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The Role of EIA in the Hydroelectric Planning Process

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INTRODUCTION

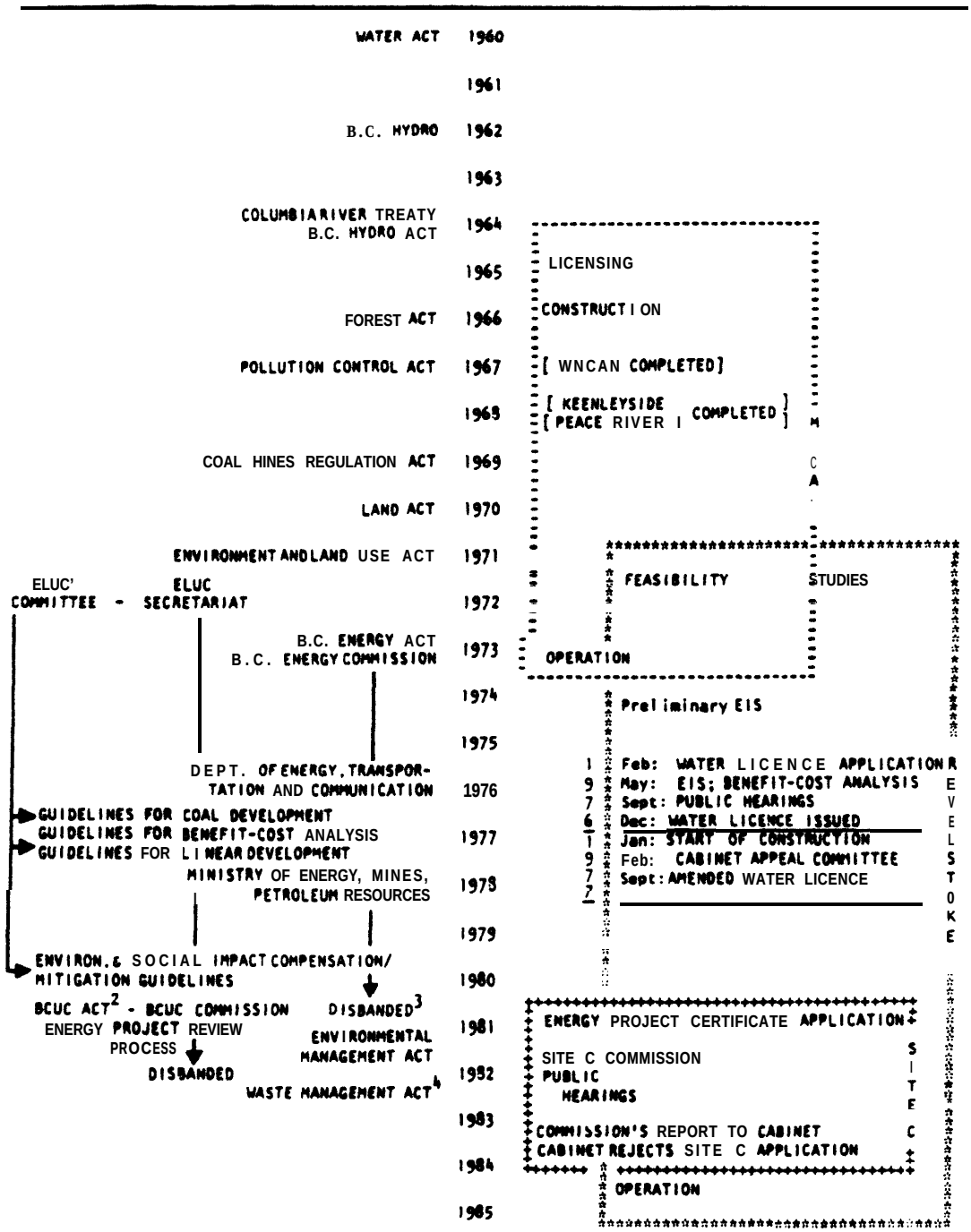
Procedures for the selection, licensing and implementation of large scale energy projects must evolve with the escalating complexity of such projects and the changing public value system. Despite the introduction of cost-benefit analysis in the early 1960s (Sewell et al., 1962), followed by environmental and social impact assessment procedures in the late 1960s and early 1970s, respectively, government policies appeared unresponsive to the rapidly changing conditions.

The environment itself became recognized as a natural resource, fundamental to human survival, and the growth ethic was seriously questioned. However, legislative and procedural changes were slow to develop and implementation of large scale development projects led to numerous conflicts. Projects were approved without their need having been justified within the broad policy context as this was generally beyond the narrow mandate of the approving agency. The need to identify the objectives of the three major participant groups--the developer, government, and society at large--and to find ways of accommodating their differences was not addressed. As a rule, direct public input into resource development had little or no effect on the actual decisions made (Grima, 1985). Large scale development projects were implicitly sanctioned by government, rather than explicitly approved within the public forum.

From these conflicts arose the public's demand for a change in the decision making process itself: from a representative to a more participatory democracy. A stronger and more meaningful public participation at the policy-making, program or project approval, and implementation level was perceived to render the selection and approval of large scale development projects fairer and more credible (Case et al., 1983) by leading to government accountability and to better informed decisions that would be in the public's interest (Burch, 1976; Grima, 1985). Additionally, the experience with environmental impact assessment (EIA) to date had clearly shown that it, too, must be improved in order to become an effective and integrative assessment tool of development projects (Beanlands and Duinker, 1983; Henshaw, 1984; Larking, 1984). In the face of these persistent demands for change, government could not help but respond and the 1980s saw the evolution of public policies and the accompanying introduction of new selection, approval, and implementation procedures for large scale development projects. In British Columbia the increasingly more contentious approvals of major hydroelectric development projects under the Water Act (1960) in the 1970s, led to the introduction of the Energy Project Review Process (EPRP) under the B.C. Utilities Commission Act in 1980 (see Table 1).

The geographer's interest in resource development has grown up within the man-land tradition of the discipline. This growth has been enriched by interactions with those in the environmental, behavioral, management, and policy sciences and tested by geographers who are professionally

Table 1 B.C. Legislation, Agencies and Procedures in Relationship to the Licensing of Selected Hydroelectric Projects



1. Environment & Land Use.
2. B.C. Utilities Act.
3. Some functions to D.C. Utilities Commission and to Ministry of Energy, nines and Petroleum Resources.
4. Replaced Pollution Control Act (1967).

engaged in resource management (O'Riordan, J., 1981). In the 1960s Canadian geographers were already writing about techniques of project assessment (Sewell et al., 1962) and the institutional arrangements required for the development of international river basins (Chapman, 1963). By the early 1970s major general works on resource and environmental management had been published (Burton and Kates, 1965; White, 1971; O'Riordan, T., 1971; MacNeil, 1971) and by the end of that decade the emphasis on the general theme was giving way to more focussed lines of enquiry often in the context of water resources.

As early as 1971, and reflecting the influence of the behavioral approach, the role of perceptions and attitudes in resource management was documented (Sewell and Burton, 1971). This was quickly followed by some of the first writings by geographers on public participation in resource management decisions (Draper, 1975), a sub-theme which has evolved rapidly ever since (Owen, 1985; Grima, 1985). Also in the mid-1970s geographers began to focus upon environmental quality (Berry et al., 1974) and the character and role of environmental impact assessment techniques (Mitchell, 1976; Mitchell and Turkheim, 1977), another sub-theme which has developed into a major area of geographical enquiry (Maclaren and Whitney, 1985). Writing on the policy, institutional and administrative aspects of resource management also started in the mid-1970s (Mitchell, 1975; Jackson, 1976; Mitchell, 1977), matured in the early 1980s (O'Riordan, T. and Sewell, 1981b; Mitchell and Sewell, 1981) and now constitutes another established sub-theme for geographers in the more general context of resource management.

In this paper several of the sub-themes noted above have been combined in a study that documents and evaluates the selection, licensing and implementation of the Revelstoke Hydroelectric Dam under the Water Act and assesses to what extent the current EPRP selection and licensing procedure in the case of the Site C Dam proposal overcame the shortcomings of the Revelstoke experience. The methodological approach is that of a post-development analysis. This type of analysis reflects the work of Mitchell (1977), draws upon the methodology more recently developed by Munro et al. (1986) and benefits from the conceptual framework developed by O'Riordan, T. and Sewell (1981a), and Sadler (1983).

THE REVELSTOKE HYDROELECTRIC PROJECT

In the 1960s electric energy demand in B.C. experienced a period of rapid increase (average >14%). B.C. Hydro and Power Authority (B.C. Hydro), a Crown Corporation established by the provincial government in 1962, met this demand by building major dams on the Peace River in northeastern B.C. and, under the Columbia River Treaty of 1964, on the Columbia River in southeastern B.C. Project approval proceeded under the Water Act (1960), which did not address project selection and justification within the public forum and policy context. Public concern about the lack of such provisions led to the introduction of new

legislation. The Environment and Land Use Act (1971) and the B.C. Energy Act (1973) to some extent dealt with these issues (Table 1). However, when B.C. Hydro indicated the need for another large scale development in the early 1970s new approval procedures were not in place. Furthermore, the B.C. Energy Commission, which administered the latter Act, held no jurisdiction over B.C. Hydro. Consequently, the Revelstoke Dam, too, was licensed under the Water Act.

PROJECT DESCRIPTION

With a planned electric generating capacity of 2700 megawatts (MW), the Revelstoke Hydroelectric Dam (Revelstoke Project) would add more than half of B.C. Hydro's existing capacity of 5080 MW. The dam site is on the Columbia River, 5 km north of the City of Revelstoke, in southeastern B.C. (Figure 1). The Project consists of a concrete dam, an earthfill dam and a spillway with a power house designed to hold six electric power generators of 405 MW each. The reservoir (surface area 11,534 hectares) stretches 130 km north in a narrow, forested valley to the Mica Dam. Two thirds of the reservoir water comes from Mica Dam and the other third from tributaries south of that Dam.

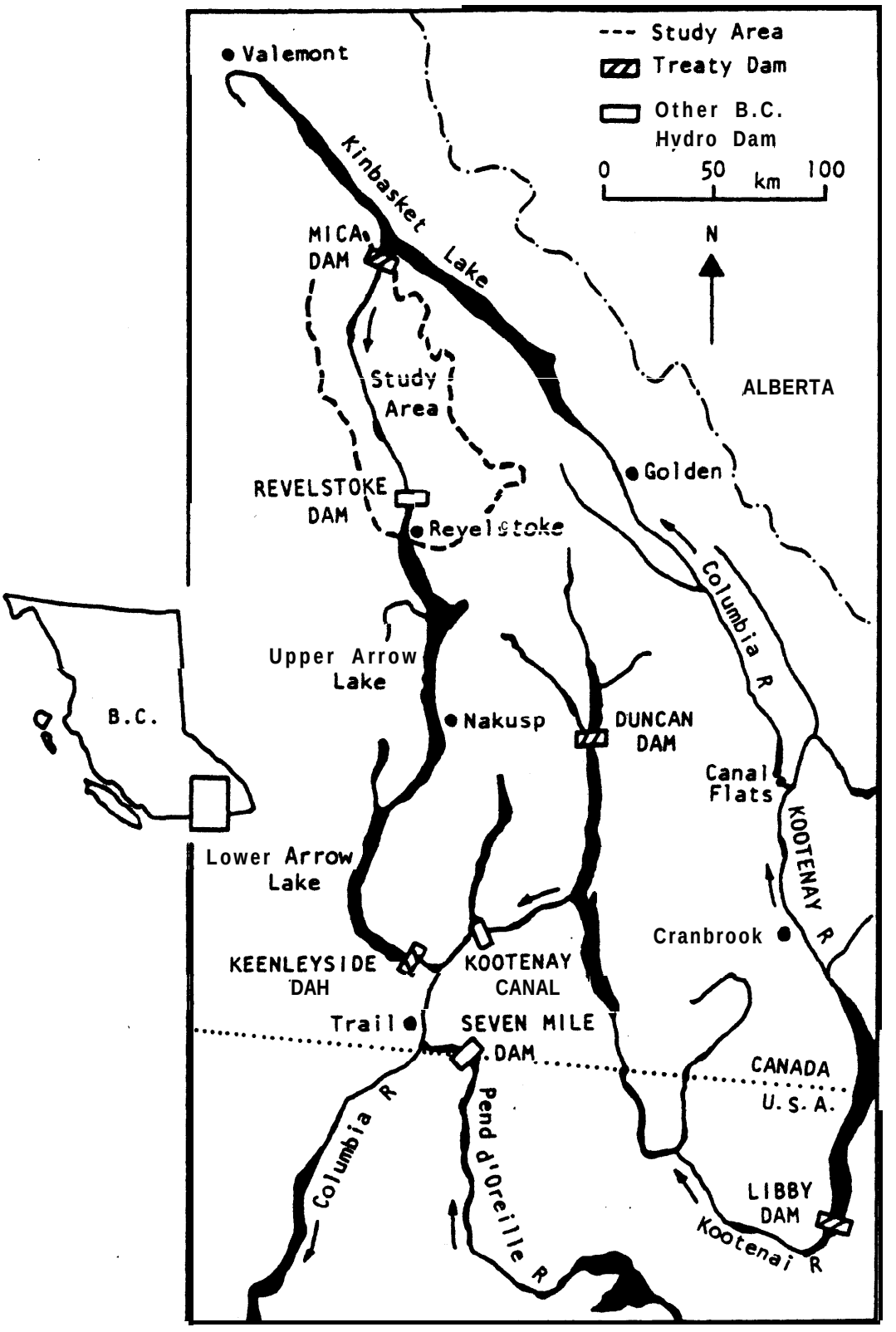
Water release criteria are dependent on the obligations for discharge from Mica Dam and storage requirements in the Arrow Lakes under the Columbia River Treaty. In the short term, however, the Revelstoke Project can be run independently of the other two dams. The Project is a predominantly run-of-the-river plant, insofar as it is only used for flood control in times of extreme flood danger. Thus reservoir peak level (573 m) and use of the spillway are rare (B.C. Hydro, 1976b).

