a variety of construction projects.

Much of the information collected for this study was gained from personal interviews with key players involved in the project. A questionnaire was designed to assess individual opinions on all aspects of project organization and management. It became apparent in the interviews that most respondents could not easily assign positive or negative values to program components and processes. Virtually all responses were conditional upon other factors. The standardized interview format was discarded, therefore, and the questionnaire used only as a basis for exploring questions of interest in qualitative rather than quantitative terms.

CHAPTER II

SOUTHEAST B.C. PROJECT DESCRIPTION

A brief summary of physical environmental concerns identified during the project assessment phase is presented here. The administrative environment is more important to this study and insitutional arrangements and planning processes are discussed in greater detail. Federal and provincial government efforts to create an environmental management system in advance of pipeline construction are described by examining arrangements for developing terms and conditions, design review procedures, and surveillane methods. The company's environmental management program which evolved in response to these arrangements is also analyzed. With some understanding of the events leading up to construction and the perceptions of the players concerning project administration, the goals and objectives of each party are assessed. Finally, the sequence of events during the construction phase is described. Evaluation of project environmental management follows in Chapter 3.

2.1 Physical Environment

From Crowsnest to Kingsgate the ANG pipeline crosses four major drainages: Michel Creek, Elk River, Kootenay River, and Moyie River. Approximately 97% of the pipeline occupies the cleared and graded right-of-way established during construction of the original line in 1961. Deviations were required over short distances where the existing right-of-way contained a security loop or where ground conditions precluded its use.

The principal environmental concerns identified for the project by provincial agencies and environmental consultants are discussed below.

1. Forestry

The B.C. Forest Service was primarily concerned with alienation of forest lands, the contractor's fire control system, debris and fire hazard abatement, soil stabilization, and provision for forest access roads (Slaney 1974; 31). A 12 to 18 metre extension of right-of-way width was required for approximately 27.2 km of line through crown provincial lands.

2. Wildlife

The major river valleys provide range for a variety of ungulates including elk, deer, and moose. Alpine and sub-alpine areas in proximity to the line support sheep, goat, and bear populations. Concerns centred on the temporary loss of habitat for those animals grazing on the existing right-of-way, disturbance during critical life-stage periods, and harassment by construction personnel. Hunter access would be improved

during construction but would not be significantly increased over the long term.

3. Fisheries

Five species of salmonids with sport fishery value populate watercourses traversed by the pipeline. Water quality, habitat, and behavior during critical periods could be affected by a variety of construction activities. These included gravel removal, blasting, river crossings, drainage alterations, noise, and toxic material spills.

4. Archaeology

The right-of-way passes near several known pre-historic and historic sites along the lower valley slopes from Crowsnest to Kingsgate. Preliminary surveys indicated a high potential for new discoveries along the route. Concerns centred on protection of known sites from construction activities and identification and protection of new sites discovered during clearing and ditching operations.

5. Recreation

Two Class "A" provincial parks at Km 3 and Km 150 and one provincial park reserve at Km 158 were crossed by the pipeline. Another park reserve borders the right-of-way at Km 90. Aesthetics and maintenance of access were the primary concerns in recreation areas. Clearing was to be minimized and revegetation to be carried out quickly following construction.

2.2 Institutional Arrangements

2.2.1 Federal and Provincial Roles

The Northern Pipeline agency (NPA) was established by an act of Parliament in April 1978. This was in accordance with the Transit Pipeline Treaty between Canada and the United States of September 1977. The treaty was the basis for cooperation in planning and constructing the Alaska Highway Gas Pipeline. In passing the Northern Pipeline Act, Parliament conferred special status on the project. It recognized the need for new approaches in the regulation of mega-projects in light of the Alyeska oil pipeline experience. The Trans Alaska Pipeline System (TAPS) was marked by construction delays, cost-overruns, technical difficulties, social and environmental problems, and lack of coordination among the many federal and state agencies and departments involved. To avoid a similar situation, the agency was created to oversee the planning and construction of the Canadian portion of the pipeline by the Foothills group of companies. It was designed to function as a "single regulatory window" to streamline and expedite the approval process.

Among the agency's responsibilities, as set out in Section 3 of the act (Appendix A), was that of minimizing ". . . any adverse effect on the social and environmental conditions of the areas most directly affected by the pipeline". In keeping with this responsibility the agency developed a set of socio-economic and environmental terms and conditions which were to govern

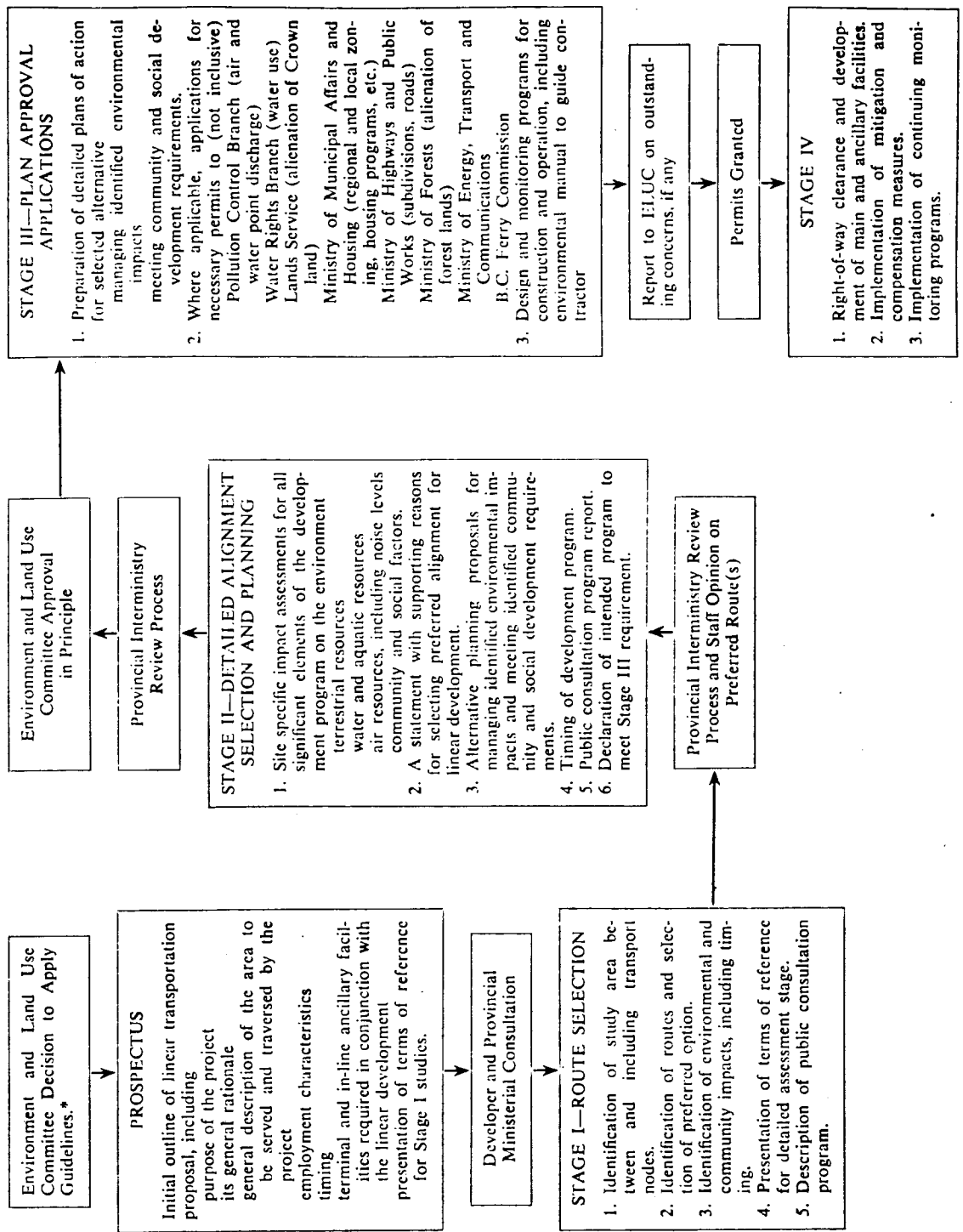
construction of each segment of the pipeline. The Terms and Conditions, in part, outlined the environmental considerations to be included in company plans and the standards to be achieved in design and construction. Plans indicating how each segment company intended to comply with the Terms and Conditions were to be approved before permission was granted to begin construction. Draft plans would be reviewed in consultation with the company, the provincial government, and with native and other interest groups. Comments received were to be taken into account and final plans produced. Compliance with approved plans and procedures constituted compliance with the Environmental Terms and Conditions.

Although British Columbia was a party to, and signed, the Transit Pipeline Treaty with the United States, the provincial government was not satisfied with the level of federal-provincial consultation preceding the agreement. Many provincial officials felt that British Columbia was pressured into signing by the federal government. Analysis of treaty benefits and charges by the province indicated that the Yukon, Alberta, and federal governments stood to gain more from the project than British Columbia. There would be no increase in gas sales for the province, as in Alberta, only assumption of the environmental and social construction costs. Cost recovery arrangements with the federal government were unsatisfactory as they would not cover anticipated administrative expenses incurred in processing applications and other regulatory

functions (Alley 1983). Formal agreements with the federal government were signed by the Yukon and Alberta but not British Columbia. To date there is still no agreement in place. Difficulties with this federal-provincial arrangement significantly affected management of the South B.C. project.

In keeping with established policy, the province took the position that the project was one of concurrent jurisdiction with specific responsibilities and approvals at the provincial level. The province emphasized that the National Energy Board (NEB) had a policy of respecting provincial jurisdiction and had given assurances of cooperation. Since there were significant resource concerns, the Environment and Land Use Committee (ELUC) of the Ministry of Environment (MOE) felt that the project should follow the recently developed Guidelines for Linear Development (fig. 4). In this process, detailed terms and conditions normally follow design review and are attached to the permits and approvals issued to the proponent. There was no difficulty anticipated in incorporating provincial standards into the NPA Terms and Conditions and the province was willing to jointly develop those for South B.C. The major concerns of the province, however, were ensuring that detailed environmental planning was carried out for the project, that a major provincial role was maintained in design review and surveillance, and that provincial agencies retained the authority to attach conditions to permits and approvals following design review (O'Gorman 1979).