It took almost fourteen years to complete the Project: six years from initial studies in 1971 to the start of construction in 1977, and just under eight years to operation in 1984. Only four turbines, with a generating capacity of 1800 MW, were installed.

PLANNING PHASE

B.C. Hydro justified the need for a new project to come on line by 1982 solely on its own forecast of an annual electric energy demand increase of 10.2% to the year 1990 (B.C. Hydro, 1975). This contrasted strongly with the B.C. Energy Commission's forecast of 5.5% for 1974-1982. The Crown Corporation had been convinced of this need since the late 1960s and by 1971 appeared to be favouring the Revelstoke site for which feasibility studies were then initiated (Table 2). Preliminary design for the Revelstoke Project commenced in 1974, even before cost-benefit comparisons of six other potential projects, including three variants of the Revelstoke proposal, were completed (Reid, 1976; Environment and Land Use Committee, 1977). By late 1975 and after engineering, financial and environmental (predominantly concerned with

Figure 1 **The Columbia River Treaty Dams and Other Dams of the Area** (based on B.C. Hydro, undated)



potential dangers of the Downie Slide area) factors had been weighed, B.C. Hydro was committed to building the Revelstoke Project, and, early *in* 1976, applied to the Water Management Branch for the approval of the Project in the form of a water licence. The Revelstoke Project had been selected single-handedly by B.C. Hydro--without participation by the public and government ministries, and despite the conflicting energy demand forecasts.

LICENSING PHASE

Initial project licensing by the Water Management Branch took just under a year: from the water licence application in February 1976, the public hearing in September to the issuance of the water licence in December of that year. Notwithstanding an appeal to Cabinet to revoke the water licence, B.C. Hydro was able to continue with the dam construction, which had commenced in January 1977. On the recommendations of an appeal tribunal, Cabinet amended the conditions of the water licence twice (September 1977, June 1978) and a consolidated water licence was issued by the Water Management Branch in August 1978, thus completing the approval phase of the Project.

The Water Act Licensing Procedure

The Water Act approval procedure was concerned mainly with engineering and safety issues, and site-specific environmental matters. The applicant had to furnish such information as the descriptions of the land, water to be diverted, purpose and project specification. A review of the justification of the project and an environmental impact statement (EIS) were not required. However, the Comptroller of Water Rights could request any information that he considered relevant. Individuals or groups could file objections to development proposals and public hearings were to be held at the discretion of the Comptroller (Bankes and Thompson, 1981). At public hearings the Comptroller could adjudicate any relevant issue brought to his attention as long as it was within his mandate as outlined in the Water Act. Upon approval of a development the Comptroller could include any conditions with the water licence that he considered necessary to the implementation and operation of the project. Of note is that, though B.C. Hydro had always complied with the Comptroller's orders, the B.C. Hydro Act (1964, Section 53A) exempted the Corporation from having to comply with any provincial statute or statutory provision. The public had the right to appeal the issuance of the water licence. If the appeal was accepted, Cabinet would pass the final decision for upholding, amending or revoking the licence.

A major shortcoming of these provisions was the narrow mandate assigned to the Comptroller of Water Rights--the assessment of project selection and justification were not his authority. This, as well as the attitude of B.C. Hydro, led to the public's perception that the Revelstoke

Project public hearing was a sham and the question arose at the hearing: Does the Comptroller of Water Rights have the mandate and expertise to assess a project of such complexity? (Anthony, 1979; Waite, 1979; Bankes and Thompson, 1981).

The Water Act authorized the Water Comptroller to rule on the use and withdrawal of water from provincial water bodies. Thus he could evaluate the engineering and some environmental conditions for a project at the public hearing. O'Riordan, J. (1981) states that the Comptroller cannot decide on matters pertaining to energy and resource policies or to project alternatives. Nevertheless, at the Revelstoke hearing, the Comptroller allowed discussions of these issues to take place as much as he possibly could, but he neither conducted a detailed examination nor passed a decision on project justification. The conflict between the electric energy growth forecasts by B.C. Hydro and the B.C. Energy Commission was not resolved.[1]

On the other hand, the Water Comptroller appeared to exceed his mandate by ruling on the broad range of environmental, social and economic concerns of the Project. Anthony (1979) writes that wildlife management schemes and the determination of social impacts were outside the Comptroller's mandate. In fact, he believed that the only reason why the proponent did not challenge the Water Comptroller's mandate in these matters was that they needed the water licence to proceed.

Additionally, the expertise in environmental and socio-economic issues of the Comptroller and of his staff was questioned. The Water Management Branch staff consisted mainly of engineers who lacked the necessary qualifications. Although technical consultants from provincial ministries were retained for the public hearing, it was an inadequate provision. The consultants asked few questions and were inaccessible to the public, who also perceived them as biased due to their past and anticipated future dealings with B.C. Hydro. Their advice to the Comptroller should have been made public, so that intervenors could have questioned or challenged it (Anthony, 1979). Furthermore, if the Project were to be approved, the Water Comptroller would retain jurisdiction over these matters during the implementation phase as stipulated in the conditions of the water licence.

Participation by the public and concerned government agencies during the planning phase of the Project had not been possible and only improved somewhat during the approval stage. Initially, B.C. Hydro seemed to be in control of the schedule of events. The Water Comptroller determined the hearing style and date, the latter as requested by the Public Utility.

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1. Although B.C. Hydro lowered the demand increase forecast from 10.2% to 8.6% at the public hearing, the Company insisted that the Revelstoke Project was needed by 1982.

Table 2 Studies for Project Select ion

STUDIES	CONTENT	RESULTS
Feasibility Studies 1971 - January 1973	Two alternatives examined: (1) high Revelstoke dam at 573 m[1] (2) combination of two dams: Revelstoke Dam at 514 m Downie Creek Ban at 573 m	Alternative (1) more economical: lower capital costs higher Installed capacity higher ● lectrlc production
Downie Slide Study July 1973 - April 1974	Panel of experts examined safety concern over Downie Slide - massive bedrock slide, 10,000 years ago, 65 km north of Revelstoke	Slide does not impose any limitations on tither of the alternatives (I) and (2)
Preliminary EIS Jan. 1973 - Oct. 1974	Preliminary EIS on ● Iternatlve5 (I) and (2) conducted by private consultant firm	Essentially no difference between environmental Impacts on fish, wildlife, recreation, agriculture & mineral resources for the two ● Iternatlves
Preliminary project Design June 1974 - early' 1976	B.C. Hydro chose ● Iternative (1) and proceeded with Its preliminary design	
Cost-Benefit Analysis 1976	Six ● Iternatlves assessed: (1) and (2) as above, (3) low Revelstoke Dan at 514 m, (4) Downie Creek Dam at 514 m, (5) Peace-McGregor hydroelectric project (6) Hat Creek thermal-electric project	On basis of provincial income, the environment and effect on region, alternative (I) most cost-effective but some undetermined mitigation expenditures not included
Environmental Impact Preview February 1976	B.C. Hydro Issued a very short preview on alternative (I)	
final EIS Aug. 1975 - May 1976	B.C. Hydro rewrote 2 reports by private consultant firms, combining environmental, social and economic Impacts In one EIS[2]	Private consultants' view: B.C. Hydro EIS not Incorrect, but they would have described the rltuatlon dlffercntly[3]

1. Elevation figures signify the full reservoir water operatlng level above sea level.
2. B.C. Hydro, 1976b
3. Anthony, 1979

This allowed intervenors too little preparation time and necessitated a rescheduling of the hearing. Whereas all participants complied in filing their relevant data with the Comptroller, B.C. Hydro did not.

The Comptroller held a 21-day hearing in Revelstoke (Comptroller of Water Rights, 1976a, 1976b). It was quasi-judicial, allowing for cross-examination except of the advisors to the Comptroller. A B.C. Hydro commentator felt that participants were not intimidated as the hearing was conducted in an "unimposing relaxed manner" (Waite, 1979, p. 55). Of the forty-four intervenors all but three objected to or raised concerns about the Project. The main issues raised were adverse environmental, social and economic impacts; lack of environmental baseline data resulting in the inability to devise mitigation and compensation measures; public safety with regard to the Downie Slide; and project justification (Water Management Branch, 1976-1988). Intervenors lacked funding for efficient participation and thus were at a disadvantage compared to B.C. Hydro, who had retained twenty-two specialist consultants.

The most serious criticism of the public hearing was that its primary function turned out to be the gathering of information rather than the assessment of information (Anthony, 1979). The main source of environmental data was the EIS. Despite the fact that such a document was not required under the Water Act, B.C. Hydro had prepared an EIS (B.C. Hydro, 1976b) by combining two consultant reports. Deficiencies in the available baseline data were blatant; the reports had only been commissioned in August 1975 and were based on the terms of reference determined by B.C. Hydro. The exclusion of the government and the public limited the identification of concerns and the establishment of priorities to those perceived as important by the proponent. Thus data deficiencies were only identified at the hearing and the resolution of significant issues, such as determining environmental protection and mitigation measures, and compensation for fish and wildlife losses, had to be deferred to the project implementation phase to be dealt with under the conditions of the water licence.

Another shortcoming arose from the public's view of the role of the public hearing. From information disseminated by B.C. Hydro, the public perceived that the major decisions had already been made. In the eyes of many, B.C. Hydro had established both that none other than the Revelstoke Project would meet the electric energy demand by 1982, and that the Project had been adequately assessed so "that the public hearing was really a matter of fine tuning" (Anthony, 1979, p. 61). The Environmental Preview Report (B.C. Hydro, 1976a) substantiated the former and the EIS the latter ". . .decision makers . . .through the public hearing process will determine the final form and extent of the development" (B.C. Hydro, 1976b, p. V). Furthermore, B.C. Hydro declared at the beginning of the public hearing that construction contracts for the dam had already been awarded, subject to approval of the Project. B.C. Hydro had established the need for-the Revelstoke Project, the provincial government had

implicitly approved it, and the Water Comptroller dutifully issued the water licence on December 1, 1976 (Comptroller of Water Rights, 1976c).

The Water Licence Appeal

Four intervenors (three conservationist groups and a forestry company) appealed the issuance of the water licence. In essence the appeals called for a delay, but preferably for the cancellation of the water licence. The need for the Project had not been proven, B.C. Hydro had too much power over environmental matters, and conditions of the water licence were inadequate with respect to environmental issues and public participation. A five member Cabinet Appeal Committee was set up to hear the appeals and make recommendations to Cabinet. Whereas the members of the Committee concurred that the Project was needed at some time in the future, they did not determine when for two reasons: the decision was "perhaps" outside their terms of reference and the evidence was not at all complete (Cabinet Appeal Committee, 1977). Some Committee members thought a later in-service date would allow more time to study financial implications and consequences of borrowing requirements, the Revelstoke labour requirements in relation to those of future projects, and environmental, social and economic concerns. The Committee asked Cabinet to determine the starting and in-service dates of the Project, but in so doing to consider the Committee's report.

The Appeal Committee made three recommendations concerning issues not specific to the Revelstoke Project. First, the Committee concluded that the Water Comptroller was required to rule on matters well outside the sphere of the Water Act when approving such projects as B.C. Hydro's. It recommended that in future an organization not connected with the proponent forecast the electricity demand growth rate.

Second, the Committee recognized the deficiencies of the Water Act in regard to environmental, social, and economic aspects, and the limited staff available in the Water Management Branch for the enforcement of water licence conditions. The latter was seen as particularly crucial when dealing with the long-term commitments and complexities of large scale developments. Consequently, it was recommended that the Minister of Environment and member Ministries of the Environment and Land Use Committee (ELUC) develop new legislation outside the Water Act to provide the necessary framework for licensing such projects as Revelstoke.

The third recommendation was that B.C. Hydro's right not to have to comply with the Water Act be revoked.[2] This exemption corroborated the perception that B.C. Hydro was largely beyond the government's control and

2. Cabinet did not act on this recommendation. The Hydro and Power Authority Act (1979) is still in effect, thus to date B.C. Hydro has retained the same power.

that the Water Comptroller might have been unable to enforce the orders he issued to B.C. Hydro.

Cabinet did not grant the moratorium called for by the appellants and favoured by some of the Appeal Committee members, but rather amended the water licence as recommended by the Committee (Comptroller of Water Rights, 1977b).

The Water Licence

The conditional water licence (Comptroller of Water Rights, 1976c)[3] and its amended versions (Comptroller of Water Rights, 1977b, 1978) outlined the provisions under which the Revelstoke Project was to be implemented. The licence of June 1978 consolidated the original licence and the amendments. It contained twenty-six conditions, the enforcement of which was the responsibility of the Comptroller of Water Rights. Twelve of the conditions were common to water licences in general and had not been amended. They pertained to the source, diversion, storage, volume and use of water, construction of the dam and auxiliary facilities, and effective dates of licence and operation of the dam. The remaining fourteen clauses were specific to the Revelstoke Project.

Table 3 summarizes the project-specific conditions under the following broad topics: (1) site preparation and facilities, clauses (k, l, m, o, z); (2) environmental protection, clauses (p, q, r); (3) mitigation of impacts on the local community, clause (s); (4) claims arising from the Project, clauses (t, u, v); and (5) committees, clauses (x, y). Amendments are dated September 1977 and June 1978 and replace the original clauses (o, p, q, r, s, t, u) of December 1976, and add three new conditions (x, y, z).

The most significant change was that the amended licence had provisions for an administrative framework for project implementation. Clauses (x) and (y) called for two administrative committees, the Revelstoke Project Coordinating Committee (RPCC) and the Community Impact Committee (UC), and clauses (t) and (u) greatly improved the claims procedure. The two Committees provided for liaison and consultation between the appropriate provincial ministries and agencies and thus should have furnished the environmental and socio-economic expertise lacking in the Water Management Branch, but needed for ensuring environmental protection and for determining the mitigation and compensation of impacts.

The direction and approval function of the Water Comptroller now embraced all project-specific clauses, but for half of them (1, o, p, r, s, v) decisions were to be based on the recormnendations of the two

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3. For a detailed discussion see Missler (1988).

Table 3 Summary of Content of Selected Clauses in Water Licence

TOPIC	WATER LICENCE CLAUSE - DATE	B.C. HYDRO REQUIREMENTS	ROLE OF COMPTROLLER OF WATER RIGHTS (CWR)	CONSULTATION AND LIAISON	PERSONNEL AND COMMITTEES RESPONSIBILITIES	MEMBERS
SITE PREPARATION AND FACILITIES						
- land clearance	(k) Dec. 1976	clear reservoir area	direct extent and manner	---	---	---
- remedial work Downie Slide	(l) Dec. 1976	limit level of water behind dam until remedial work complete	direct level of water	---	---	---
- release water	(m) Dec. 1976	release water at times & in quantities specified	direct	CWR with Hydro & DM of Recreation and Conservation	---	---
- recreational facilities	(o) Dec. 1976	construct facilities in vicinity of reservoir	direct	CWR with Hydro & DM of Recreation and Conservation	---	---
	(o) Sept. 1977	as above	direct	---	---	---
- log transfer	(z) June 1978	provide & operate (or assist with) facilities for log transfer around dam	direct	---	---	---
ENVIRONMENTAL PROTECTION						
- programs & studies to protect, enhance and mitigate loss of fish & wildlife habitat	(p) Dec. 1976	not specified in water licence[1]	direct	CWR with Hydro & DM of Recreation and Conservation	---	---
	(p) Sept. 1977	carry out programs and studies	direct	---	---	---
- fish and wildlife aspects of Project	(q) Dec. 1976	employ a fisheries & a wildlife biologist (site biologists)	determine period for information gathering	biologists with Hydro staff, contractors & government agencies as required	monitor & gather information during & after construction	---
- environmental guidelines	(q) Dec. 1976	as above	as above	as above	assist in drafting guidelines	---
	(r) Dec. 1976	prepare guidelines for construction related activities	approve	CWR with DM of Recreation & Conservation, Director of Pollution Control & other regulatory agencies	---	---
	(r) Sept. 1977	as above and adhere to guidelines	direct	---	---	

Table 3 Continued

TOPIC	WATER LICENCE CLAUSE - DATE	B.C. HYDRO REQUIREMENTS	ROLE OF COMPTROLLER OF WATER RIGHTS (CUD)	CONSULTATION AND LIAISON	PERSONNEL AND COMMITTEES RESPONSIBILITIES	MEMBERS
MITIGATION						
- impacts on local community	(s) Dec. 1976	prepare budgets for mitigation	approve	Hydro with local public agencies	---	---
	(s) Sept. 1977	carry out programs of mitigation in accordance with approved budgets	direct	as above	---	---
CLAIMS						
- arising from construction, maintenance, use or operation of Licensee's works	(t) Dec. 1976	fund engineer as Claims Officer (CO)	---	---	---	---
	(t) June 1978	pay any claims ≤ $10,000 accepted by CO and fund co	appoint CO, submit claims ≤$10,000 to CO, establish procedures for making ad hearing claims	---	---	---
	(u) Dec. 1976	pay any sum determined by CO	---	---	---	---
	(u) June 1978	pay claims over $10,000 determined in court, submit to arbitration upon claimant's choice	specify conditions of arbitration	---	---	---
	(v) Dec. 1976	provide security to meet costs of complying with clauses o, p, s, u	direct amounts & terms	---	---	---
COMMITTEES						
- Revelstoke Project Coordinating Committee (RPCC)	(x) Sept. 1977	pay for RPCC's expenses attend on Invitation, report and consult with WCC	appoint members & chairman, give public notice of RPCC's recommendat Sons & of CWR's orders & approvals	Hydro & si ta biologists with RPCC re matters of clauses l, n, o, p, r, s, v	recommend to CWR re orders & approvals for clauses l, n, o, p, r, s, v	representatives of Ministries & Agencies concerned
- Community Impact Critter (CIC)	(y) Sept. 1977	pay for CIC's expenses, attend on invitation, report and consul t with CIC	appoint members & chairman, give public notice of CIC's recommendations & of CUD's orders & approvals	Hydro wlth CIC re matters of clause s	monitor consultations in clause s, assist Hydro on utters ● rlstog, recommend to CWR re orders & approvals for clause s	representatives of Hinistr les & Agencies concerned

1. Explanatory notes (CUR, 1976e) accompanying the water licence call for the Fish and Wildlife Branch (FWB) to prepare and cost programs for studies and works, and to implement them with the assistance of the D.C. Hydro site biologists (clause q) if available. The payment for the programs was to be approved by D.C. Hydro, following the programs ● pproval/armenbnt by the CUD.

Committees.[4] The Comptroller was required to give reasonable public notice of the Committees' recommendations and his orders and approvals for clauses (1, n, 0, p, r, s, v). This provision allowed some limited public input. For the six clauses outside the realm of the two Committees (k, m, q, t, u, z), the Comptroller was required to consult with a government ministry only for clause (m). Added responsibilities were the giving of directives for the claims procedure (clauses (t, u)) and for log transfer around the dam (clause (z)).

The amended water licence gave more explicit directives for clauses (p, r, s). It called for B.C. Hydro to carry out the programs under clauses (p) and (s) and to adhere to the environmental guidelines to be developed under clause (r). But the amendments fell short in other matters. They did not assign anyone to the task of designing the programs for clauses (p) and (s) and, rather than addressing one of the objections raised in the appeal, that B.C. Hydro had been given excessive control over environmental matters, the Corporation's control was increased (clause (p)). B.C. Hydro also remained responsible for employing the site biologists (clause (q)), and writing the environmental guidelines (clause (r)). The implications of some of the water licence conditions will be evaluated next.

IMPLEMENTATION PHASE

The implementation of a large scale development such as the Revelstoke Project requires many skilled individuals to be assembled in design teams, construction consortia and planning work groups in order to deal with the various segments of the project as it progresses. In addition to these task-specific individuals and groups there must also be a broader organizational and administrative framework which establishes clear lines of authority, integrates the activities of the three major participatory groups (proponent, government, public) and the specialists, coordinates the role of the multiplicity of agencies within each, monitors all aspects of the project and both informs the public as well as provides for its participation in decision making.

The Administrative Framework

The administrative framework for the Revelstoke Project was not holistically conceived but rather evolved over the span of two and a half years as the "unofficial program" under B.C. Hydro and the "official program" under the terms of the conditional water licence. The former was set up--and already partially implemented--before the water licence hearing and continued into the construction period. The official program

4. Also clause (n), but it is not included here because it is not a project-specific clause.

emerged in three phases based on conditions in the December 1976, September 1977, and June 1978 versions of the water licence. No provisions were made in the water licence to integrate the two programs.