FIGURE 4: LINEAR DEVELOPMENT AND PLANNING REVIEW PROCEDURE



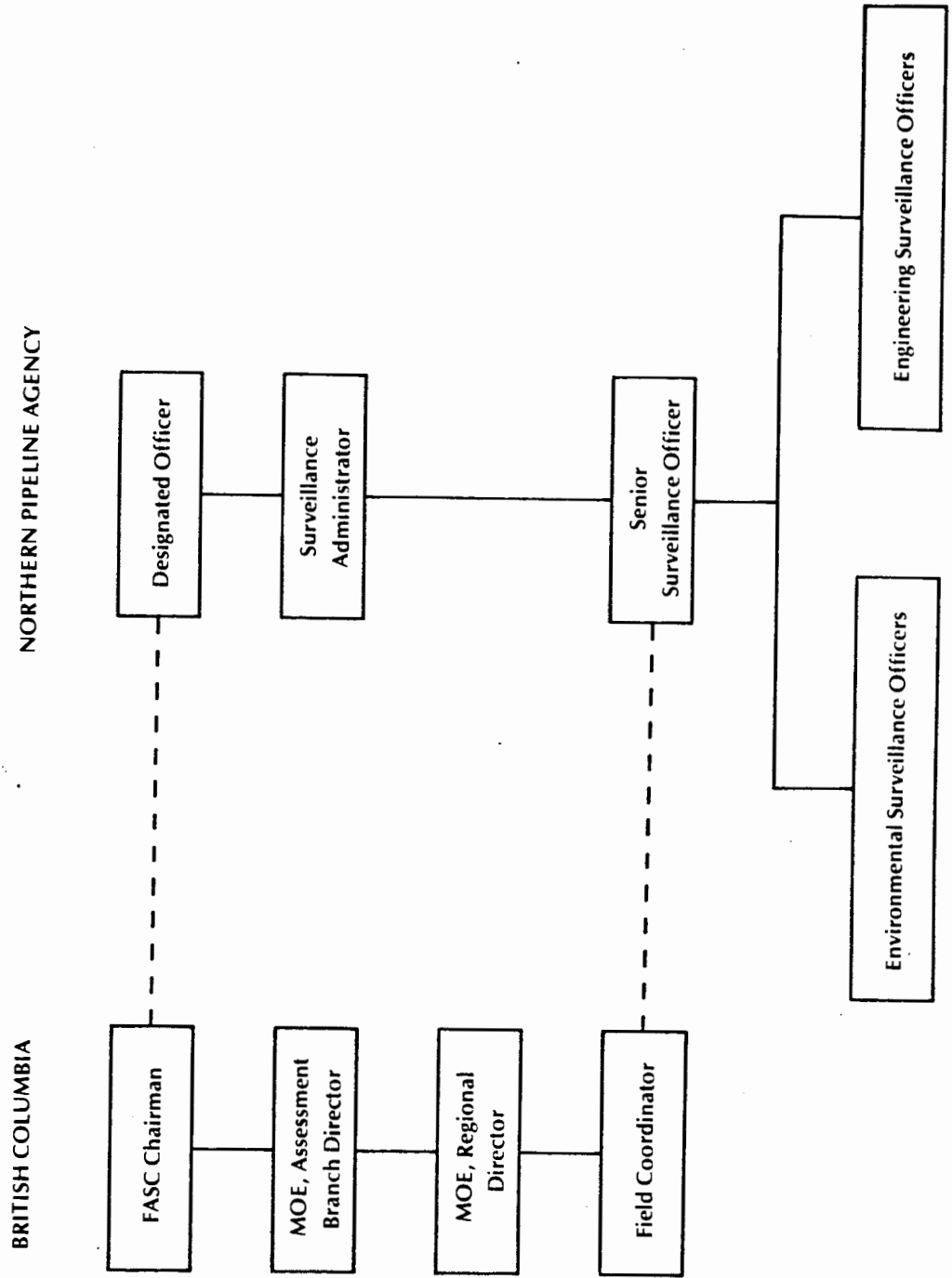
Source: B.C., 1977, 6.

The Foothills Assessment Steering Committee (FASC) was formed under the Linear Development Guidelines by the Environment and Land Use Committee to direct project administration. The steering committee was comprised of representatives of each provincial agency with interests affected by the pipeline. It assumed environmental responsibilities for South B.C. previously held by the Lands Branch of the Ministry of Lands, Parks, and Housing. The primary purpose of the committee was to be design review for North and South B.C. segments. The committee chairman was to be the single point of contact with the newly developed Northern Pipeline agency at the level of the designated officer (fig. 5).

Drafting of the terms and conditions for South B.C. took approximately two years. It culminated in their attachment to the Certificate of Public Convenience and Necessity granted to Foothills Pipe Lines (South B.C.) Ltd. by Order-in-Council of 3 July 1980. The scope and wording of the Terms and Conditions primarily reflected agency concerns but evolved by consensus among the NPA, provincial agencies, and Foothills. The document was couched in legal terms in order that it be binding on the company and to ensure that terms and conditions were consistent with those for other segments. Appended to the Environmental Terms and Conditions were Environmental Guidelines setting out more specific requirements and standards for such activities as clearing, blasting, fuel handling, waste management, and drainage control. These were drafted by several provincial

FIGURE 5: REGULATORY ORGANIZATION

COMMUNICATION LINKS - - - - -
 LINES OF AUTHORITY ————



agencies in consultation with the NPA.

During drafting of the Terms and Conditions, fundamental differences became apparent between the agency and province with regard to the role of this document. It was the intention of the agency that terms and conditions be sufficiently general " . . . to give the company direction as to what standards of performance it must achieve in constructing and operating the pipeline" (NPA 1980; i). Specific plans and procedures developed by the company in response to the Terms and Conditions then would be reviewed and evaluated in terms of how well they conformed with the intent of the requirements. In this manner the agency could retain a certain amount of flexibility during design review and construction. Site specific situations could be assessed individually and construction facilitated through decision making in the field. It was also the intention of the agency that the Environmental Terms and Conditions be used primarily as a planning and design document. Company plans approved by the agency were to be the principal documents for field surveillance personnel with the Terms and Conditions providing the necessary legal support. Originally it was not intended by the agency that the Terms and Conditions be the sole document for field reference (Yarranton 1983).

The principal difficulty which the MOE and FASC had with the Terms and Conditions was the general wording of the document (Ferguson 1983). It was felt that the lack of specific standards and procedures made it impractical for construction

planning purposes. After exchanging drafts, a compromise was finally reached wherein terms and conditions remained as general instructions to the company and environmental guidelines were appended to specify more detailed procedures, plans, and standards. FASC was still concerned with the emphasis placed on development of the Terms and Conditions by the agency and that the planning process described was basically at odds with provincial procedures under the provincial Linear Guidelines (Ferguson 1983).

2.2.2 Planning for Design Review and Surveillance

Administrative Arrangements

The formal channel of communication between the province and NEB on pipeline matters was through the British Columbia Attorney General's office. As the Foothills pipeline was to be administered under new and different arrangements, FASC and the NPA agreed to collaborate more closely on design review and surveillance. A sub-committee was established for this purpose. Both parties recognized that an administrative agreement was necessary to formalize these arrangements and deal with specific problems such as overlapping jurisdiction, information exchange, permitting, and cost sharing. They also recognized that an administrative agreement should be made prior to the approval of any master agreement between the federal and provincial

governments (Ferguson 1979).

A draft agreement was produced in August 1979. This document called for information exchange on the project and consultation on such matters as alignment review but did not detail a design review process. Instead it proposed that the agency utilize provincial personnel in surveillance roles subject to another agreement on design review, approvals, and construction surveillance. Under this agreement the province would be in a position to enforce provincial legislation as well as the Terms and Conditions. The draft also called for appointment of a provincial representative to act as a single environmental coordinator for the project.

Arrangements were discussed and modified over the next six months. In February 1980 a tentative agreement was reached whereby the province would provide five people for surveillance: a field coordinator and a four-member surveillance team consisting of a fisheries biologist, hydrologist, forestry technician, and an archaeologist. The four junior members would be seconded from provincial ministries and become employees of the NPA. The field coordinator would remain with the province, providing an independent provincial presence during construction and facilitating liason with regional managers. It was felt that this would not be feasible if he were employed by the agency. In March, FASC and the NPA agreed that only three positions would be necessary as the forestry technician and archaeologist would not be required on a full-time basis. The

hydrologist and biologist would be seconded on a full-cost recovery basis to the surveillance team but would be subject to provincial direction through the field coordinator.

Arrangements were also included in the agreement for a provincial representative to provide a first level of design review and to coordinate the provincial review process.

In April 1980 the agency suggested to the MOE that as construction start dates were approaching, design review arrangements for North and South B.C. and surveillance administration for South B.C. should be finalized. Surveillance for North B.C. would be left until the South B.C. experience could be evaluated. The agency agreed to funding arrangements for the provincial representative, field coordinator, and two surveillance officers. In the opinion of the agency an administrative agreement could be signed without jeopardizing the federal-provincial master agreement (Yates 1980).

In May 1980 there were indications that the province would not sign the administrative agreement without a master agreement in place (O'Gorman 1980). Although the regional manager was instructed to identify the two surveillance officers and clarify administrative procedures with the NPA, authority to proceed did not come from the assistant deputy minister level in spite of requests by the FASC chairman. In early June the energy minister advised the agency that any agreements involving cooperation and cost sharing must await a meeting between himself and Senator Olsen representing the NPA. The NPA advised

FASC that arrangements must be finalized by 15 June or the agency would proceed to advertise outside of government for the two environmental surveillance officers. On 24 July the MOE informed the provincial regional manager that the province would no longer be responsible for supplying the surveillance officers as agreement had not been reached with the NPA. As a result, the province would proceed as planned with the field coordinator reporting to the regional manager and the FASC chairman. However, the coordinator now was placed strictly in an advisory position and had no formal authority to enforce terms and conditions through the NPA administered surveillance team.

The failure to formalize arrangements meant that no provincial representative was appointed; design review procedures between FASC and the NPA remained unstructured. Negotiations between FASC and the NPA continued, however, and resulted in a less binding Memorandum of Understanding on 20 October 1980, nearly three months after the start of construction. Given the advanced stage of construction and the general wording of the document, it was intended more as a preliminary agreement on regulation of construction in North B.C. than an effort to define relationships in South B.C. In this document the NPA and province agreed to:

- a. consult in drafting terms and conditions, reviewing route alignments and company plans, and providing surveillance of construction,
- b. provide each other with company plans, environmental

reports, and other information required for evaluation of proposed environmental measures,

- c. coordinate respective review and approval processes to ensure that they reflect the objectives of Canada and British Columbia, they avoid duplication of company requirements, and that the issue of approvals would not interfere with project schedules,
- d. require at least minimum provincial environmental standards during construction, and
- e. assign responsibility to the province for the issue of all permits and dispositions required for construction activities on provincial crown lands in keeping with the project assessment process outlined in the Guidelines for Linear Development.

The Memorandum of Understanding suggested cooperation but was weak on specifics, perhaps most notably on surveillance. In spite of officially voiced concerns regarding major provincial involvement, the province foreclosed the option of effectively participating in surveillance by opting out of the administrative agreement. A considerable planning effort over a number of years by MOE and EMPR staff was negated for political reasons.

Environmental Studies and Documentation

Preliminary provincial design review of the project essentially began in 1973. ANG consulted provincial agencies

regarding environmental concerns and procedures for a new pipeline adjacent to the existing right-of-way. Environmental, social, and archaeological studies were planned in support of the first looping proposals. Field work commenced in spring 1974 with studies of surficial geology, fisheries, and archaeology. Overview studies were conducted on vegetation, wildlife, land use, and revegetation. After further consultation with the province in 1975, more detailed studies were carried out on big game and aquatic habitat, and surveys conducted for birds, vegetation, and recreational land use. Public hearings were convened following submission of these studies in order to establish environmental stipulations for the project. Further studies were carried out after the hearings to determine the effect of compressor noise on overwintering wildlife and to survey knapweed infestations along the right-of-way. Archaeological and fisheries work continued into the construction phase.

The 1975 report by Renewable Resources Consulting Services Ltd. contained information to supplement the Environmental Considerations report prepared by F.F. Slaney and Co. Ltd. (1974) the previous year. ANG intended that the Renewable Resources report be of the scope and quality required by the B.C. Land Branch for a Stage III site-specific environmental assessment and by the NEB regulations. Provincial agencies reviewed the document and generally found it to be overly descriptive with inadequate assessment and prediction of

probable impacts resulting from construction (Secter 1983). Deficiency statements were sent to the company but the looping project was delayed indefinitely and no revisions were made to the report. Following the decision to proceed with the Foothills proposal, the company began receiving frequent requests from the province for more specific information. However, the original reports were not updated.

Documentation of company plans and procedures for review did not proceed as originally envisioned by the NPA or according to provisions of the Linear Guidelines. The "Comprehensive Plan" consisting of detailed description, impact analysis, and mitigative measures for sensitive areas, an environmental atlas, and other specific documents was not called for in the Terms and Conditions for South B.C. as in the Yukon. Company planning was done on relatively short notice because of the uncertainty regarding the pipeline as a whole and the perception of the South B.C. segment by the manager as a relatively small looping project (Peak 1983). As a result, the documentation was hastily assembled, weak on specifics, and submitted late for review.