The Unofficial Program

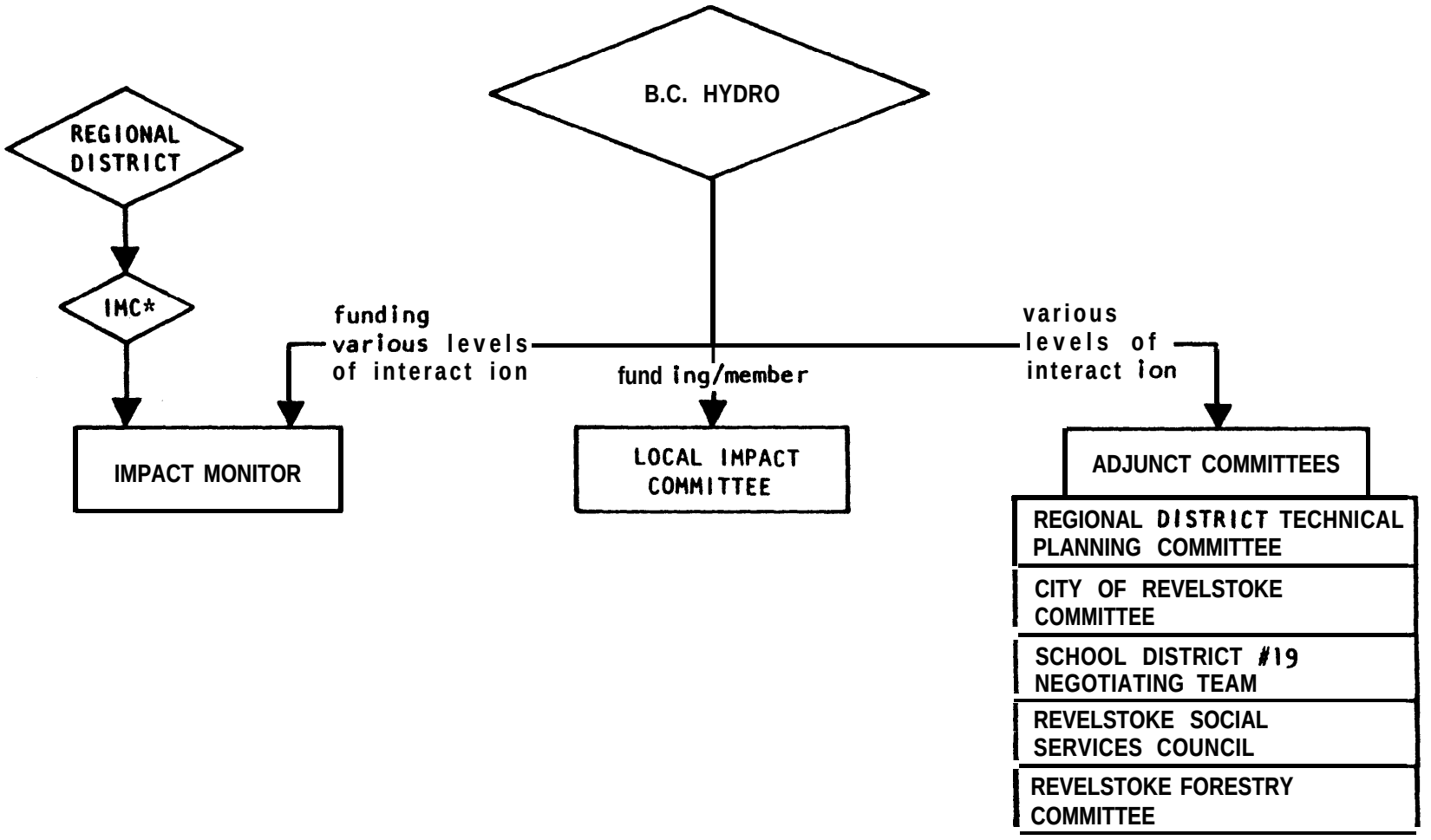
The administrative program developed by B.C. Hydro consisted of the three elements shown in Figure 2: the Revelstoke Project Impact Committee, "Local Impact Committee for short, the Impact Monitor and the five Adjunct Committees, which were the City of Revelstoke Committee, the School District #19 Negotiating Team, The Revelstoke Social Services Council, the Revelstoke forestry Committee, and the Technical Planning Committee of the Regional District. The unofficial program was intended to provide a structure for the monitoring, mitigation, and compensation of the impacts of the Revelstoke Project.

The Impact Monitor: The monitoring function was to be fulfilled by the Impact Monitor. His studies were to inform the local communities of socio-economic impacts, help the Community Impact Committee (CIC, official program) to design mitigation and compensation measures, test the predictions of the impact assessment, provide information for the wind-down of the local economy following project completion, and serve as a learn-by-doing experience for future large scale development projects (Kopas, 1980). An Impact Monitor was appointed in August 1977 by the Regional District of Columbia-Shuswap in consultation with B.C. Hydro. The latter also funded the Monitor and his travelling expenses, but provided no support staff.

In reality the Office of the Impact Monitor was ineffective. The Impact Monitor lacked authoritative power, support staff and integration with the rest of the administrative structure. Though the data to be generated could have been most useful to the CIC, the Local Impact Committee, the City of Revelstoke, and B.C. Hydro, he was employed by the Regional District, which, as a whole, was little affected by the Project. The Regional District provided neither the directives nor guidance necessary for effective impact monitoring (Kopas, 1988). Thus not only was the work undertaken on an ad hoc basis (DPA Group, 1986), but a crucial problem developed (Davidson, 1984; Bankes and Thompson, 1980, 1981). The very different interpretations of the Office by the two successive Impact Monitors brought about both their resignations. While the first Monitor claimed that B.C. Hydro was emasculating his position (Vancouver Express, 1979), the second Monitor experienced difficulties with the Regional District (Kopas, 1988).

After having run for only two and a half years, from August 1977 to April 1980, B.C. Hydro terminated the position altogether. The reasons for this are not clear. Subsequently some of the work was carried out by

Figure 2 The Unofficial Program



*IMPACT MONITORING COMMITTEE 0 DECISION MAKER COMPONENT OF UNOFFICIAL PROGRAM

B.C. Hydro[5] and, in the end, the Water Comptroller under the water licence commissioned two studies in 1984 to be done by consultant firms (Sussex, 1985; DPA Group, 1986) (see section: Official Program, CIC, below).

The Local Impact Committee: This Committee of local citizens was set up early in 1977 by a steering committee consisting of a representative from each of B.C. Hydro, the Regional District and the City of Revelstoke (Water Management Branch, 1976-1988). B.C.-Hydro funded the Committee and some secretarial help.

The main function of the Local Committee was to settle claims arising from the Project. It evaluated the claims brought before it and, together with its recommendations, forwarded them to B.C. Hydro for settlement. If claims remained unresolved at this level, they were passed to the CIC of the official program, who advised the Water Comptroller. He in turn could impose a binding decision.

Several factors rendered this claims procedure inadequate. The Committee was unable to evaluate claims effectively due to underfunding and understaffing. Until 1980, the Committee depended on the Impact Monitor as a resource person, who, for the same reasons, could offer little help. These limitations also prevented the Local Impact Committee from undertaking the Monitor's work as called for in its revised terms of reference. The monitoring of socio-economic impacts might have been useful for the identification of issues in the community and consequently for the settling of claims. Furthermore, claimants could only argue their case in front of the local Impact Committee as the public was virtually excluded from the CIC. Most importantly though, the Committee had no authoritative power, it was only advisory to both B.C. Hydro and the CIC.

Two other avenues, however, existed for the resolution of claims. Claimants with more clout, like the forest industry or government agencies, could approach the management of B.C. Hydro directly, thus getting fast remedial action (Bankes and Thompson, 1980, 1981). Conflicts could also be settled through some of the Adjunct Committees, in particular the Revelstoke Forestry Committee and the City of Revelstoke Committee.

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5. B.C. Hydro carried out semi-annual labour force surveys; see also B.C. Hydro Review of Revelstoke Project Impacts on Social and Community Services, 1981.

The Adjunct Committees: There were five Adjunct Committees.6 Two of these, the City of Revelstoke Committee and the Revelstoke Forestry Committee, were set up early in 1976, prior to the public hearing. Whereas initially their objective was the identification of problems (Bankes and Thompson, 1980, 1981), during project implementation it changed to the mitigation and compensation of impacts. The City of Revelstoke Committee consisted of members of the City Council, the City Administrator, and B.C. Hydro personnel, including the Construction Manager, and representatives of the B.C. Forest Service and the local forest industry. Its objective was to mitigate and compensate the impacts on the local forest industry.[7] (Water Management Branch, 1976-1988).

The formation of the School District #19 Negotiating Team was called for in the EIS (B.C. Hydro, 1976b). Its membership could not be established. It was responsible for keeping the school taxes in the same proportion to the pre-project provincial average, by having B.C. Hydro reimburse the Province for costs arising from the influx of families (B.C. Hydro, 1978).

The Revelstoke Social Services Council, composed of local citizens and representatives of public agencies, such as the Public Health and Justice Council, acted as a forum for solving social problems, devising a program for community improvements, and liaising between agencies and B.C. Hydro. Two senior B.C. Hydro staff members provided support to the Council (B.C. Hydro, 1978).

The Technical Planning Committee of the Regional District dealt with project impacts such as housing requirements. B.C. Hydro was represented by either the Construction Manager or the on-site manager for environmental and socio-economic affairs (B.C. Hydro, 1978).

Not much could be found out about the operation and the effectiveness of the Adjunct Committees. It appears that they were a means for the identification and, if possible, the prevention of impacts and provided a forum for the negotiation of mitigation and compensation measures. Many of the issues that the Local Impact Committee and the CIC dealt with

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6. Waite (1979) mentions two more committees, however, it seems that they did not much extend, if at all, into the project implementation phase. They were (1) the Revelstoke Highway Committee, which was to review proposals for relocating Highway 23 North along the reservoir and to address impacts on roads in the region and in the City of Revelstoke; and (2) the Revelstoke Environmental Committee which was to consider compensation opportunities for fish losses arising from the Project.

7. The forest industry was seriously impacted by the Revelstoke Project; it is a major employer in the area.

appear to be the kind of concerns that the Adjunct Committees could have addressed and, if they did, must have been unable to resolve, and referred them to the Local Impact Committee.

Interaction of the Components: As B.C. Hydro had not prescribed any lines of communication or reporting between the various parts of the unofficial program, any interaction seems to have been on an ad hoc basis. Especially the Impact Monitor, because he worked for the Regional District, was a rather detached part of the administrative structure and appeared not to have become the valuable resource person that he might have been to the Local Impact Committee (DPA Group, 1986).

In conclusion, it can be said that B.C. Hydro, in devising the unofficial program, appears to have given little thought to the adequate staffing, clear directives, and enforcement powers needed for the effective operation of each part of the program and the liaison required for the integrated functioning of the program as a whole.

The Official Program

The official program was established in three stages. The first stage proceeded under the original water licence. Despite the deferral of major concerns, there were no provisions for an administrative structure other than the consultation with specified governmental bodies and B.C. Hydro and the appointment of a claims officer. Hence the implementation of the Project was initially administered by an ad hoc committee, chaired by a senior member of the Water Comptroller's staff. It brought together the government agencies concerned and B.C. Hydro in order to address the issues of various water licence clauses, such as the development of reservoir clearing standards, environmental guidelines and mitigation and compensation measures. From January to August 1977, seven meetings were held six in Victoria and one in Revelstoke. The second stage of the official program, ushered in by the amended water licence of September 1977, established two administrative committees. Stage three, based on the second amendment in June 1978, provided a much improved claims procedure.

As shown in Figure 3, the official program consisted of: (1) the Community Impact Committee (CIC) established by water licence clause (y); (2) the Revelstoke Project Coordinating Committee (RPCC), clause (x); (3) the Claims Officer, clause (t); the claims procedure, clause (u); and (4) one fisheries and one wildlife biologist (site (biologists) to be employed by B.C. Hydro, clause (q). As the need arose, the two administrative committees could set up small subcommittees to address specific issues. The whole structure was headed by the Water Comptroller and funded by B.C. Hydro.

The program was responsible for the implementation of eleven of the twenty-six water licence clauses, and for advising the Comptroller on eight of the eleven conditions. This required decisive leadership, thorough understanding of the issues and timely negotiations and decision making. However, neither the Comptroller's in-house staff nor his two private engineering consultants were competent to address environmental, social, and economic matters. The two administrative committees had to rely on the advice and judgment of their members and B.C. Hydro, who were guided by their own Interests. The Water Comptroller faced the same lack of expertise in regard to the two site biologists and the Claims Officer. Thus the capability of the official administrative program was seriously handicapped.

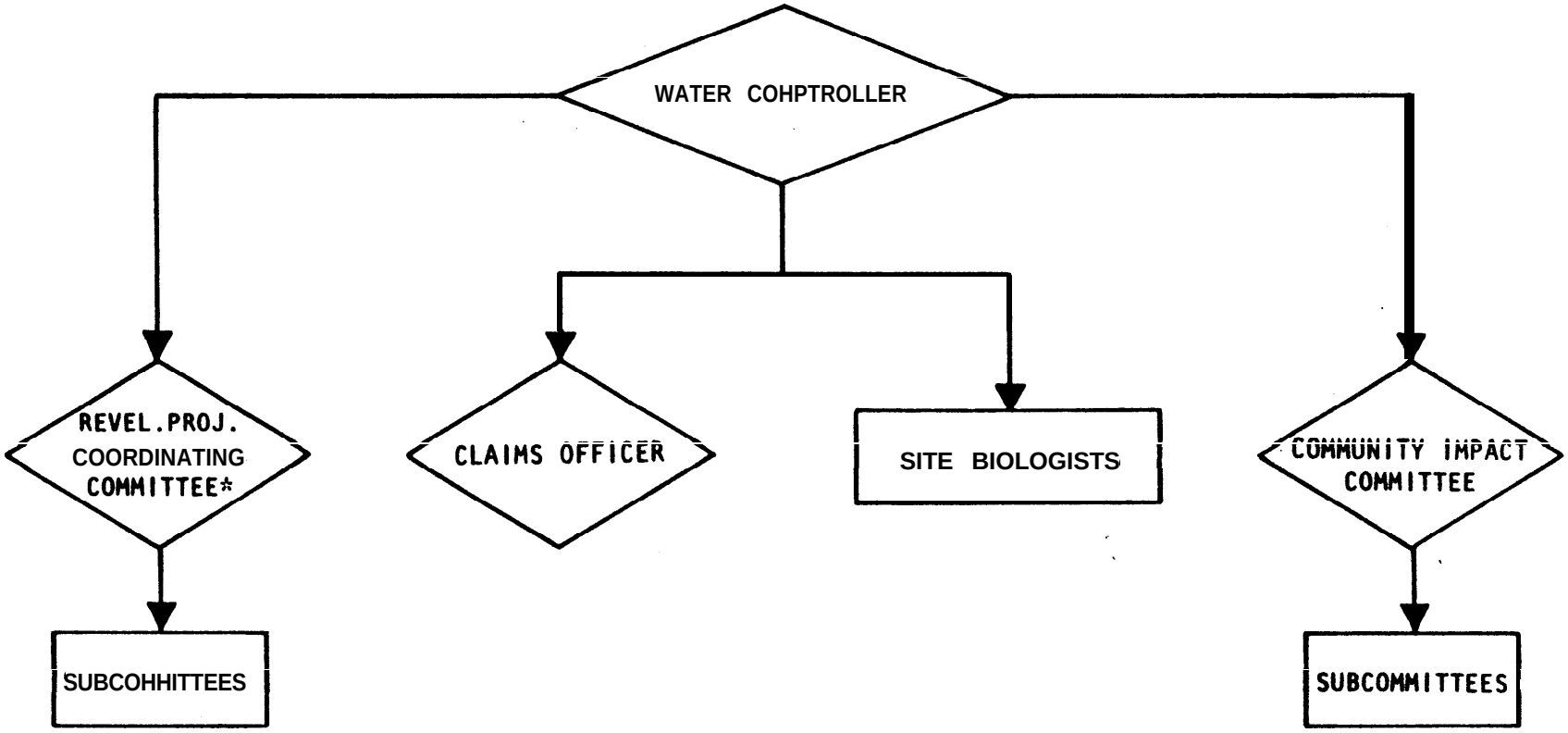
The Community Impact Committee: In the fall of 1977, the Water Comptroller appointed the CIC chairman and members from provincial ministries concerned about the impacts of the Project on nearby communities. Meetings were open to the Impact Monitor and the local Impact Committee, and B.C. Hydro by invitation. Public participation was not encouraged.

The CIC had two functions: to help with and to monitor the consultations between B.C. Hydro and local public agencies with respect to the mitigation of adverse impacts on the local community, and to make recommendations for approvals and orders to be issued by the Water Comptroller under water licence condition (s). Though "local" and "impacts" were not defined, the CIC dealt with environmental, social and economic impacts on the City of Revelstoke and the neighbouring communities of Malakwa, Armstrong and Sicamous, all within the Regional District.

The CIC got off to a slow start, meeting infrequently until 1979, then an average of four times per year up to 1985, and once in each of 1985 and 1986, and was disbanded in 1988. The Committee lacked a liaison person in Revelstoke, had no prescribed procedure for public input and held most meetings in far-away Victoria. Initially local agencies ignored the CIC as they preferred to deal with B.C. Hydro directly or through the Adjunct Committees. Only unresolved issues, which increased as the Project progressed, were referred to the CIC via the Local Impact Committee (Cox, 1988a).

Matters handled by the CIC were: development of an alternate water system for the Big Eddy Water District, an unincorporated community contiguous to Revelstoke; the increased need for police and court services; additional expenses incurred by the Revelstoke School District No. 19; high rates charged by a mobile home park in Revelstoke; compensation payments for lost time and wages due to road closures claimed by the B.C. Interior Logging Association; and demands to expand the Sicamous water system.

Figure 3 The Official Program



*Revelstoke Project Coordinating Committee

Components of Official Program

◇ Decision Maker

▭ Non-Dee is ion Maker

In 1984 the CIC took an important step by commissioning two private consultant firms to assess the effects of the Revelstoke Project on local communities. The studies (DPA Group, 1986; Sussex, 1985) were undertaken for two reasons: (1) to enable the CIC and the Water Comptroller to resolve outstanding mitigation and compensation issues; and (2) to take advantage of an important learn-by-doing opportunity, as the Revelstoke Project was the first large scale development project in B.C. for which an EIS on both environmental and socio-economic impacts had been prepared.

The DPA study (DPA Group, 1986) covered the Project's wind-down phase (May - December 1984) and the first year of operation (January - December 1985). Four issues were identified as important to the local communities:[8] (1) more skilled non-resident workers were preferred to less skilled residents; (2) unfilled high expectations of local businesses were self-induced rather than project-induced; (3) the perceived unfair treatment of the community of Sicamous by B.C. Hydro resulted from the generous compensation paid to the City of Revelstoke; net negative socio-economic impacts on Sicamous were not significant; and (4) B.C. Hydro's community relations program in Sicamous had been inadequate. Whereas B.C. tiydro had mitigated many impacts, the Company should also have addressed several others, such as that of price inflation on disadvantaged groups, the lack of adequate medical and dental services, and the fear of a possible dam failure.

The study also found that the water licence provisions for mitigation and compensation were inadequate and the monitoring program was ineffective. The CIC lacked full local support and the Impact Monitor and Local Impact Committee (unofficial program) had no authoritative power. The CIC's recommendations to the Water Comptroller "were based on ad hoc studies or political lobbying, and not on comprehensive on-going monitoring efforts" (DPA Group, 1986, p. 153). With adequate monitoring the interest of all sectors of the local communities, not only the better organized and articulate, would have been attended to and mitigation/compensation decisions on the whole would have been fairer.

On the basis of the DPA study the CIC made the following recommendation with respect to the approval process, that provincial agencies were to consider representation of significant, unincorporated rural settlements prior to the approval of future projects (CIC, 1986).

The second study (Sussex, 1985) evaluated the impacts of the Revelstoke Project on local government services and finances. In three

8. The evaluation of the effectiveness of mitigation measures was based on the guidelines developed by the Environment and Land Use Committee (ELUC) (1977, 1980).

volumes it deals with (1) compensation and mitigation criteria;[9] (2) engineering matters such as Revelstoke's roads, water, and sewers; and (3) impacts on and compensation for the City of Revelstoke, Regional District and Sicamous Waterworks District.

The objective of the report was to assess the impacts, to present the commitments and payments made so far by B.C. Hydro, and to give a general view that might be used for comparing the compensation and impacts.

The Sussex study rejected as unfounded three outstanding claims by the Regional District and two by the Sicamous Waterworks District. It corroborated that Sicamous felt unfairly treated in comparison to the City of Revelstoke, but if there were a problem of inequity, the provincial government could choose to alleviate it.

The City of Revelstoke had thirteen unresolved issues, seven of which were found to be valid, one unclear, and five invalid. Of the seven valid claims three had been adequately compensated, one was more than offset by other benefits, one required no further action, one needed to be monitored and another was the responsibility of the provincial government rather than B.C. Hydro's. The study concluded that over the long term, the City of Revelstoke has benefitted from the Revelstoke Project. The CIC's response and the Water Comptroller's order were that two claims were to be referred to the Ministry of Finance and Municipal Affairs, the unclear issue was to be further investigated, and ten claims had been properly settled, but one of these (Columbia River erosion of golf course) could be addressed in the future, if need be.

The City of Revelstoke appealed the order under Section 38 of the Water Act (1979). Impacts perceived as not adequately compensated were: the golf course erosion, a climatic change apparently affecting ski hill operation, and community costs arising from road damage, the water and sewer systems. The City of Revelstoke and B.C. Hydro negotiated a $35,000 settlement before a scheduled Environmental Appeal Board Hearing was to have taken place (Cox, 1988b).

The Revelstoke Project Coordinating Committee: This Committee was appointed by the Water Comptroller in the fall of 1977. It was chaired by the chairman of its forerunner, the ad hoc committee; members represented the resource and social service ministries and agencies affected by the Project. B.C. Hydro and the site biologists had to attend meetings on request, but the RPCC was closed to the public.

The objectives of the RPCC were to consider and make recommendations with respect to eight water licence conditions to the Water Comptroller,

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9. ELUC guidelines (1977, 1980) were adapted to include more specific compensation criteria.

who would then pass orders and approvals in these matters. The issues at hand were varied and far-reaching: reservoir clearing (clause (k)); level of water in reservoir (clause (1)); location of auxiliary facilities for dam construction (clause (n)); construction of recreational facilities (clause (o)); programs for the protection and enhancement of fish and wildlife habitat and for mitigation of losses of habitat, studies thereto to be done by Licensee (clause (p)); Licensee% preparation of and adherence to environmental guidelines for all construction-related activities (clause (r)); Licensee to give security to ensure compliance with clause (o, p, s, u); and Licensee to carry out programs for the mitigation of adverse impacts on the local community (clause (s)). The latter had also been assigned to the CIC, but by mutual agreement was delegated to the CIC.

The RPCC met as the need arose, initially five times per year, decreasing to two in 1984 and one in 1985. Only one meeting per year was held in Revelstoke, the others took place in Victoria and Vancouver. B.C. Hydro was well represented at all meetings.

The question that needs to be answered is: How adequately and efficiently did the RPCC fulfil1 its mandate? Due to the confines of this paper an answer can only be furnished with respect to the environmental management of the Project.

The aspects of the Revelstoke Project to be addressed by the RPCC were only broadly defined in the water licence. A plan that identified and established the priority of issues and concerns of individual participants and related them to the phases of the construction of the Project was not developed by the RPCC. The Committee chose to deal with matters in an ad hoc manner, dictated largely by the interests of individual participants with respect to the conditions of the water licence. Furthermore, the ambivalence inherent in the water licence conditions covering environmental studies, impact monitoring and environmental guidelines (p, q, r) caused two major actors, the Fish and Wildlife Branch (FWB) and B.C. Hydro, to set a contentious scene from the very start.

Initially, before the RPCC was established, the conflict between B.C. Hydro and the FWB arose over the supervision and terms of reference for the site biologists who were to be hired by B.C. Hydro under clause (q). However, the root of the contention went much deeper: it was the struggle for the mandate to design and implement the fish and wildlife programs, and the determination of the financial settlement for the losses of these resources.

The amended water licence of September 1977 (Comptroller of Water Rights, 1977b) assigned the task of carrying out the programs and studies as directed by the Water Comptroller to B.C. Hydro, but did not specify who was to design them. B.C. Hydro and FWB agreed to divide the studies between themselves.

Reaching an agreement for compensation of fish and wildlife losses proved to be a much more difficult, frustrating and lengthy task. The reasons for this are threefold. First, losses had to be identified in detail through ongoing inventory and habitat studies. Second, B.C. Hydro and the FWB disagreed on biological and compensatory principles, the very basis for quantifying the losses. B.C. Hydro advocated that compensation be paid for existing fish and wildlife resources under the present level of management. In contrast, the FWB, who wanted to set a precedent for future settlements, demanded that compensation be based on the principle to replace "like with like". Therefore lost habitat (21,000 ha for wildlife; about 2,843 ha for fish) must be replaced with one of the same potential carrying capacity, notwithstanding the present management level. The third reason was the lack of leadership displayed by the RPCC and its compensation subcommittee. For two years the FWB requested unsuccessfully that the RPCC make B.C. Hydro disclose its expenditures for environmental programs under clause (p). B.C. Hydro's uncontrolled spending not only excluded the FWB from the decision-making process, but also used up funds destined for the final compensation settlement. The compensation subcommittee set up by the RPCC also failed in this matter and the quantification of losses remained just as contentious.

The FWB's perception, that the RPCC was largely a clearing-house for the time-consuming exchange of reports with little action, led to a hiatus in their attendance at RPCC meetings from early 1981 to the summer of 1982. Finally early in 1982, the FWB and B.C. Hydro negotiated a $6.2 million compensation settlement outside the RPCC (Water Management Branch, 1977-1985).