ANG submitted a draft of the Environmental Plans and Procedures Manual, the basis for its environmental management program, for review in July 1980. FASC found the document too generally worded and requested that environmental procedures be more specifically described and that more emphasis be put on defining administrative and reporting systems (Ferguson 1983). Deficiencies were identified in right-of-way engineering,

erosion control, access roads, stream crossing designs, and inspection procedures. Three drafts were produced by the ANG consultant before approval on 5 August, one week after start of clearing. Environmental alignment sheets indicating site-specific procedures were not submitted to the province for review (Appendix B). Nonetheless, all necessary approvals were granted by the province and the NPA and construction proceeded as scheduled on 6 August 1980.

Surveillance

The NPA as the federal regulatory authority clearly had primary responsibility for surveillance during construction. Under the Northern Pipeline Act, jurisdiction was assumed by the agency that normally would have fallen to provincial agencies and the National Energy Board. Its surveillance function was to ensure compliance with engineering standards and with approved environmental plans and procedures. On the construction spread, two NPA environmental surveillance officers and two engineering surveillance officers reported to a senior surveillance officer appointed for the segment. The senior surveillance officer reported to the surveillance administrator in Calgary who, in turn, reported to the designated officer (fig. 5).

The authority of the environmental surveillance officers was limited in that they could not prevent non-compliance with the Terms and Conditions by stopping construction activities. When problems arose, standard procedure was for the senior

surveillance officer to send a letter to the engineer noting non-compliance and requesting an explanation. If the explanation was unsatisfactory the senior surveillance officer could report to the surveillance administrator. The issue would be discussed with the surveillance staff in Calgary and the designated officer. If it was decided that the situation warranted a shut down, authority was given to the senior surveillance officer to issue a non-compliance order. This occurred on two occasions during construction: once for excessive open ditch and once for inadequate wildlife crossings.

Partly as a result of the provincial decision to opt out of a joint arrangement, construction surveillance by the NPA was late getting organized in South B.C. This function initially was the responsibility of a separate surveillance group within the agency whose primary concern was engineering. This arrangement was unsuitable to the environmental group as it did not permit direct reporting from the field or involvement in environmental decision making (Yarranton 1983). The system was changed approximately two months after start of construction with the environmental surveillance team reporting directly to the environmental group in Calgary.

The provincial field coordinator was hired on 1 August 1980. The terms of reference for this position were:

- a. to coordinate provincial input into field surveillance for the enforcement of the provincial terms and conditions,

- b. to facilitate liason between the provincial agencies, the Northern Pipeline Agency, and project proponent during project construction,
- c. to facilitate and coordinate the resolution of on-site conflicts which arise during construction through collaboration with regional resource agencies, the NPA, the proponent, and the Foothills Assessment Steering Committee,
- d. to provide, as necessary, ongoing briefing to the Foothills Assessment Steering Committee and Regional Resource Management Committee,
- e. to provide information on the project to government agencies and the public, and
- f. to assist, if necessary, in the preparation of the environmental requirements for the North B.C. portion of the Alaska Highway Gas Pipeline.

The field coordinator was to take policy direction from, and report to, the FASC chairman. He was also to work under the direction of, and report to, the MOE regional manager, coordinating and facilitating field surveillance activities with the Regional Resource Management Committee and line agency staff.

Although ostensibly functioning in a surveillance role, the actual authority that the field coordinator would have on the spread was not articulated. There were no formal links with the company or the contractor. The coordinator's sole means of

input was to be through the NPA senior surveillance officer. Although the agency had agreed to comply with all provincial legislation, authority for unilateral provincial action was thought to rest in the B.C. Water Act and B.C. Land Act. Precedence over any conflicting federal legislation had not been established in court, but the province felt that the field coordinator was in a position to exercise indirect authority during water crossings through the regional water manager with the water crossing approvals and through the provincial conservation officers under the federal Fisheries Act (Langford 1983).

2.2.3 Company Project Management

The owner of this segment of the pipeline is Foothills Pipe Lines (South B.C.) Ltd., jointly held by Foothills Pipe Lines (Yukon) Ltd. and Alberta Natural Gas Company Ltd. of Calgary. ANG acted as agent for Foothills and was designated construction manager. The manager contracted Quadra Engineering International Ltd. as project engineer. Quadra was responsible for preparing the bid documents, selecting the contractor, administering the contract, and inspecting the work. The contractor for this segment was Marine Pipeline Construction Ltd. of Calgary.

No detailed environmental planning or design work was carried out by ANG until 1979. At that time a consultant was contracted to produce the Environmental Plans and Procedures

Manual to comply with the Terms and Conditions. The consultant was later retained by the company to manage all environmental matters for the duration of the project. Initially he reported directly to the manager but as construction progressed he became a trouble-shooter for the engineer. He advised the engineer on environmental concerns, liased with NPA and provincial surveillance personnel, and provided on-site training for the environmental inspectors. He also audited inspector's reports and other communications relating to environmental issues to determine the degree to which concerns were being addressed.

According to the consultant, the owner was not actively involved during construction beyond reviewing reports and sending an occasional observer into the field. There was no direct intervention at any time. Similarly, the manager's role in construction was minimal. Most supervisory personnel were committed to other projects. One member of the operations staff was assigned to protect the operating line but did not get involved in construction of the loops. Middle and upper management staff reviewed reports and maintained formal communications with government agencies but none was assigned to the project full time (Stutz 1983).

The engineer administered the construction contract through the construction supervisor. A chief inspector was appointed to whom all activity inspectors submitted daily reports, and through whom all concerns were communicated to the construction supervisor. One activity inspector was originally designated to

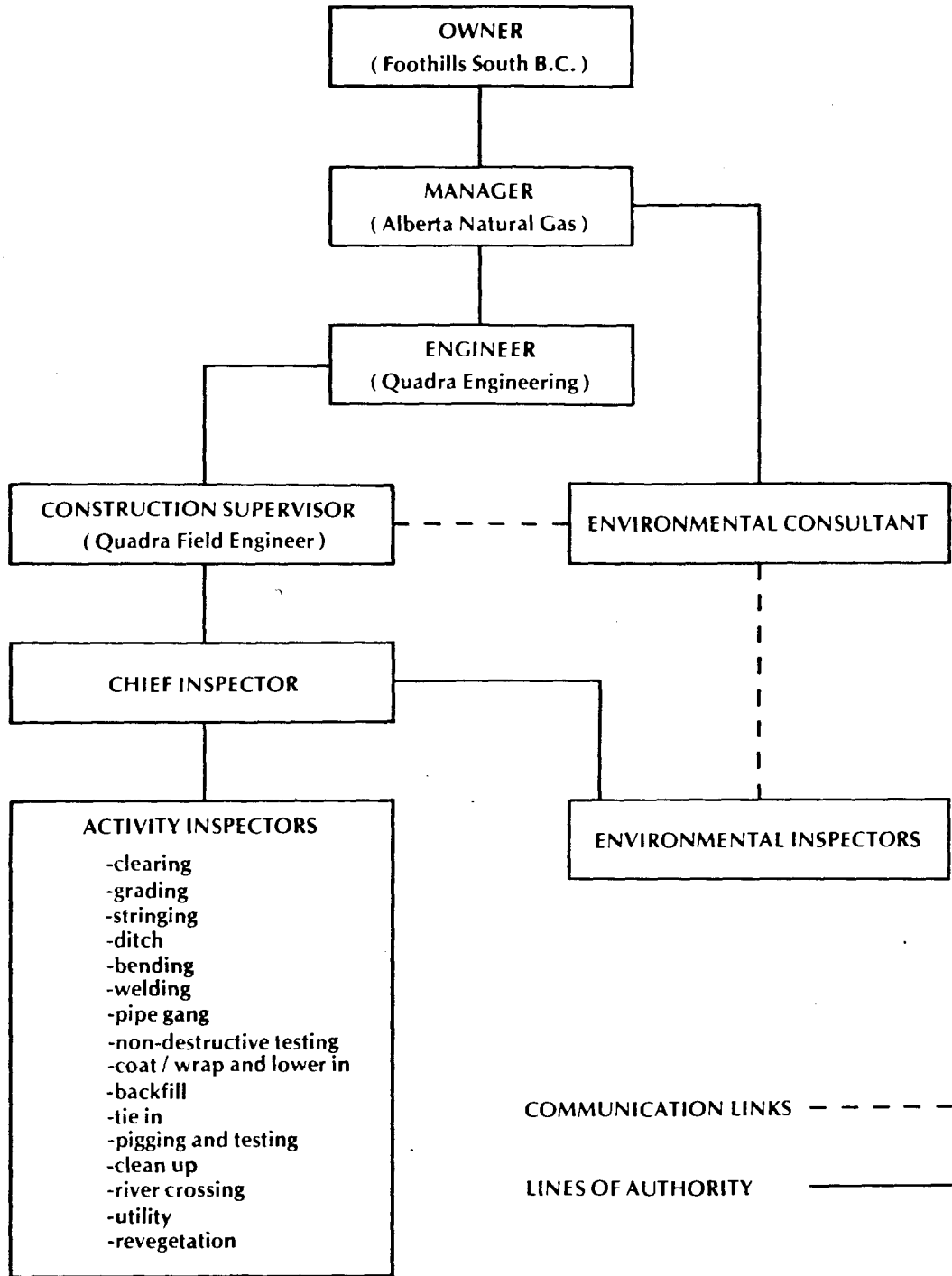
be an environmental inspector (fig. 6).

The Environmental Plans and Procedures Manual produced by the consultant was approved by the NPA on 5 August 1980 and became the basis for the company's environmental management program. The document was organized to reflect the order of requirements in the Terms and Conditions. Terms and conditions requiring the collection of baseline data were met by reiterating findings and conclusions of earlier survey and assessment work. Site-specific concerns set out in the Environmental Guidelines were addressed by indicating that specific schedules, designs, and procedures would be developed. Special construction procedures required for environmental protection were covered by transcribing individual terms, conditions, or guidelines, or by reproducing standard pipeline construction contract specifications approved by the NEB. The Procedures Manual, therefore, systematically addressed all terms and conditions technically fulfilling the stated environmental planning requirements. However, it did so in a manner similar to the way in which those requirements were conveyed; generalized statements of intent, for the most part.

The Procedures Manual also contained the environmental alignment sheets (Appendix B). These photo-mosaics of the pipeline route were annotated with three types of information:

- a. construction details which identified construction activities requiring special attention because of environmental, social, or archaeological concerns,

FIGURE 6: PROJECT MANAGEMENT ORGANIZATION



- b. environmental concerns which provided a kilometre by kilometre assessment of potentially sensitive areas and features, and
- c. mitigative procedures which listed site specific measures to be taken to protect identified concerns.

Instructions to the contractor regarding environmental requirements were conveyed through three contract documents: Invitation to Bid, Specifications, and the Revegetation Contract. Detailed environmental design and procedural measures were to be included on the alignment sheets, typical drawings, and the line list. Appended to the Invitation to Bid was the Environmental Field Manual, an abbreviated version of the Environmental Plans and Procedures Manual. The contractor was instructed to become familiar with this document and to adhere to the requirements in it. Additionally, the contractor was required to comply with provisions of the Terms and Conditions and Environmental Guidelines and all applicable federal and provincial laws, regulations, and ordinances.

The manager submitted two documents to the NPA regarding environmental inspection. The Environmental Plans and Procedures Manual prepared by the consultant detailed the qualifications, reporting arrangements, and responsibilities of an environmental inspector. The individual was to be thoroughly familiar with construction procedures, knowledgeable of environmental principles, trained in dealing with environmental emergencies, and familiar with environmentally sensitive areas

traversed by the pipeline. The inspector was to hold a staff position, reporting directly to the project engineer. Included among the duties set out in the manual were responsibility for:

- a. implementation of an environmental education program,
- b. management of an environmental monitoring program,
- c. awareness of federal and provincial legislation and required approvals,
- d. evaluation of mitigative measures to protect wildlife habitat, and
- e. assessment of the extent of siltation and sedimentation during watercrossing operations.

Under Section 149(5) of the Terms and Conditions regarding the Environmental Plans and Procedures Manual, the company was obliged to comply with each part of the manual approved by the designated officer. This inspection system was not implemented as designed, however. The education and monitoring programs were never fully developed nor was any systematic program for evaluating environmental design.

A second document, Pipeline Construction: Inspection and Monitoring Procedures and Guidelines was also submitted and approved by the NPA. This document described a similar system to that in the Procedures Manual with a field environmentalist operating as an independent staff member reporting to the construction supervisor. In addition, each technical inspector was to be responsible for certain environmental procedures directly related to his particular activity. In this manner,

maintenance of environmental standards during construction was to become a quality control function (Appendix C). The environmental inspection systems outlined in these two documents differed on the inspector's job title and on the reporting arrangements. Neither document referred to the other, elaborated on quality control or quality assurance, or indicated how the environmental consultant would be integrated into the system. These inconsistencies in inspection planning were not identified by the agency during design review.

2.3 Environmental Management Goals and Objectives

2.3.1 Northern Pipeline agency

The objectives of the Northern Pipeline Agency are set out in Section 3 of the Northern Pipeline Act (Appendix A). For the purposes of this study, the objectives of expediting planning and construction, minimizing adverse environmental effects, and coordinating with the provincial government, will be thought of as broader agency goals.

The dual role of facilitating construction while ensuring that adverse impacts were minimized was not officially seen as conflicting but rather as "complimentary and mutually reinforcing" (Sharp 1981). Through consultation with federal and provincial agencies and Foothills, it was felt that the agency would facilitate the "efficient and expeditious planning and construction of the pipeline in full compliance with the

regulations" (Sharp 1981).

The process by which the agency would realize these goals consisted of three major components:

- a. formulation of broad terms and conditions,
- b. review of detailed plans submitted by Foothills for implementing the terms and conditions, and
- c. maintenance of field surveillance to ensure compliance by the company with the terms and conditions, approved plans and procedures, and the engineering requirements.

Each phase of this process was to be carried out in conjunction with provincial agencies. A fourth phase involving monitoring of impacts was not ready for implementation in South B.C. On future segments the program would evaluate the effectiveness of the terms and conditions and mitigative measures adopted to reduce impacts.

The expressed purpose of the Terms and Conditions to provide "direction" as to standards of construction performance suggests flexibility in interpretation. This was reinforced throughout the introduction to the document:

The terms and conditions set out several environmental and socio-economic objectives which the company must attain in the construction and operation of the pipeline. Many of them are cast in general terms and will be interpreted by the Agency in light of experience gained by the National Energy Board and the Province of British Columbia in regulating the construction and operation of gas pipelines in British Columbia.

. . . the Agency, in assessing Foothills' compliance with the Terms and Conditions, must exercise professional judgement in determining the degree of minimization of adverse impacts that the company must achieve.

Reference was also made to the environmental guidelines:

In some cases the environmental concern will be the predominant factor in a decision; in such cases the Agency will normally expect the company to follow these guidelines. In other cases the environmental concern may be relatively minor in comparison with engineering, economic, or social factors; in these cases the Agency will accept plans and actions appropriate to the particular situation. This section will guide both the Agency and the company in obtaining the best results practicable - a goal which cannot be obtained either by use of inflexible standards or by the absence of any standards.

During development of the Terms and Conditions, the NPA also recognized that

. . . the minimization of adverse social or environmental impacts can best be achieved during planning and design of the pipeline, rather than after construction is underway (NPA 1980; ii).

The principal objectives of this document, therefore, were:

- a. to provide the company with an indication of the scope and detail of environmental planning that would be required prior to construction,
- b. to provide the company with an indication of the general measures, specific procedures, and specific performance standards with which the company could be required to comply during construction and generally should be prepared to meet, and
- c. to provide design review and surveillance personnel with a set of standards to evaluate the adequacy of company plans and construction performance.

The NPA environmental review process differed somewhat from socio-economic plan review. Under the socio-economic terms and

conditions the company was required to prepare a number of plans indicating how it intended to comply with various requirements. Environmental design review was geared toward the Environmental Plans and Procedures Manual and detailed alignment sheets. Baseline and impact studies were to be updated, results would be reviewed with the company and province, and the procedures manual and alignment sheets would be produced and reviewed prior to construction. The objectives of the agency design review, therefore, were:

- a. to ensure that adequate environmental data were collected and analyzed,
- b. to identify deficiencies in the Procedures Manual and alignment sheets in terms of failure to meet specified objectives, and
- c. to make required trade-offs between engineering, social, environmental, and economic concerns and to develop acceptable solutions to identified problems prior to construction.

The surveillance team for South B.C. included two engineering surveillance officers responsible for company compliance with the technical requirements and two environmental officers. The team was headed by an experienced pipeline construction and inspection hand who it was felt could communicate well with all parties and administrate knowledgeably and fairly. The objectives of the surveillance system were:

- a. to ensure compliance with the terms and conditions and

- technical requirements,
- b. to provide field authority for arbitration of environmental and engineering conflicts, and
 - c. to liase with the public, landowners, and the province, and to provide a mechanism for input by the provincial field coordinator.

2.3.2 Provincial Goals and Objectives

Provincial management goals generally differed from those of the NPA as the province had no mandate to expedite pipeline construction. As previously stated, the province took the position that it had considerable jurisdiction for environmental management and would, therefore, regulate the project according to the Guidelines for Linear Development and applicable provincial statutes. The political decision not to sign a formal agreement with the NPA reflected strong resistance on the part of the province to defer totally to the agency in environmental matters or to fully coordinate environmental management responsibilities. Victoria was willing to cooperate in project planning and design review but was extremely cautious about being co-opted in the process. The goal was to ensure protection of provincial environmental interests outside of the administrative structures suggested by the NPA (Ferguson 1983). Provincial objectives were:

- a. to review design through the Foothills Assessment Steering Committee and the referrals process,

- b. to regulate construction through permits and approvals,
and
- c. to observe and control construction by the field
coordinator through the NPA senior surveillance officer.

2.3.3 Company Goals and Objectives

ANG goals for this project were to put in place a well engineered, high-quality pipeline with an efficient, trouble-free construction process under standard contractual and procedural arrangements (Peak 1983). The company did not express environmental objectives as such, other than to state in the Procedures Manual commitment to building the line with "minimum adverse impact on the environment" (ANG 1980e; 1). It was the manager's belief that with good engineering and proper management, the long-term environmental effects of pipeline construction and operation would be minimal (Peak 1983).

A changing regulatory environment in the province, specifically with this project, necessitated the development of an environmental management program by the company. The objectives of the program were:

- a. documentation of company environmental plans and procedures for regulatory approval,
- b. instruction to the contractor of environmental requirements and responsibilities during construction,
and
- c. inspection of construction procedures adequate to

satisfy regulatory requirements.

2.4 Project Actions and Impacts

Clearing to widen the existing right-of-way began on 30 July 1980 following the granting of the leave-to-proceed by the NPA. The pipeline construction contract was awarded to Marine Pipelines on 5 August 1980 with grading and right-of-way preparation beginning the following day. Although the contractor had to scramble to assemble men and equipment, construction was underway on schedule.

2.4.1 Field Administration

The NPA surveillance officers were hired on 11 August but did not get into the field until 10 days after start of construction. Because of planning delays, they were not equipped with maps, alignment sheets, or radios during their first month on the spread (Low 1983). Administrative and reporting procedures within the surveillance team were well defined but initially, there was no direct connection with the environmental group in Calgary. Working relations with the engineer and contractor had not been clearly established prior to construction and the surveillance officers felt that their role on the spread was not well understood (Low, Deyell 1983). Lacking documentation of specific standards, procedures, and designs, they were required to interpret and enforce compliance with the Terms and Conditions without sufficient authority to

direct the contractor or to shut operations down. The senior surveillance officer who had indirect shut down authority via Calgary was similarly faced with interpreting general terms and conditions when dealing with more complex site-specific problems.

Relations between the NPA and ANG during planning stages were generally cooperative (Yarranton 1983) but trouble developed almost immediately during construction. For the most part, the requests and instructions of the surveillance officers were ignored or carried out reluctantly (Morrison 1983). The terms and conditions were generally ignored by the engineer and contractor as were the procedures and standards set out in the Environmental Field Manual (Morrison, Low 1983). Interaction between surveillance personnel and the contractor was restricted by the engineer to established formal channels. All communication was through the senior surveillance officer to the construction supervisor.

The provincial field coordinator also had limited success exercising his authority in the first few months of construction. Administrative and reporting arrangements were sufficiently clear with the regional manager and FASC and a working relationship was established with the senior surveillance officer. The legislative authority for the position remained undefined, however. The field coordinator primarily relied on the MOE Water Management Branch approvals for authority and on the Terms and Conditions and Field Manual

for guidance on other matters (Langford 1983).

The surveillance officers and field coordinator were in agreement that a major part of the problem in controlling the contractor was the lack of strong environmental inspection by the company. The activity inspector designated by the engineer at the start of construction to act as the environmental inspectors had practical pipeline experience but no specific environmental training. Following complaints by the field coordinator, formal letters of concern were sent by the NPA to the manager in August and again in October stating dissatisfaction with the quality of environmental inspection. An initial response by the manager indicated that the company interpreted the Monitoring and Inspection Procedures as requiring environmental inspection only at the level of the activity inspectors (Stutz 1983). The engineer responded later that the designated environmental inspectors was performing according to the description in the Environmental Plans and Procedures Manual. Continued pressure by the field coordinator and the agency resulted in the appointment of a second environmental inspector with better environmental qualifications but less construction experience. In the opinion of the field coordinator this individual was effective within the constraints of the system and a working relationship was established with surveillance and inspection personnel (Langford 1983). According to the engineer, qualified environmental inspectors were very difficult to find. He felt that the system as

originally planned with an environmental consultant available to an experienced construction inspector had greater merit (Prior 1983).

2.4.2 Non-compliance with Terms and Conditions

With the exception of clearing, problems developed with virtually every aspect of construction in terms of non-compliance with terms and conditions and approved procedures. Grading during right-of-way preparation involved excessive cuts and fills leading to stability problems and excess material frequently being pushed out into the trees (fig. 7). Topsoil was not always conserved where required. Section 140 of the Terms and Conditions required proper erosion and drainage control on the right-of-way when it was to be used as a travelling surface. This was interpreted by the company to mean that no such maintenance was required during construction but only during operation of the pipeline. As a result, heavy vehicle traffic and muddy conditions led to excessive erosion and stream sedimentation (fig. 8). Similarly, berms were seldom constructed on steep slopes to handle spring runoff until the cleanup stage (fig. 9). Ditch plugs were inconsistently installed on stream approaches and on steep slopes to prevent development of sub-surface channels (fig. 10). Streambank restabilization was not always carried out immediately after disturbance (fig. 11). On one occasion pipe de-watering following testing took place on a steep slope above a waterbody



Surface runoff is
into the travel.