The RPCC was also responsible for clause (r), which called for B.C. Hydro to prepare and adhere to environmental guidelines for all construction-related activities. On the recommendation of the RPCC the Water Comptroller approved a set of guidelines with the proviso that they would undergo "a continuing review and updating in the light of experience on the project" (Comptroller of Water Rights, 1977a). However, the form of the guidelines--provisions in construction contracts awarded by B.C. Hydro--precluded any changes. A surveillance program for B.C. Hydro's adherence to the guidelines was not developed by the RPCC, who rather took an ad hoc approach. A persistent problem, not resolved by the RPCC, was the improper disposal of garbage which attracted nuisance bears. In another instance, B.C. Hydro did not implement the environmental guidelines specifically developed for the construction of the transmission line through the Dolan Creek watershed. The resulting damage to the watershed was not repaired for several years, although the local office of the Water Management Branch had called for prompt remedial action.

Land reclamation of the Project site, though not specifically covered by the water licence, was dealt with under clause (r) also. This matter was only addressed by the RPCC upon B.C. Hydro's request. A subcommittee was set up by the RPCC to assess the potential use of Revelstoke Project

Crown Land; to resolve allocation conflicts; and to review B.C. Hydro's reclamation program in order to ensure that it was adequate, compatible with the anticipated end use of the land and met the requirements of various provincial regulatory agencies. The requirements for a comprehensive land reclamation plan were passed to B.C. Hydro, who promised the plan by June 1983. When in February 1984, a program had still not been received, B.C. Hydro was given an ultimatum of four weeks and rebuked for their procrastination. The results were almost instant--B.C. Hydro furnished a site reclamation program in less than three weeks.

To conclude, one more example of the manner in which the RPCC handled the environmental management of the Revelstoke Project is presented. In 1980, the need for the continuation of an existing water quality testing program following reservoir filling was brought to the attention of the RPCC by two staff members of the Ministry of Environment. The data was potentially useful in the management of the post-impoundment fisheries and in learning more about reservoir aging in general. The RPCC solicited the opinion of the FWB. The agency, while not directly opposing the program, did not support it, because it did not want to jeopardize negotiations for the compensation of fish and wildlife losses with B.C. Hydro. But two years later, when the compensation agreement was already in effect, the FWB held the same view, advocating only the testing for gas supersaturation below the dam. B.C. Hydro readily agreed, as did the Water Comptroller, on the basis of the FWB's judgment. That in the end an adequate post-impoundment water quality program was implemented, can only be accredited to the tenacious efforts of the above mentioned two individuals. Today B.C. Hydro perceives the program as an invaluable learning experience of benefit not only to the management of the Revelstoke Reservoir, but also to future hydroelectric projects.

The foregoing analysis has shown that the RPCC had faced two serious handicaps in fulfilling its responsibilities: the decision maker's lack of environmental expertise prerequisite for such a complex task, and the inadequate provisions of some of the water licence conditions. As a consequence of the former, leadership was mostly indecisive and dependent on the judgment of its members and B.C. Hydro, who were guided by their own goals. The Committee followed an ad hoc approach to which B.C. Hydro responded with seemingly unchecked procrastination. The shortcomings of the water licence not only caused the RPCC great difficulties in the administration of some of the clauses, but further complicated this task by the contentious scene it set between two main participants. On the whole, the framework established to administer the environmental management of the Project was neither adequate nor effective.

The Claims Officer and the Claims Procedure: The part of the official program that was most poorly defined was the initial claims procedure. It called for an engineer to be appointed as the Claims Officer pursuant to the Water Act, and for B.C. Hydro to pay his salary and expenses (clause (t)) as well as "any sum" that he determined "to be owing to any

claimant under Section 18 of the Water Act" (clause (u)) (Comptroller of Water Rights, 1976c, 1977b).

However, the water licence amendments of June 1978 were more detailed and provided an improved framework. The Claims Officer was to be appointed by the Water Comptroller, who also was to determine the procedure for making claims and hearings, and could submit claims himself. Clause (t) now limited the Claims Officerto claims not exceeding $10,000; his decision was to be final and binding; Claims exceeding $10,000 were covered by clause (u). It allowed a claimant to either sue B.C. Hydro or submit his claim for arbitration under the B.C. Arbitration Act "...except as may be otherwise specified by the Comptroller from time to time" (Comptroller of Water Rights, 1978).

In effect, the Comptroller did not appoint a Claims Officer and the settling of major claims by clause (u) seemed never to have been used (Cox, 1988a). The Water Comptroller saw no need for a Claims Officer as claims were resolved through the unofficial program and the CIC, or by B.C. Hydro directly. That the official claims procedure was not instituted is unfortunate, because it would have provided more local contact and also appeared to offer a more adequate method for claims resolution than the one actually used--and at no cost to the government.

The Site Biologists: Under clause (q) of the water licence, B.C. Hydro was to hire a fisheries and a wildlife biologist within three months of the issuance of the licence, for the length of-the construction period and thereafter for as long as the Comptroller thought necessary. Their duties were outlined as follows: (1) to help in writing the environmental guidelines for construction activities; (2) to monitor fish and wildlife aspects of the Project; (3) to collect additional data as needed during construction; and (4) to maintain liaison with the staff of B.C. Hydro or its contractors and with government agencies as required (Comptroller of Water Rights, 1976a, 1978).

It was the first time that construction site biologists were employed by B.C. Hydro and not the FWB. This had been a controversial issue at the public hearing. Environmentalists thought they would be little more than apologists for B.C. Hydro's actions, but the Water Comptroller believed that experienced professionals would uphold their integrity and credibility (Comptroller of Water Rights, 1976b).

B.C. Hydro employed both site biologists within the required time (March 1977). Although the site biologists had an immediate supervisor (on-site manager of environmental and socio-economic affairs), their work was largely determined by the Construction Manager, whose paramount

objective was to build the dam as quickly and efficiently as possible.[10] Because their tasks were only broadly outlined in clause (q), the need for terms of reference was discussed by the RPCC. The Construction Manager's response was to determine what needed doing and get it done, rather than to worry about the terms of reference (Water Management Branch, 1977-1985). It appears that terms of reference were eventually written up and in effect for about a year and a haff, after which time the site biologists decided what was important and, following approval by their superiors, implemented their programs (Bonar, 1987; Mason, 1988).

On the basis of the site biologists' monthly reports (B.C. Hydro, 1977-1984), one can conclude that their work did adhere to the second and third tasks of clause (q), but only insofar as its phrasing was so indefinite. The second task, collecting additional information as required during construction, was certainly done, although there was some ambiguity of whether to allocate it to clause (q) or (p). The third requirement, monitoring of fish and wildlife aspects of the Project, was freely interpreted by B.C. Hydro. Whereas initially the site biologists carried out this work, it was rather discouraged than encouraged and finally stopped completely by the Construction Manager (Bonar, 1987; Mason, 1988).

The fourth task, that the biologists keep up liaison with B.C. Hydro staff or contractors and with government agencies as required, was only partially fulfilled. Communication between B.C. Hydro's site and head office biologists, viewed by both as essential to the success of the environmental work, was prevented by the prescribed line of communication. The site biologists were unable to leave Revelstoke, telephone communication was found to be unsatisfactory and written communication, via the office of the Construction Manager, was often delayed for months, thus precluding meaningful discussions and changes in programs. The lack of an in-depth review of the work rendered some of it less useful (Bonar, 1987; Mason, 1988; Bradley, 1988).

Communication between the site biologists and Project contractors was also very limited. This was a direct. result of the site biologists' duties, which did not include the implementation and compliance monitoring of environmental guidelines and contract clauses, and allowed little monitoring of construction activities in general.

The site biologists maintained liaison with three government agencies: the B.C. Forest Service on forest clearing, the Water Management Branch on water, and the FWB on fish and wildlife. With the first two agencies communication was on an ad hoc basis, but with the FWB it was regular and cooperative. The site biologists were able to attend

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10. The attitude of the Construction Manager has been confirmed by interviews of persons closely connected with the Revels-toke Project.

RPCC meetings for a year only. When the Committee requested their continued attendance, the Construction Manager refused to comply due to the biologists' work load (Water Management Branch, 1977-1985).

In summary, it can be said that the vague directives of the water licence clauses and the free hand allowed B.C. Hydro in interpreting and implementing them rendered the services of the site biologists much less adequate and efficient than they should have been.

Interaction of the Components: The CIC and the RPCC made recommendations to the Water Comptroller for the orders and approvals to be passed by him in regard to the water licence clauses they administered. Interaction between the two Committees was limited because the CIC dealt predominantly with socio-economic matters, and the RPCC with environmental issues. The CIC and the RPCC decided on the delegation of the responsibility for clause (s) and referred some issues from one Committee to the other. Each Committee kept well informed of the undertakings of the other, because the chairman of each was also a member of the other Committee (Cox, 1988b).

Although the RPCC did not administer clause (q), it could request the attendance of the site biologists at its meetings. The biologists attended initially, but the RPCC's request for their continued attendance was refused by the Construction Manager. Other than determining their length of employment, the Comptroller had no dealings with the site biologists.

Relations Between the Two Programs

The relationship between the unofficial and official program, as well as that of the combined administrative framework to the larger context of the Project is depicted in Figure 4. The two programs had not been interfaced, each having been set up at various times and by different bodies.

Duplications in the responsibilities assigned to the various bodies and the lack of clear lines of communication between them rendered the administration of the Project hard to coordinate and execute right from the start.

Considerable overlap of responsibilities existed between the programs as well as within each program. Whereas the official program addressed technical, environmental, social and economic matters, the unofficial structure dealt with the same issues except technical ones and the management of environmental matters of the Project per se.

Both programs had provisions for resolving claims. However, those of the official program were neither implemented (Claims Officer) nor used (clause (u)), because claims were settled by direct negotiations between

claimants and B.C. Hydro, the Local Impact Committee (unofficial program) and the CIC (official program), which addressed the unresolved claims the Local Impact Committee referred to it.

Interaction between the CIC and the Local Impact Committee was not altogether satisfactory. The two Committees did not always agree on the seriousness of the issues, nor did the CIC always respond promptly, as it lacked a liaison person in Revelstoke. The Local Impact Committee's views were not entirely representative of those of the local population/as it did not solicit true grassroots input (DPA Group, 1986).

The Office of the Impact Monitor had no direct line of communication with the official program, hence he dealt with the CIC on an ad hoc basis and hardly ever with the RPCC. There seemed to be no need for interaction between the Adjunct Committees and the official program and for the site biologists and the unofficial program.

Three important differences existed between the two programs. All parts of the official program, except the site biologists, had authoritative power, but none of the unofficial program did. This uneven distribution, however, virtually excluded the public from the decision making process insofar as only the cloudless unofficial program was open to the public. The official program had no provisions for proactive public input. The RPCC was closed to the public and the CIC allowed only very limited direct public participation. Though the public could respond to advertised CIC and RPCC recommendations to the Water Comptroller, and the latter's approvals and orders before they came into effect, the decisions had been reached long before public notice was given. Lastly, even though B.C. Hydro funded the whole structure, the Impact Monitor and Local Impact Committee did not receive adequate funding and support staff.