Figure 7: Right-of-way Pushouts. Excess material has been pushed off right-of-way into the trees. (Source: R.W. Langford)



Figure 8: Right-of-way Drainage. Inadequate drainage on right-of-way while used as an access road. (Source: R.W. Langford)



Figure 9: Berms Correctly Installed. Surface runoff is diverted from right-of-way into the trees. (Source: R.W. Langford)



Figure 10: Ditch Plugs Correctly Installed. Plugs restrict water flow on steep slopes minimizing erosion of ditch. (Source: R.W. Langford)



Figure 11: Inadequate Streambank Stabilization. Active cut bank in the centre of photo should be riprapped to protect right-of-way. (Source: R.W. Langford)

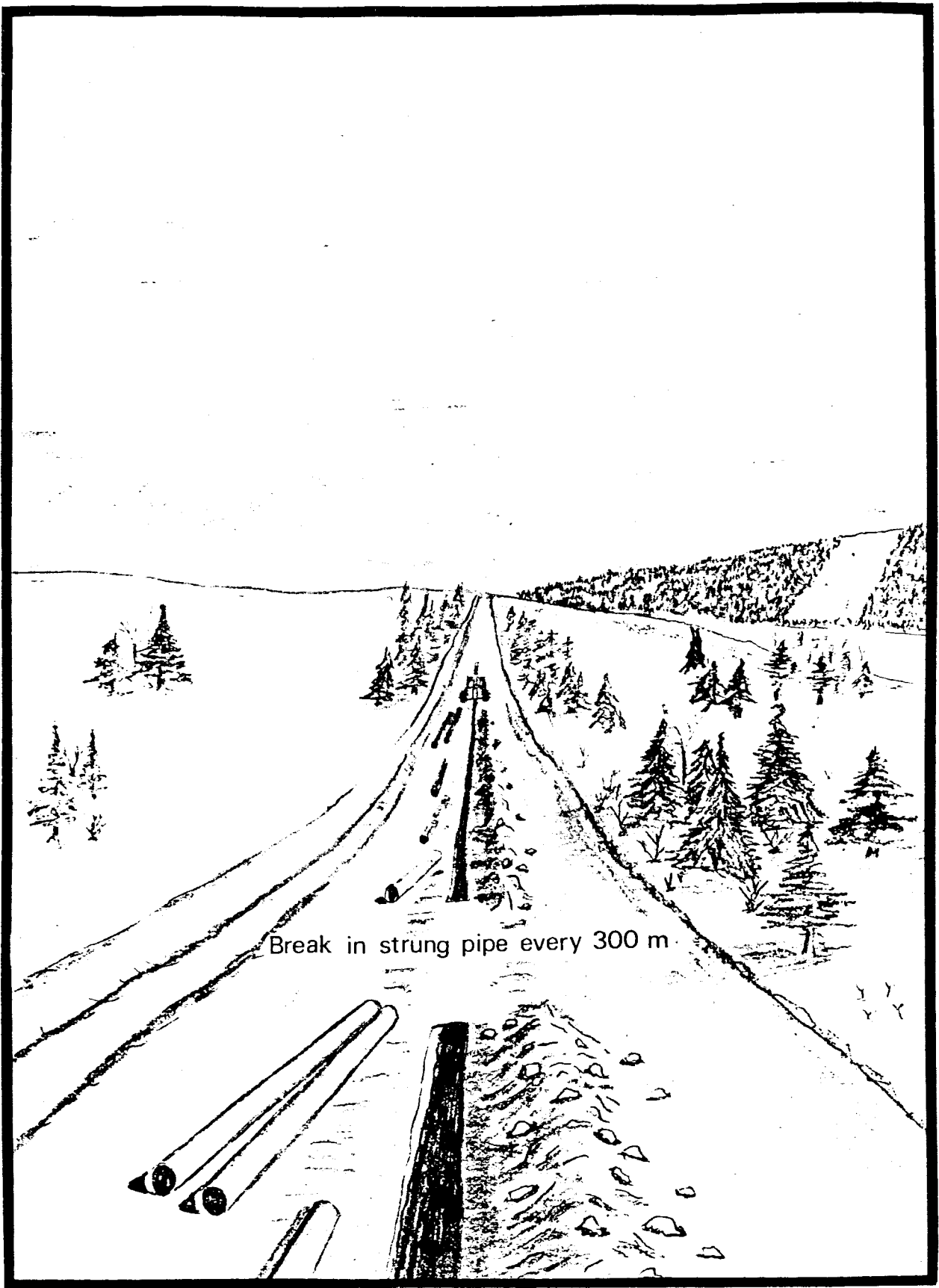


Figure 12: Inadequate Drainage on Access Road. Undersized culvert has washed out resulting in severe erosion. (Source: R.W. Langford)

causing erosion and sedimentation. Access roads were built without permission, inadequately drained, and left unprepared for spring runoff (fig. 12). The location of borrow sites on crown land was not recorded and buffer strips required for aesthetic purposes were not retained. In one case the surveillance officer had to intervene at an archaeological site specifically protected by law and flagged by the owner to prevent gravel removal by the contractor (Stutz 1983).

According to the terms and conditions, ditch plugs and gaps in strung pipe were to be provided at 300 m intervals to allow animal passage (fig. 13). Numerous NPA letters of concern and one non-compliance order cited the company for failure to meet the standards. The company's position was that such crossings were only required in high-density wildlife areas identified on the alignment sheets (Stutz 1983). The length of open ditch also became an issue when the contractor exceeded the 8 km maximum specified in the contract documents. Ditching was shut down by the senior surveillance officer until welding crews caught up but difficulties arose later when welding was delayed by the ditching operation.

Provincial officials became increasingly concerned with project environmental management as non-compliance continued through the fall. It was generally perceived by provincial authorities that the principal problem of lack of enforcement by NPA surveillance personnel was a function of the dual role of the agency: expediting pipeline construction took precedence



SOURCE: NOVA, 1981, 4.21

FIGURE 13: DITCH PLUGS AND PIPE GAPS FOR WILDLIFE CROSSINGS

over environmental protection (Langford 1983). The surveillance team was there to ensure compliance with terms and conditions and provincial requirements but was seen as providing discretionary exceptions to the company too much of the time. The field coordinator who was initially acting as a third level of control after the company inspector and NPA surveillance officer was put in a position of direct intervention with the engineer and his consultant in attempting to control construction activities. The province was also concerned with the lack of planning for access roads, stream crossings, drainage control, and for specific resources such as fisheries streams and archaeological sites. Much of the time planning and engineering were carried out in the field (Stutz 1983). The surveillance personnel became responsible for making field decisions on design and procedures which should have been determined during design review.

2.4.3 Water Crossings

More than any other activity, it was water crossings which became the focus of attention during construction. The concern for the protection of water quality became the catalyst for a confrontation on project administration. At issue was the question of the necessity and effectiveness of stream fluming.

In the Environmental Plans and Procedures Manual the approved method of in-stream pipe installation was to section out the crossing and ditch in a continuous operation using an

open-cut. In this procedure the section of pipe for the crossing is prefabricated and prepared for installation. The ditch is excavated across the stream and the pipe lowered into place (fig. 14). No provision for sediment control is made other than to pile spoil on stream banks where possible.

Contrary to this approved method the provincial Water Management Branch attached conditions to its approvals on 1 August, specifying 26 streams to be sectioned out, flumed, and crossed with a dry ditch (fig. 15). The company appealed and a compromise was reached wherein the first few streams would be open-cut, suspended sediment would be monitored, and, if levels were acceptably low, the fluming requirement would be withdrawn. The first streams crossed were not sectioned out as stipulated, spoil was piled in-stream, water flow on one stream was stopped for a period of hours, and sediment levels were high (Stutz 1983). As a result, the Water Management Branch insisted that the remainder of the streams be flumed.

A number of subsequent flume installations along the Flathead Ridge did not conform to conditions attached to the approvals. The flumes did not receive the entire stream flow, they leaked, and many were washed out. Some crossings were not sectioned out so flumes remained in place for several weeks. Suspended sediment levels remained high (Stutz 1983). Although the engineer attributes some of the crossing problems to a lack of experience with fluming techniques (Prior 1983), ineffective company inspection to ensure compliance with special conditions



Figure 14: Open-cut Stream Crossing. Ditch has been excavated and pipe is positioned for lowering in.
 (Source: R.W. Langford)



Figure 15a: Flumed Stream Crossing. Culvert carries all of stream flow across the right-of-way. Ditch is dug under the culvert and the pipe lowered in.
 (Source: R.W. Langford)

of the approvals and lack of NPA commitment to the procedure were perceived as critical by the field coordinator (Langford 1983).

It was becoming clear to the province in October 1980 that a new working arrangement with the NPA was necessary for more effective field management. At a meeting convened later in the month the regional manager expressed concern with project surveillance. He indicated that the province was reassessing its role because of the agency's priority in facilitating construction (Schorn 1980). The agency spokesman admitted to start-up problems with surveillance but denied that surveillance officers were there to facilitate construction rather than protect environmental interests. It was agreed that there were fundamental differences in jurisdiction between the region and the NPA. The regional manager stated that the province had final authority on site surveillance where construction activities fell under provincial legislation. The agency recognized overlapping jurisdiction but insisted that while mechanisms were established for provincial input to planning and surveillance, final authority on site decisions was vested with the NPA. No agreements were reached at this meeting.

At the request of the company, permission was granted by the Water Management Branch to open-cut two more crossings at Leach Creek and Michel Creek. The company wished to demonstrate the effectiveness of this method in limiting siltation and their ability to do it quickly and efficiently. According to the

consultant, however, in both cases construction procedures varied from approved methods, inspection and surveillance were limited, workmanship and supervision were suspect, and high levels of suspended sediment were recorded (Stutz 1983). MOE officials were dissuaded from issuing a stop work order on the second crossing on the grounds that the damage had already occurred. As a result of these activities the MOE announced on 4 November 1980 that it was assuming control of environmental surveillance for water crossings on the project and that strict adherence to approvals would be required.

2.4.4 The Court Injunction

In spite of efforts to cooperate in planning water crossings, strong differences developed between the NPA and the field coordinator. The Gold Creek crossing and two Tepee Creek crossings were successfully sectioned out and flumed in compliance with Water Management guidelines. However, prior to the Moyie River crossing the agency informed the company on 23 October that more fisheries data were required before a decision was made on crossing procedures. On 7 November the designated officer explicitly ordered the company to refrain from proceeding. Fish habitat surveys were carried out between 10 and 17 November. In a letter to the regional water manager on 20 November, the agency stated that the designated officer would approve final conditions for the Moyie crossings. Following review of the fisheries studies and estimates of comparative

costs, the agency determined that fluming was not justified and instructed the company on 27 November to proceed with the Moyie and Hawkins Creek crossings using an open cut procedure. On 28 November an injunction was served on the agency, the company, and the contractor by the province prohibiting crossings by any other method than that specified in the Water Management Branch approval. An agreement was worked out by the NPA and MOE whereby the first crossing would be flumed and a record of sedimentation and costs would be kept and used to decide how the other crossings would be carried out. While the plans and designs for water crossings were being negotiated between the two levels of government, however, discharge of the Moyie River increased with unseasonable winter rains. The higher water level made fluming infeasible, the court order was lifted, and the river was crossed by open-cut in January 1981. The jurisdictional question was never settled in court.

Suspended sediment levels were monitored on the flumed crossings of Gold Creek and Tepee Creek, and the open-cut crossings of Michel Creek, Hawkins Creek, and Moyie River. Data collection and analysis were insufficient to determine whether fluming significantly reduced sediment loading (Langford 1983). Testing of a curtain across the ditch at the banks of Hawkins Creek during the crossing yielded similar results.

Pipeline construction proceeded until 9 May 1981 when the final tie-in with the existing line was made. Cleanup was completed on 24 July. The revegetation contract was awarded to

a native group in August and completed 20 September. Cleanup and revegetation generally were carried out to the satisfaction of the regional ministries, field coordinator, and NPA. The field coordinator attributes much of the success of this program to the ANG consultant who designed the program and to the company inspector appointed specifically to oversee its implementation (Langford 1983).

Although there were considerable administrative problems during construction surveillance, inspection, and construction procedures improved over the course of the project. Much valuable experience was gained considering the relatively small project size. Improvements in administration will require evaluation by all parties of their respective roles and responsibilities. Consensus on changes in system design and procedures is necessary prior to beginning work on future pipeline projects.

CHAPTER III
PROJECT EVALUATION

The environmental management system established for South B.C. had significant shortcomings on four accounts: the federal and provincial regulatory processes failed to create an effective administrative structure under which planning and construction could be carried out; the proponent was not effectively informed of specific environmental requirements; the management system was ineffective in enforcing compliance with the requirements during planning and construction; and the company's environmental management program developed in response to the requirements did not meet their intent or function effectively in the field.

3.1 Regulatory Arrangements

The number and magnitude of administrative problems which characterized this project suggest that the formal agreement between Canada and British Columbia and the administrative agreement between the NPA and province which were sought but not attained are a necessary basis for effective joint regulation. The institution of a unified regulatory system or single window agency requires a high degree of cooperation and coordination between the two levels of government as well as substantial

political will. In British Columbia there was little trust between the senior governments and little agreement on the purpose, scope, or wording of the Terms and Conditions--the basis for the agency's system. The NPA did not take the lead in developing the agreement, its authority was compromised, and its utility as a single window agency was diminished. As a result, the province largely pursued its own environmental objectives outside of the organizational structure of the NPA, jurisdictional disputes developed, and a lower level of environmental protection was achieved as a result. Comparisons with the Alberta pre-build must be made carefully as weather, geography, and company planning contributed significantly to the administrative success of this project. But inter-governmental regulatory arrangements were not a problem in that province with the agreement in place (Yarranton 1983).

3.2 Environmental Terms and Conditions

In general, a high level of planning by the project proponent is dependent on the clear understanding of construction and regulatory requirements early in the development process. Construction standards as well as the planning and approvals process including the documentation required, review procedures, and acceptance criteria, therefore, should be clearly described in the terms and conditions or stipulations provided. In this respect the provincial Guidelines for Linear Development are more effective than the

NPA Terms and Conditions for guiding the proponent through the environmental regulatory process. In South B.C., the company technically was put in a position of having to respond to both documents and, to a certain extent, follow two different planning processes. The consistency of information available to the company early in the process was a function of the coordination between the regulatory authorities. The company planning effort was by no means entirely dependent on the information provided, but it did reflect the uncertain regulatory environment.

The NPA Terms and Conditions achieved the stated purpose of providing "direction" as to what standards would be required during construction but it was not effective as a means of attaining those standards. The intent of the Terms and Conditions to serve as a basis for detailed planning was met in South B.C. only in so far as the documentation which was produced conformed with the required format: the Procedures Manual outlined proposed company plans and the alignment sheets identified some areas where specific mitigative measures were to be taken. However, neither accurately reflected company actions during construction or served as a useful reference for field personnel.

The general wording of individual terms and conditions permitted flexibility in plan design but gave no real indication of the level of planning required by describing the process to be followed or the criteria used in design review. In South

B.C. environmental planning simply was not integrated with engineering design or construction planning as intended by the agency and the province. This is equally attributable to company intent, regulatory design review, and time constraints, however, as it is a reflection of the adequacy of the Terms and Conditions.

The project engineer felt that the Terms and Conditions provided some indication of the standards desired by the NPA and suggested that construction personnel were more aware of the requirements than was generally believed. While concerned with the legal basis of the Terms and Conditions he still felt that many requirements, particularly those related to water quality, road construction, and wildlife were impractical and therefore irrelevant. This contributed to the negative perception of the document as a whole (Prior 1983). Given the flexibility in interpretation and enforcement of the requirements and in the implementation of the measures, there was little incentive for the engineer or contractor to plan or construct to higher than usual standards.

The consensus among NPA surveillance personnel was that the Terms and Conditions was inadequate as a construction document because of the general wording of the requirements. The field coordinator felt that the document could have been used effectively under different administrative arrangements but agreed that by itself it was unsuitable as a source of standards for surveillance purposes (Langford 1983). A document primarily

designed for planning purposes, it was oriented towards construction standards rather than planning process, review, and implementation. As a result, without backup documentation it failed both as a planning tool and field construction manual.

3.3 Design Review

A comprehensive design review process is equally as important as the stipulations in informing the proponent of basic and evolving environmental requirements. It should also serve to inform the regulatory agencies of the level of planning the proponent is likely to achieve and consequently indicate the level of surveillance which may be required. Environmental design review for South B.C. did not proceed as originally intended by the NPA or the province. It was largely ineffective and resulted in a lower level of planning than was required for the environmental management system to operate smoothly and efficiently. The process failed to identify inadequacies in the environmental data base, company plans, procedures, and designs or to develop practical solutions to problems prior to construction.

There is a general consensus among those interviewed that there was sufficient environmental information available for design review purposes. Baseline surveys and impact assessment studies required for right-of-way expansion were carried out from 1974 until after the start of construction. Provincial resource personnel were familiar with regional concerns and

local conditions. From a planning standpoint, however, more fisheries information was necessary to determine the degree of concern at the crossings and establish accurate timing windows. The delay at the Moyie and confrontation between the province and NPA were partially due to inadequate data on fish populations and sensitivity to potential impacts.

Provincial permits issued following design review should reflect agreements made or understandings reached during this process. The provincial referral process was partially effective in that company and agency documents circulated and comments from ministerial staff were taken into consideration during revision. As a result of the process, changes were made in the Terms and Conditions and Procedures Manual regarding activities affecting specific resources such as agricultural land, archaeological sites, and fisheries streams. The system broke down, however, when crossing approvals were issued conditional upon fluming, contrary to earlier agreements with the Water Management Branch and approved in the Procedures Manual. The fact that fluming was subsequently carried out indicates that the province could exercise authority in this manner. It also points to certain deficiencies in design review, specifically the lack of coordination between Victoria, the region, and the NPA.

An evaluation of the administration of environmental requirements for the Trans Alaska Pipeline System (Skinnarland 1977; 432) determined that "The Permittee did not include the

implementation solutions to the intent of the Agreement and the Stipulations as integral parts of the project design and execution". The study recommended that the design review procedure be modified to place more emphasis on implementation. Although concern for implementation was also voiced by the province and recognized as a potential problem by the agency (Yates 1978), the Terms and Conditions did not specifically call for development of quality control or quality assurance programs for the Foothills project (Appendix C). The South B.C. experience reinforces the TAPS finding that the stipulations should stress integration of some form of quality control and quality assurance into project design and execution and that design review should focus equally on plans and means of implementation.

The design review process resulted in the approval by the NPA and the province of the Environmental Plans and Procedures Manual as the basis for the company's environmental management program. The Procedures Manual had provisions for most of the terms and conditions but was weak on implementation strategies. It did not specify how standards were to be maintained or protection measures determined in the field. The chapter on environmental inspection did not specify the authority of the inspector or the spread or describe in any detail the working relationship with activity inspectors, surveillance personnel, or the contractor. No mention was made in the manual of the surveillance role or administrative arrangements between company

and regulatory agencies.

The ineffectiveness of design review in generating adequate documentation of company plans and procedures is attributable, in large part, to the absence of a defined review process. The primary concern of the NPA prior to construction was the establishment of internal administrative arrangements, acquiring and training staff, and development of the Terms and Conditions (Yarranton 1983). Similarly, provincial efforts were directed towards the Terms and Conditions and an administrative agreement with the agency. The province recognized the need for detailed planning but did not put sufficient pressure on the company or the agency to produce acceptable documentation. The province stated that the project was to follow the Linear Guidelines procedures but did not establish itself with the company as the regulatory planning authority. The NPA supported the Linear Guidelines process but simultaneously required the company to produce an Environmental Plans and Procedures Manual in accordance with the Terms and Conditions. This negated in perception and in fact the single window approach to project review, a problem which persisted well into the planning phase for North B.C.

3.4 Surveillance

The regulatory surveillance system did not function as intended. It did not ensure consistent compliance with the Terms and Conditions, Procedures Manual, or provincial permits and approvals. It failed to provide a sufficient level of field authority to arbitrate environmental and engineering conflicts and as a result it was not an effective mechanism for the NPA surveillance staff or the provincial field coordinator to exercise their responsibilities.

Design review should emphasize implementation of environmental requirements and surveillance personnel should be recruited early to participate in the process. This recommendation was made by Wright (1978) in his analysis of TAPS and was supported by Kavanaugh (1978), U.S. (1978), and Skinnarland (1977). Mitchell (1981) makes a strong case that the effectiveness of the field environmentalist in a quality assurance role is dependent, in part, upon awareness of site-specific factors behind planning and design decisions. The same is true for surveillance, particularly when flexibility is stressed in mediating engineering and environmental conflicts in the field.

The NPA recognized the importance of organizing the surveillance system well before construction but was unable to do so. Attempts to reach an administrative agreement with the province were scuttled for political reasons resulting in an eleventh hour scramble to identify, train, and equip the

environmental surveillance officers. There is a general consensus that the individuals selected were qualified and suitable for the job, with adequate environmental training and construction experience. Once in the field, however, they were hampered by the internal organization and administration of the surveillance system. Working under the original surveillance group they were given no clear terms of reference or job descriptions. Formal and informal communication links with the manager, engineer, contractor, provincial authorities, and NPA headquarters were not well established. They had insufficient authority to halt perceived non-compliance with the Terms and Conditions and were forced to follow a cumbersome reporting process which did not provide the responsiveness required for timely or effective field decision making.

The effectiveness of the provincial field coordinator was also restricted by administrative arrangements which limited the formal exercise of authority through the senior surveillance officer. The lack of signed agreement between the MOE and NPA meant there was no firm consensus on construction standards or administrative processes prior to construction and no formal means of resolving surveillance disputes between the agencies. Had the surveillance function been integrated as originally intended, the jurisdictional disputes could have been avoided.

In order to effectively regulate construction activities, surveillance personnel require clear and enforceable environmental stipulations. This point was also stressed by

Wright (1978) in light of the TAPS experience. In Alaska the Joint Fish and Wildlife Advisory Team (JFWAT) was established to carry out a spot check surveillance role. According to Morehouse (1978) the lack of an effective quality control program on the part of Alyeska led to assumption by JFWAT of the quality control function for which the stipulations were inadequate. The NPA planned to avoid this problem by instituting full time surveillance, vesting surveillance officers with greater authority, requiring a higher level of planning by the company, and producing more specific terms and conditions. However, the design review process failed to produce the intended specific plans leaving the Terms and Conditions as the only field reference document for the surveillance team. Compliance with many individual requirements was unmeasurable and therefore unenforceable. The document did not provide the detailed standards and procedures necessary to clearly and consistently determine compliance. There is a remarkable similarity between TAPS and South B.C., then, as the company environmental quality program was not well developed, front line responsibility for environmental protection again fell to the surveillance team, and the Terms and Conditions proved inadequate as a field document.

The Terms and Conditions were adequate for surveillance purposes in Alberta because of a more effective company program. Pressure was not placed on surveillance personnel to the same extent to interpret generally worded requirements under

site-specific field conditions. This suggests that the number and detail of stipulations required for environmental protection is dependent upon the extent of the role which the company intends to play in the management process. Again this is consistent with, and reinforces, the conclusion that surveillance personnel should be involved in design review in order to better ascertain the requirements for specificity in the stipulations according to the level of company planning.