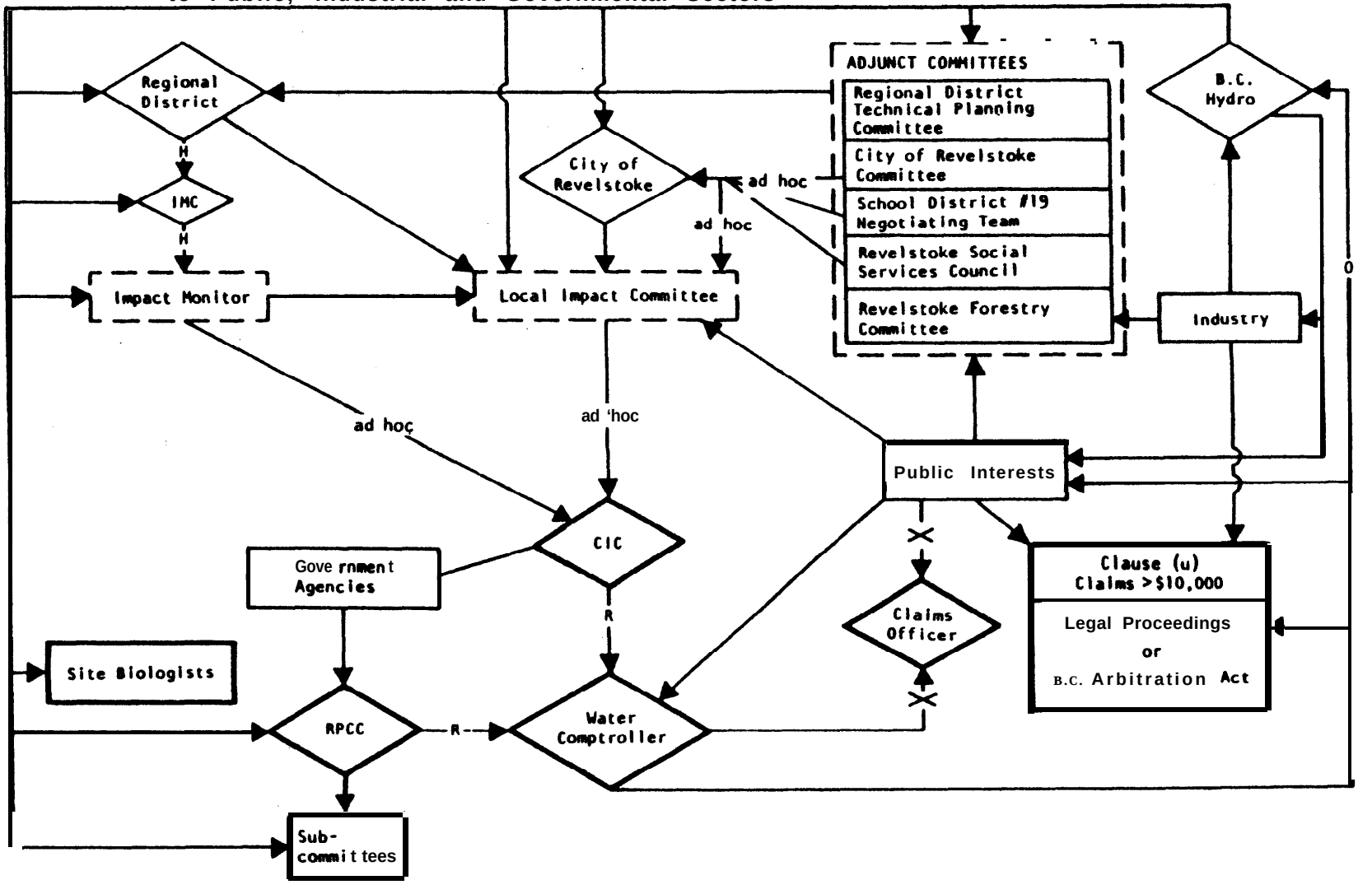
As a whole, the administrative framework should have provided the essential components for the proper and efficient management of the Revelstoke Project. However, the design deficiencies of each separate component and the lack of integration of the two programs did not allow this potential to be realized.

Environmental Guidelines

As required by the water licence (clause (r)), B.C. Hydro prepared environmental guidelines for the Project. Following incorporation of changes requested by the Ministry of Environment, the Water Comptroller approved them in June 1977, with the understanding that they be "subject to continuing review and updating in the light of the experience on the project" (Water Management Branch, 1976-1988).

The objective of the guidelines (B.C. Hydro, 1977a) was to identify and control the main activities of the construction of the Project in order to minimize their impact on the environment. The guidelines were

Figure 4 Administrative Framework for the Revelstoke Project - Relationship to Public, Industrial and Governmental Sectors



CIC - Community Impact Committee
IMC - Impact Monitoring Committee
RPCC - Revelstoke Project Coordinating Committee

Official Program
Unofficial Program

Decision Maker
Not Instituted
Communication

H - Hierarchy
O - Order
R - Recommendation

in the format of (1) contractual requirements consisting of environmental protection clauses included in B.C. Hydro's Revelstoke construction contracts; and (2) actual environmental guidelines, which were to clarify the purpose and administration of the contractual clauses.

Selected requirements of contracts and the corresponding contextual environmental guidelines are summarized in Table 4 under the following categories: compliance with laws, preservation, pollution, waste disposal, and site restoration; for the last category, fish and wildlife protection, there were only environmental guidelines and no contractual requirements.

The contractual requirements, the main body of the guidelines, were of a very general nature, outlining commonly accepted construction practices for the conservation and protection of the environment. Site-specific details were not addressed, but referred to the Construction Manager, who was responsible for ensuring compliance with all contractual requirements (Table 4, guideline 4.01). None of the contractual requirements called for consultation with the site biologists.

Of note is that the somewhat more specific guidelines for the protection of fish and wildlife (6.00-6.08) are not included in any contractual requirements. Though the site biologists were to monitor the effectiveness and implementation of the guidelines (guideline 6.00), they had no authoritative power and were to be consulted only with respect to three of the thirteen guidelines.

While some of the provincial acts and regulations that contractors had to comply with were specified (guidelines 4.01, 4.07, 4.08), a complete list would have ensured the contractors' awareness of all governmental requirements. Additionally, much of the wording was vague, as for instance in contractual requirement 4.54, which calls for the prevention of "unnecessary" destruction of vegetation and "unnecessary" disfigurement of countryside; guideline 4.07 specifies that waste water be as free as "practical" from pollutants; and guideline 6.00 states that B.C. Hydro will cooperate with "reasonable" requests by the FWB. The guidelines neither covered reservoir filling nor mentioned the separate sets of clearing standards developed for the reservoir area and transmission lines. Review and updating of the environmental guidelines seemed precluded by the binding contractual requirements, and, indeed, was not undertaken.

As a whole the environmental guidelines were a very inadequate document. They did not provide the necessary guidance for the conservation and protection of the environment.

Compliance Monitoring

The water licence had no provisions for a compliance monitoring program, nor was one developed later. The licence only called for the

employment of two site biologists to monitor fish and wildlife aspects and for B.C. Hydro to prepare and adhere to environmental guidelines. The Water Comptroller did not assign compliance monitoring and enforcement to the site biologists, but to the Construction Manager.

In practice, B.C. Hydro appointed engineers as contract administrators to carry out compliance monitoring of construction contracts. Records of compliance monitoring were not available for evaluation. But one of the site biologists observed that administrators, who predominantly lacked environmental training, gave priority to contractor' adherence to technical specifications and treated environmental concerns superficially (Bonar, 1987).

Initially the site biologists attempted to monitor construction activities and the implementation and effectiveness of guidelines. However as of early 1979, this work was discouraged by the Construction Manager. From then on the amount of monitoring depended on the biologists' "tenacity" (Mason, 1988) and, indeed, the very brief accounting of this work in the biologists' monthly reports stopped as of 1980 for wildlife matters and as of 1982 for fisheries aspects (B.C. Hydro, 1977-1984). One of the site biologists perceived his activities as those of an informer who, while reporting incidents to the Construction Manager and the relevant government agencies, was hamstrung by the lack of authority and the low priority assigned to the environment at the Revelstoke site (Mason, 1988).

Enforcement was up to the Construction Manager and the responsible government agencies. One of the biologist felt that the Ministry of Environment, and in particular the FWB, which was responsible for fish and wildlife resources, should have insisted on proper monitoring (Mason, 1988). The FWB's position however was, that since they were not given supervision over the site biologists, compliance monitoring was the responsibility of B.C. Hydro. Furthermore, once approval for a project had been granted, environmental monitoring and mitigation are of a very low priority, no matter who does the monitoring (Lindsay, 1988).

Construction Activities and Environmental Impacts

The analysis of construction activities and their environmental impacts accomplishes two things: to document and evaluate the impacts, and to gain some idea of compliance monitoring as a whole for the Revelstoke Project. The paucity of the available data precludes an in-depth study. There are several reasons: extensive monitoring of construction activities and their effect on the environment was not undertaken, detailed records of the actual monitoring do not exist, and, overall, construction proceeded relatively smoothly--major accidents, which could have caused long term environmental impacts did not occur.

Table 4 Summary of Selected Contract Requirements and Guidelines[1]

REQUIREMENT	CONTRACT[2]	GUIDELINES[3]
1. Compliance with laws	4.27 - Construction shall comply with all applicable laws	4.01 - specifically identifies some provincial acts which must be complied with - construction activities are subject to approval & direction of Construction Manager, who ensures that contractual requirements of environmental preservation are met
2. Preservation	4.54 - No unnecessary destruction of vegetation - prevent illegal hunting and fishing - prevent unnecessary disfigurement of countryside	4.02 - clearing only in specified areas & shelter belts left 6.05/6.03 - prohibition of shooting at site / control recreational fishing 4.04/4.05 - stockpile removed soil, use for site restoration
	7.07(f)minimize disturbance of natural landscape	4.03 - shape surface areas to control runoff & prevent erosion, restore & plant native vegetation
	- smooth & grade disturbed surfaces to conform to the natural landscape	4.04 - stockpile removed soil, use for site restoration
	7.11 - spoil & rockfill piles not to interfere with natural drainage	4.12 - locate so that they do not interfere with natural drainage
3. Pollution	7.07(g)comply with Pollution Control Branch	4.07 - keep waste water discharges into watercourses as free as practicable from pollutants, biologists to monitor constantly to ensure provincial standards are met (Acts: Pollution Control, Mines, Fisheries, Health, etc.)
	- prevent solid matter, contaminants & other objectionable pollutants from entering surface & ground water	
	- construct means to keep eroded material out of watercourses	4.11 - construct dewatering & drainage systems to prevent discharges of pollutants into watercourses & if any erosion is controlled within acceptable limits
	- use turbidity control methods before discharging waste waters into watercourses	
	(h)prevent dust pollution from becoming a nuisance in work areas	4.06 - keep dust pollution on roads to minimum with water sprinkling
	- *do not use oil where it can reach watercourses*	- use of oil & calcium chloride with biologists' consent
4. Waste Disposal	7.14 - prohibited to discharge raw sewage or polluted water *into watercourses or near camp, work areas, buildings* - drainage & sewage installations to conform with provincial health & other standards	4.08 - sewage & waste water disposal to conform with provincial health & other government requirements - sewage treatment plants & septic tanks for camps & work areas to meet Pollution Control Act requirements, disposal of waste from portable toilets to meet Dept. of Health recommendations
	7.15 - collect refuse in metal, covered, fly-proof cans & dispose twice per week by incinerator or in pit & cover as specified	4.09 - dispose garbage by sanitary fill garbage pit & pay attention to drainage in & out of pit
	- periodically backfill pits to maintain sanitation & minimize attracting wildlife	- implement refuse incineration if wildlife is attracted
	- refuse disposal must be acceptable to provincial & municipal requirements	- Hydro to fund nuisance animal removal when requested by FWB

Table 4 Continued

	CONTRACT	GUIDELINES
5. Site Restoration	7.07 - see above under I2 7.10 - stabilize borrow area slopes & reshape to conform to natural landscape 7.11 - level waste piles (rockfill) & shape to conform to natural landscape & prevent ponding & runoff	4.03/4.04 - see above under #2 4.05 - see above under #2, use native vegetation to replant 4.06 - restore temporary roads to near natural condition 4.12 - use designated spoil areas & blend with natural landscape - grade to minimize erosion. reclaim with topsoil & vegetation 5.00 - landscape architect to develop landscaping program - during program preparation biologists to ensure present & future preservation of environment

	GUIDELINES[4]
6. Fish and wlidiife protect lon	6.00 - site bloiogistr to monitor ● ffectivcncss & implementation of guidelines to ensure proper protection of fish and wiidiifc in Project area - iiydro to cooperate wi th reasonable requests by FWB **6.01** * preservation of watercourses - keep construction near watercourse3 to minimum - do not "walk" construction equipment throuqh streams - remove temporary log crossings and culverts to restore natural drainage systems 6.02 * consideration of spawning cycles when possible schedule construction of structures in streams outside of fish spawning cycles 6.04 * preservat ion of wildl l fc tral is upon site wiidiifc biologist's requot wildlife trails cut by construction activities to be restored to uintain traditional movement patterns 6.06 • protection from hazardous areas - upon site wildlife biologist's request *fence* hazardous contruction areas to keep wildlife out 6.07 * continuing environmental concern - site biologists to carry out fish and wiidiife field studies assist in ● stabilshing basisfor ● nvironmcntai management programsto be implemented at discretion of FWB following project completion **6.08** * provlsion for wiidilfe crossings - at request of site or FWB bioioqists provide log booms to facilitate wiidiife crossings in reservoir area

1. Simplif led from B.C. Hydro, 1977a.
2. Numbers refer to contractual requirements pages 2-15 in B.C. Hydra, 1977a.
3. Numbers refer to environmental guidelines pages 15-23 in B.C. Hydro, 1977a.
4. No corresponding contract clauses for these guideiincs.