The authority required for surveillance personnel also relates to the effectiveness of the company program. If the company assumes full responsibility for implementation of the program then surveillance staff can assume more of an advisory and reporting role. If the company relinquishes this responsibility surveillance staff must have sufficient authority and will to control the actions of the contractor. Wright (1978; 7) was not concerned with granting surveillance personnel sufficient authority to shut down operations. He observed: ". . . such authority was usually treated with respect and rarely used except when really necessary". It is clear in the case of South B.C. that more individual authority was required for the surveillance officers and greater autonomy for the senior surveillance officer. The cumbersome reporting and appeals process through Calgary which the senior surveillance officer was obliged to follow undermined his authority and compounded problems arising from the Terms and Conditions and general lack of preparedness.

In many respects the perception of authority is as important as its legal basis. The lack of individual authority for the surveillance officers, lack of enforceable standards, nebulous administrative arrangements, and jurisdictional conflicts between regulatory agencies destroyed much of the credibility of the surveillance program on the spread. Both the engineer and the contractor became less willing to comply with many requirements as a result. Credibility and authority once lost are difficult to regain. Their absence led to the resignation of the senior surveillance officer early in the project (Morrison 1983).

3.5 Construction Documentation

Assuming adequate planning and design is assured through the design review process, the keys to effective implementation of the environmental management program by the proponent are clear comprehensive practical instructions to the contractor and effective inspection to ensure compliance. Nutrie (1979; 106) found a strong consensus in the industry that

The key environmental planning activity . . . is the incorporation of environmental controls into construction specifications so that they become part of the budgeted contract and hence legally binding.

This view is supported by Boyle (1981) who attributes good environmental control on the Coquihalla Highway project in part to the quality of specifications supplied to the contractor. The Foothills (Alberta) approach which proved effective incorporated environmental requirements into the company's

overall quality management program. In this manner the contractor was provided with a single set of specifications, alignment sheets and drawings, and an environmental procedures manual for reference purposes. Specifications and environmental designs were developed in conjunction with engineering and construction departments which assured practicality of environmental measures, increased the commitment of the construction group to implementation, and in the final analysis, reduced uncertainty for the contractor during bidding and construction (Mitchell 1981).

The environmental specifications for South B.C. were standard NEB approved construction requirements and were not revised substantially by the company for the project. They covered most areas of concern identified in the Terms and Conditions but left considerable discretion to the construction manager in interpretation and implementation. The Invitation to Bid prepared by the engineer referenced the Terms and Conditions and Environmental Guidelines, the Environmental Plans and Procedures Manual, and the Environmental Field Manual. The contractor was instructed to become familiar with, and adhere to, the requirements within each document. He was also responsible for complying with the specifications, the alignment sheets, the line list, construction drawings, and all applicable federal and provincial legislation, regulations, permits, and approvals. There was no clear indication, however, of how this mass of information, standards, procedures, and general

statements of intent would be interpreted or enforced.

The environmental alignment sheets prepared by the consultant were not used extensively by the engineer or the contractor. The requirements were minimal and too generally worded. They did not contain information particularly relevant to construction timing, procedures, or designs. All mitigative measures easily could have been incorporated on to the construction sheets (Appendix B). The crossing drawings also lacked significant instructions to the contractor. They provided stream profiles but did not specify timing windows or describe crossing procedures.

The Environmental Plans and Procedures Manual was effective as a construction document only in so far as it was approved by the NPA which granted the leave-to-proceed. Approval was more a reflection of the political position of the agency at the time than of the utility of the manual. It was not a relevant document on the spread. The manual, as discussed in Section 3.3, was deficient in a number of respects but approval was required in order to complete financing and planning arrangements with the companies and governments involved. In this particular case the agency's mandate to facilitate construction seems to have had precedence over management of environmental concerns.

3.6 Inspection

Clearly written comprehensive contract documents cannot ensure implementation of the environmental management program without an effective inspection system. The terms and conditions required that the company " . . . in a manner satisfactory to the designated officer, inspect the pipeline and the land and water disturbed by the pipeline . . ." (NPA 1980; 34). The Environmental Guidelines made indirect reference to an "environmental inspector" and an "inspection program". However, there was no specific requirement to establish an environmental quality control or quality assurance program (Appendix C) or to integrate environmental and technical inspection in any way. The design and implementation of the environmental inspection system was left entirely to the discretion of the company.

The brief job description in the Procedures Manual charged the inspector with the " . . . responsibility of ensuring that construction is conducted in such a manner so as to minimize environmental damage" (ANG 1980e); 72). Specific responsibilities listed were exerpted from all terms and conditions which made any reference to inspection or assessment (Appendix D). Again there was no mention made of a quality control or quality assurance program, the company Environmental Management Program, or any other systematic means of ensuring consistent compliance. Neither was it specified whether the inspector would be responsible for enforcing the requirements in the Terms and Conditions, Procedures Manual, or the

specifications. It was a reporting and advisory role with no authority given to direct activities of the contractor in the field.

The role of the field environmentalist, as described in the Inspection Monitoring Procedures and Guidelines, was integrated more completely into a quality assurance-like system. Administrative and reporting functions were more clearly described but specific responsibilities and actual authority again were poorly defined. Modification to the text of this document suggests that an attempt was made prior to submission to transfer responsibility from the environmental to the activity inspectors and possibly eliminate the field environmentalist altogether. This modification took the form of a footnote indicating that references to the environmental inspector were to be interpreted as "not an inspector but part of all other inspectors" (ANG 1980f; Table 2, Appendix 3.4). The two documents taken together were as vague in describing a functional environmental inspection system as the requirements were for its design and implementation.

There was a consensus that the quality of environmental inspection would improve with more specific and enforceable construction specifications. The Alaska Highway Pipeline was to be a high profile project constructed to higher than normal standards. The specifications, arguably the most important document on the right-of-way, were not significantly modified to reflect this intention. As with the surveillance officers, the

inspector did not have the specific documentation necessary for determining acceptable standards and procedures. Although assisted by a consultant in the field, he also lacked the reinforcement of a comprehensive environmental design with which to work and the support of an environmental design or planning group within the company.

The addition of the second better qualified environmental inspector improved the quality of inspection and relations with surveillance personnel but did not remedy the organizational problems. The inspector, like the surveillance officers, was hampered with inadequate terms of reference, insufficient authority, and by not being integrated into a wholly functional quality control system. It appears that the inspector's role evolved with the individual during construction and largely became one of liason with surveillance personnel.

The quality of the company's inspection system, perhaps more than any other factor, indicated the level of genuine commitment to environmental management. As Mutrie (1979; v) noted,

The rationale for employing environmental supervision (inspection) is that a strong committment to environmental control adopted during the environmental planning stage warrants a strong enforcement measure during construction

A number of observations indicate a lack of serious planning for inspection on this project. These include the qualifications of the first inspector, the discrepancies between the manager and engineer regarding the program, and the apparent willingness of

the engineer in the early stages to operate with environmental inspection only at the activity inspector's level.

Mitchell (1981) documented commitments made by ANG and Foothills to quality control and full time environmental inspection at NEB hearings into the Foothills (Yukon) application. Citing an EPS report (Canada 1978b) which estimated that substantial numbers of field inspectors and design review staff would be required, he observed that ". . . the pipeline companies were not going to allow government to usurp a function which was obviously in their interest to control" (1981; 39). The company was very apprehensive of the new environmental requirements and government enforcement procedures for what was perceived to be a small looping project. It saw little benefit in developing a comprehensive environmental management system for such a project or attempting to fully accommodate the requests of a fractious assembly of regulatory agencies. The result was a paper program which superficially dealt with the regulatory planning requirements coupled with a diplomatic stonewalling of efforts to change field procedures while construction was underway. There was little intent, therefore, to design or implement the inspection system and little commitment to its effective operation.

All parties involved in the project agree that the completed pipeline is of high quality and no permanent environmental damage was sustained during construction. The

problems encountered on the project were primarily administrative and reflect, in large part, the different perceptions of the players. For the manager and engineer it was an average looping program using existing right-of-way, following standard construction procedures, and presenting little or no environmental threat. For the press it was the Alaska Highway Gas Pipeline, the largest privately financed construction project ever undertaken and one of the most controversial in Canadian history. The NPA and the province regarded the project as a preview of mainline construction questions and a test case of jurisdictional and management issues. Hopefully through hindsight evaluation perceptions of scale and risk held by the regulatory agencies and the proponent can be more closely aligned. As a result of this pipeline, administration of other projects should be substantially improved promoting greater harmony between players without increasing the cost or time of project construction.

CHAPTER IV

RECOMMENDATIONS

The institution of new management systems is seldom immediately successful. The problems encountered do not necessarily indicate structural deficiencies but may result from implementation difficulties. The environmental management system designed for the Alaska Highway Project worked well in Alberta and, with modification, could be applied to mainline construction in North B.C.

The following recommendations are based primarily on conclusions drawn from this evaluation of the Foothills (South B.C.) project. Findings from other studies which apply to this pipeline are also repeated. Some recommendations apply specifically to North B.C. but have application to other projects as well. Environmental management requirements will vary from project to project depending on size and risk. The recommendations are general, therefore, indicating areas which require improvement and directions for change rather than specifying particular designs or procedures.

Regulatory Arrangements

1. The formal master agreement between Canada and British Columbia should be signed before further administrative planning

is undertaken for the North B.C. segment of the Foothills project. This would ensure greater political will to cooperate in, and more fully coordinate, project administration.

2. An administrative agreement between the senior governments should be reached before further work on the North B.C. segment is undertaken and generally as early as possible in the planning stage for other projects. Such an agreement should formalize areas of jurisdiction, cost sharing arrangements, and procedures for information exchange, design review, permitting, surveillance, and monitoring. Arrangements should be defined to a level which permits the "single window" approach to project regulation to function as such, simplifying the proponent's passage through the planning and approvals process.

3. A formal review committee of NEB, NPA, and provincial personnel should evaluate all management aspects of this project prior to recommencement of mainline construction planning. Such evaluations should be carried out routinely and systematically for all large projects in order to improve management methods.

Environmental Planning

4. Better utilization should be made of regional resource personnel and data bases in project planning, design review, and surveillance. Those most familiar with the resource base should be involved in management from the planning phase through

construction to cleanup.

5. Environmental inventory and impact assessment study requirements should reflect the size of the project and risk involved. Greater effort should be made to determine what specific information is required which could affect project design, construction timing, or construction procedures. Coordinators and coordinating committees should play a more active role in assessing relevant environmental concerns and arbitrating inter- and intra-agency conflicts.

Terms and Conditions

6. Environmental terms and conditions or stipulations should be provided for the proponent as early as possible in the planning process. The terms and conditions should provide direction concerning the level of environmental management expected but, more importantly, they should also detail the documentation required, the design review process, and the acceptance criteria to be used.

7. The terms and conditions should emphasize the implementation of environmental management systems and controls which the proponent develops. Integration of environmental requirements into standard quality control and quality assurance systems should be encouraged.

8. If the terms and conditions or stipulations provided to the proponent are to be used in the field by surveillance personnel they should be specifically worded so that compliance is measureable and therefore enforceable.

Design Review

9. Powers and responsibilities for design review should be clearly defined between levels of government and among the agencies involved. Each authority should be made aware of explicit requirements in the process and also the realistic limitations to its involvement. Coordinators must be actively involved in assessing the relevance of individual agency concerns, evaluating the adequacy of the proponent's design, and assigning priorities to critical environmental management system components. The lead agency should have a clear understanding at the beginning of what is to emerge from the process.

10. Design review should lead to the issuance of permits and approvals which reflect understandings and agreements reached during the process. The proponent should expect regulation during construction to be predictable and consistent with the agreements made.

11. As with terms and conditions, design review should be focussed equally on construction standards and implementation of the environmental management program. The surveillance and

inspection systems must be well documented and designed with reporting procedures and lines of authority clearly defined.

12. Surveillance personnel should be involved in design review and construction planning. These individuals should be appointed early in the planning process and be at a high level of preparedness when construction begins.

Surveillance

13. Levels of authority and lines of communication should be clearly established for surveillance personnel. Working relationships should be developed early with all relevant management, regulatory, and construction personnel on the spread. If authority of field surveillance personnel is restricted, the reporting system should allow for decisions to be made quickly at the management level so that construction delays are avoided and surveillance credibility is maintained.

14. Surveillance on the spread should be limited to a single authority. Joint federal-provincial surveillance systems must be designed to permit both parties satisfactory levels of input. Visible conflicts between agencies should be avoided if authority and credibility are to be maintained.

15. Surveillance personnel should have explicit terms of reference and detailed standards or stipulations to enforce.

Construction Documentation

16. The documentation supplied to the contractor for environmental management purposes should be minimized. General construction activity standards should be written as specifications and integrated into the contract document. Site-specific requirements should be detailed on the alignment sheets with reference to a procedures manual or a typical drawing if required. Only environmental information which directs the actions of the contractor should be placed on sheets and drawings.

17. An environmental procedures manual or other such document should detail the environmental management system for the project. The roles and authority of all surveillance personnel, environmental inspectors, and activity inspectors should be clearly described.

Inspection

18. Environmental inspection should be integrated into an environmental management system rather than appended to a regular inspection program. The environmental inspector or a field environmentalist should be placed in a quality assurance role, acting as a resource person or an advisor to activity inspectors and management. The inspector should have direct ties with the environmental planning or management group.

19. Front line responsibility for environmental inspection should be placed with the individual activity inspectors. Environmental specifications particular to each activity should be completely integrated with construction specifications and enforced in the same manner as part of a quality control program.

20. As with surveillance personnel, environmental inspectors should be involved early in the planning process if they are to perform a quality assurance function or act in an advisory role.

21. As with surveillance personnel, the role and authority of the environmental inspector must be clearly defined and well understood on the spread. The individual should assure that formal and informal lines of communication are established and maintained with surveillance personnel, the contractor, and the engineer.

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APPENDIX A

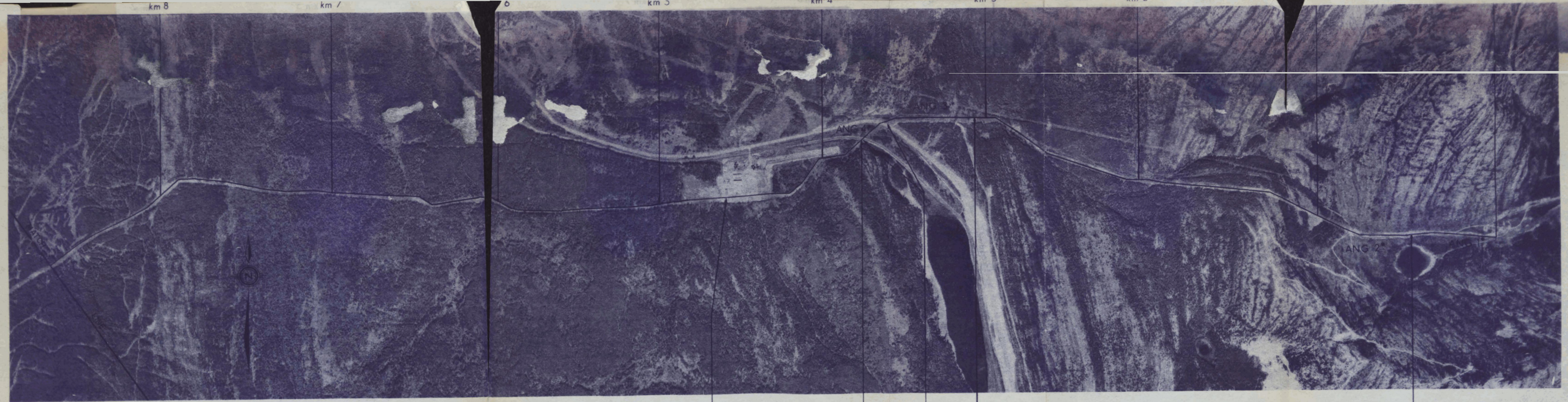
Section 3 Northern Pipeline Act

OBJECTS

3. The objects of this Act are
 - a. to carry out and give effect to the Agreement;
 - b. to carry out, through the Agency, federal responsibilities in relation to the pipeline;
 - c. to facilitate the efficient and expeditious planning and construction of the pipeline taking into account local and regional interests of the residents, particularly native people, and recognizing the responsibilities of the Government of Canada and other governments, as appropriate, to ensure that any native claim related to the land on which the pipeline is to be situated is dealt with in a just and equitable manner;
 - d. to facilitate, in relation to the pipeline, consultation and coordination with the governments of the province, the Yukon Territory and the Northwest Territories;
 - e. to maximize the social and economic benefits from the construction and operation of the pipeline including the maximizing of the opportunities for employment of Canadians while at the same time minimizing any adverse

effect on the social and environmental conditions of the areas most directly affected by the pipeline; and

f. to advance national economic and energy interests and to maximize related industrial benefits by ensuring the highest possible degree of Canadian participation in all aspects of the planning and construction of, and procurement for, the pipeline while ensuring that the procurement of goods and services for the pipeline will be on generally competitive terms.



Appendix B

CONSTRUCTION DETAILS

Stream crossing at Summit Creek (km 3.7)
 Site of water withdrawal and discharge from Summit Creek. Annual discharge .05 m³/sec.

Stream crossing at tributary of Summit Creek (km 3.1)

Pipeline crosses railroad and Highway 3 (km 3.5)

Tie in with existing line (km 4.6)

Tie in with existing line (km 0.4)

ENVIRONMENTAL CONCERNS

Summit Creek contains spawning habitat for cutthroat trout
 Beaver dams and ponds downstream of crossing of Summit Creek

← Crows Nest Prov. Park →

Highway 3 receives high summer use by tourists

← Winter range for deer, elk, moose, and bighorn sheep (high density) →

MITIGATIVE MEASURES

Water for hydrostatic testing will not be withdrawn from beaver ponds

Right-of-way on east side of Highway 3 crossing will be revegetated with shrubs to reduce visual impact and control vehicular access to right-of-way

Vehicle activity will be restricted to existing roads and right-of-way

← Clearing and ditching operations will be monitored by an archaeologist →

* Archaeological sites ANG 1 and 2 will be flagged and all vehicles will be excluded from the sites. Archaeological sites ANG 3 and 4 will be excavated prior to construction. All vehicles will be restricted to the right-of-way in this area.

	ALBERTA NATURAL GAS COMPANY LTD. AGENTS FOR FOOTHILLS PIPE LINES (SOUTH B.C.) LTD.
	ENVIRONMENTAL ALIGNMENT SHEET PREBUILD km 0.4 to km 4.6
	DWG NO. 5 08 01 00 EV-001

APPENDIX C

Quality Assurance and Quality Control

The CSA Z299 Standards (Canadian Standards Association 1978), provide the following definitions:

1. "Quality Control" means those actions which provide a means to measure and regulate the characteristics of an item or service to established requirements.
2. "Quality Assurance" means a planned and systematic pattern of all means and actions designed to provide adequate confidence that items or services meet contractual and jurisdictional requirements and will perform satisfactorily in service.

Quality assurance includes quality control.

Once a contract has been established for construction, a primary responsibility of the company is to ensure that the contractor complies with specifications, standards, technical performance levels, and any regulatory requirements which affect the company. Other responsibilities include ensuring that the contractor meets production schedules and is allocating adequate resources to individual activities. Quality control is the field program established to ensure that the contractor is complying with the terms of the contract. Its primary tool is continuous inspection of all (pipeline) construction activities. Standard practice is to assign an individual inspector to each

pipeline activity. Construction inspectors (activity inspectors) report to a chief inspector who in turn reports to a project or resident manager. Successful quality control is largely dependent upon clear specifications containing required as well as restricted construction practices.

Quality assurance presupposes a system or program wherein quality is designed into the product from its conception. Appropriate checks are then maintained to ensure that quality standards are met at every stage in the process. An environmental quality assurance program, therefore, would integrate environmental requirements into engineering design from the beginning. The program is implemented by making construction inspectors responsible for environmental concerns associated with the particular activity they are inspecting. If clear specifications are provided, then inspecting for environmental concerns becomes just another part of the job. The environmental inspector, or more appropriately the field environmentalist, assumes a role of ensuring that the activity inspectors are enforcing compliance with the specifications and providing advice and interpretation. This second level of control is a component of quality assurance.

APPENDIX D

ANG Environmental Plans and Procedures Manual

Job Description for Environmental Inspector

Part 19

ENVIRONMENTAL INSPECTION AND MONITORING

An Environmental Inspector will be appointed by the Company for each pipeline spread. The Inspector will be thoroughly familiar with construction procedures, knowledgeable of environmental principles, trained in dealing with environmental emergencies, and familiar with the environmentally sensitive areas traversed by the pipeline.

The Environmental Inspector, reporting to the Project Engineer, will be on-site for the duration of the construction period with the responsibility of ensuring that construction is conducted in such a manner so as to minimize environmental damage. The Inspector will:

1. Be responsible for the environmental education program (see Part 21);
2. Oversee the environmental monitoring program;
3. Keep Project Engineer informed of environmental standards and required approvals pursuant to Provincial and Federal

Legislation;

4. Inspect proposed staging areas and stockpiling areas (see Part 17);
5. Inspect clearing operations near streams and report any inappropriate procedures (see Part 10);
6. Inspect aggregate extraction operations and report cases where the construction operations are promoting erosion, sedimentation of surface waters, or interference with ground water;
7. Inspect access roads (see Part 13);
8. Ensure that the right-of-way is free of litter (see Part 12);
9. Be present during stream-crossing operations and assess the condition of the stream banks before and after crossing and the relative extent of siltation and sedimentation (see Part 15);
10. Inspect hydrostatic testing procedures, including water withdrawal and disposal (see Part 16);
11. Assess the condition of the right-of-way following clean-up and reseeded operations (see Part 2);
12. Advise both Company and Contractor's personnel of large congregations of animals in the vicinity of the right-of-way, and ensure that no deliberate harassment of these animals occurs (see Part 6);
13. Inspect wildlife habitat to evaluate the effectiveness of mitigative measures (see Part 6);

14. Inspect any storage facility under control of the Company (see Part 11).

The Company may also, from time to time, retain environmental consultants to assist in the monitoring program, and for advice pertaining to site specific conditions such as knapweed infestations, fish use at stream crossings, potential erosion areas, revegetation, and wildlife interactions.

Archaeological sites in the vicinity of the right-of-way will be flagged to prevent disturbance of the sites during construction of the pipeline. In addition, a qualified archaeologist will be on-site during trenching operations in those areas where potential archaeological values have been previously established. These areas have been shown on the Environmental Alignment Sheets in Appendix A.

During normal operations, the pipeline route is air patrolled monthly to detect right-of-way erosion. In addition, the Company routinely patrols the right-of-way on the ground for more detailed inspection. Any necessary right-of-way repair will be completed to the satisfaction of the landowner, tenant or any other authority having jurisdiction. Shrub and tree control on the right-of-way will be achieved by mechanical rather than chemical means in order to permit vegetation development over as large a portion of the right-of-way as possible. This will avoid destroying forbes on the right-of-way and damaging vegetation adjacent to the right-of-way.