FWB: Fish and Ulldiife Branch

The data sources used for this study were the site biologists' monthly reports (B.C. Hydro, 1977-1984), their annual reports (Bonar, 1978, 1979; Teleki, 1979; Mason, 1982) and personal interviews with them (Bonar, 1987; Mason, 1988). Information was also obtained from the files and staff of B.C. Hydro, the Water Management Branch, the Waste Management Branch and from B.C. Conservation Officers. There was somewhat more data for the aquatic than the wildlife ecosystem, but few references for either pertain to monitoring activities later than 1979. In general, the extensive area of the Project and the high flushing rate of watercourses rendered monitoring a difficult task. The latter led to the subjective assessment of most impacts on the quality of water until 1981, when water quality testing was improved.

Environmental impacts that resulted from the various construction activities monitored by the site biologists and some of the mitigation and compensation measures are shown in Table 5. These activities were monitored from May 1977 to December 1979 for all construction activities except #7, #8 (discharge of sewage effluent) and #10 (fishing pressure) which extended over the whole construction period, #12 (Deadman Creek diversion) for 1978 to 1983, and #13 (clearing in Dolan Creek watershed) from December 1980 to December 1983. Table 6 details the construction activities monitored by the site fisheries biologist in 1978. The initial statement is taken from his annual report (Teleki, 1979); the bracketed statement gives additional information culled from the biologists' monthly reports (B.C. Hydro, 1977-1984).

The major environmental concerns arising from the construction activities were: (1) high suspended sediment loads in the Columbia River and its tributaries from reservoir logging, access roads, borrow areas, concrete production at the batch plant, relocation of Highway 23, and the washout of Deadman Creek; (2) chemical water pollution from fuel spills and illegal garbage disposal; (3) attraction of wildlife by illegal garbage disposal; (4) increased pressure on fishing by poaching; and (5) fish blockage by the diversion tunnel (Table 5). The escalation of construction activities with the progression of the Project resulted in the greater severity of some impacts, notably that caused by logging in the reservoir area (activity #1), by the access roads and borrow pits located near watercourses (#3), and the batch plant (#5). Also different areas of ecosystem stress developed, such as the Deadman Creek erosion.

By 1979 logging and clearing of the reservoir area (#1) had resulted in high suspended sediments in the Columbia River and its tributaries. Causes were increased runoff from cleared surfaces, increased bank erosion, and debris, felled trees and machinery in streams. Some spawning areas were disrupted and upstream fish migration blocked. Reservoir clearing guidelines included in clearing contracts were not enforced (Mason, 1982). The clearing program was the responsibility of the B.C. Forest Service, who reviewed schedules and standards with the site wildlife biologist. Clearing was deferred to 1982 in twelve wildlife habitat reserves (604 ha total), areas of particular importance to moose,

Table 5 Construction Activities Monitored and Environmental Impacts Reported by Site Biologists

ACTIVITY	IMPACT ON ENVIRONMENT	MITIGATION/COMPENSATION MEASURES AND RESULTS
1. Reservoir logging	-increased runoff, Initially increased suspended sediments -during 1979 high suspended sediments in tributaries -considerable increase in stream bank erosion -spawning areas disrupted by machinery -some upstream fish migration blocked -wildlife displaced	-debris removal in strews -clearing contracts Included guidelines to keep debris machinery out of streams - but not enforced -steep reservoir areas seeded In 1979-80 - solved some problems
2. Burning in reservoir	-minor impact from increased nutrient levels, minimal increases are beneficial	-keep logging debris out of river
3. Access roads & borrow pits near water-courses	-initially little sediment Introduction in watercourses & minimal interruption of fish movement -during 1979 increased sediment introduction & fish movement inhibited In some cases	-borrow pits were kept away from watercourses
4. vehicle maintenance near yard & camp	-minor spills scraped up & buried -small diesel fuel spills went into Columbia River -most spills well away from river	-oil & petrochemicals from yard recycled -most petrochemicals burned or burled
5. batch Plant for diversion tunnel	-initially minor seepage from small settling pond into Columbia River -during 1979 high suspended sediment loads from batch plant effluent into Columbia River	-settling ponds were constructed, but did not retain particulate matter, to meet standards in 1981
6. diversion tunnel	-velocity barrier to fish: downstream migration possible, upstream not -loss of upstream fish population -some golly Varden spawn in none-natal streams below diversion tunnel	-kokanee compensation at Hill/MacKenzie spawning channel about 500000 in 1981 -possibility for compensation for Dolly Varden investigated 151000 eggs collected In 1980 -15000 rainbow trout eggs collected
7. sewage effluent from man camp & offices	-permitted discharge volumes often exceeded & fecal coliforn frequently exceeded recommended standards -no apparent nutrient increases downstream of Project -malodours at man camp	-auxilliary aeration of sewage treatment plant -sludge waste removal to regional sanitation fill
8. sewage effluent from City of Revelstoke	-periodic discharges of raw sewage into Columbia River	
9. garbage disposal	-bears attracted -increased biological oxygen demand in tributaries -aesthetic degradation	-Waste Management Branch informed -permits required to dump garbage
IO. Human ingress	-Increased fishing pressure as new locations open in reservoir area -fish accumulating downstream of diversion tunnel easily poached	-angling closure signs posted downsteam of diversion tunnel outlet

Table 5 Continued

ACTIVITY	IMPACT ON ENVIRONMENT	MITIGATION/COMPENSATION MEASURES AND RESULTS
11. Relocation of Highway 23 North	-high concentrations of suspended sediments into tributaries	-contractors informed of danger to fish in tributaries -site wildlife biologist suggested mitigative design
12. Diversion of Deadman Creek	-4 million cubic yards of alluvial gravel and sand deposited in Columbia River -short term impacts: increased suspended solids, deposition of fines on nearshore river bottom slight filling in of river pools utilized by fish to 10 km downriver -undetermined increase in kokanee mortality rate - effect on total kokanee population probably not to be dangerously high	-relocation and design changes of diversion
13. Clearing of transmission line right-of-way in Dolan Creek watershed	-constriction of Dolan Creek caused by dirt & debris accumulation at illegal Creek crossing -increased runoff from access road, log landing sites -blockage of intermittent streams	-guidelines specifically developed for clearing in this area - not implemented -prompt remedial work (revegetation, road drainage, blockage & debris removal) requested by Water Management Branch - took 2.5 years to complete

Sources: Teleki (1978, 1979); Mason (1982, 1988); Bonar (1978, 1979, 1987); B.C. Hydro (1977-1984); Gorsline (1987); Gabrowski (1988)

caribou, beaver and waterfowl. Inadvertently, in 1978, one area was completely cleared and another partially. The significance of these incidents was not reported. Whereas the site wildlife biologist thought this mitigation measure successful in 1980 as animals were using those reserves, the FWB stated that it only delayed the inevitable. Its ultimate value seems debatable (Bonar, 1987; B.C. Hydro 1977-1984; Water Management Branch, 1977-1985).

The burning of cleared material in the reservoir area (#2) caused no problems. Runoff from access roads and borrow pits located near watercourses (#3) introduced little sediment in streams initially, but by 1979 it had increased and fish movement was somewhat interrupted. Impacts from vehicle maintenance (#4) seems to have been minimal as the minor spills that did occur were promptly cleaned up. Oil and petrochemicals from the maintenance yard were recycled (Teleki, 1979; Mason, 1982). No impacts were noted from vehicle wash water discharged to the ground and operation of a diesel generating plant.

Of concern were the high suspended solids in the batch plant effluent (#5) discharged into the Columbia River and the potential danger of the proximity of the plant's settling pond to that river. The long term effects of a spill of about 1000 gallons of ammonia from the plant's cooling system into the settling pond and then into the Columbia River were probably minimal due to the river's high flushing rate (Mason, 1982). Water sampling to assess the impact was not carried out.

Major losses to the upstream fish population were caused when upstream fish migration ceased with the construction of the diversion tunnel (#6). These were to be compensated by the fish and wildlife compensation agreement. Gas supersaturation downstream of the tunnel generally stayed below 115% (115% harmful to fish); a higher level of 118% in August 1981 did not appear to have impacted fish (Mason, 1982).

From June 1978 to December 1984, B.C. Hydro operated a secondary sewage treatment plant for its camp wastes (#7). It consisted of a sewage aeration tank, a settling tank, and a chlorination tank from which the effluent was discharged underground into the Columbia River. Effluent standards for biochemical oxygen demand and total suspended solids were not exceeded, however, faecal coliform was, reaching a high of 1.3×10^6 MPN/100 ml in 1982. Records for discharge volume were not available for 1978-1981, but volumes consistently surpassed the 360 m^3/day limit during 1982 and 1983 (April through November), the highest discharge being 705 m^3/day. Inadequate aeration of the sewage tank caused a persistent and noticeably malodorous impact on the nearby camp. The problem was partially solved by increasing aeration of the tank and sludge removal of 1600 gallons per day. The plant was decommissioned in November 1984 (B.C. Hydro, various dates; Grikis, 1988). Sewage system overflows into the Columbia River periodically resulted from the increased population in the City of Revelstoke (X8).

Table 6 Construction Activities Monitored by Site fisheries Biologist in 1978

DATE	ACTIVITY
Feb.	batch plant wash pond location and configuration! (Plans were reviewed.)[2]
Feb.	Diversion tunnel effluent. (Pumped from diversion tunnel back Into the Columbia River.)
March	Deadman Creek erosion. (About 4 million cubic yards material washed into Columbia River.)
March	Diversion tunnel intake road material into river. (No details available.)
April	Location and start up of asphalt plant. (No details available.)
May	Aggregate plant operation. (No detrils available.)
May	Placement end management of Acrow bridge. (Pontoon bridge across the Columbia River connecting Westside Access Road to Highway 23 North.)
May	Dust control by salting. (Liquefied calcium chloride was used on Westside Access Road for dust control where runoff was not directly into Columbia River. Map of new salt zones prepared. Specifications were adhered to. Salting was limited to 3001bs per road mile in November 1978.)
June	Concrete curing water. (Discharged from concrete placement directly into Columbia River. Also waste concrete discharged directly at batch plant and highly turbid water drained directly into Columbia River. In future to be done at a rock piling site. Also washing out of concrete trucks directly onto road to be discontinued es It could cause damage if done closer to the river.)
June	Furl spill front tanker truck in the river. (No details available.)
July	Waste disposal by Pitts-Atlas. (Machine shop and garage wastes dumped in Deadman Creek spoil fill area. Contractor did not comply immediately when ordered to clean up.)
August	Paving preparat ion. (Road oil-tar seal coat washed into Columbia River and Moses Creek during heavy precipitation.)
Sept.	Sediment from reservoir clearing. (Noted in October - • great deal of unnecessary scarring in many places, high sediment load in runoff to Columbia River. Stricter inspection by B.C. Forest Service.1
Sept.	Trees and brush in water from reservoir clearing. (Alarmingly high number of trees felled into the river 7 to 9 km upstream of pontoon bridge. More precise clearing instructions, more stringent inspections and stricter enforcement by B.C. Forest Service of contractors recommended.)
Sept.	Loram truck fuel spi ll on site. (October 1978 - more then 1000 gallons diesel-gasoline mixture spilled, dyked off and 'fired', no fuelreached the Columbia River.)
October	Downie Creek highway proposal. (II.4 km additional roadway. Impacts. such as salt runoff, increased fines in Creek and long-term site disruption as well as mitigation measures to prevent road runoff were discussed.)
All of 1978	Downie Slide bentonite clay in river. (No details available.)

1. Unbracketed statement from Teleki(1979)
2. bracketed statements from site biologist's monthly reports (8.C. Hydro,1977-1984)

The disposal of garbage (#9) from the camp and from the equipment service area was a problem most of the time. Insufficient coverage of garbage and garbage left outside the locked gates of the Region's sanitary landfill, and handfeeding of bears at the camp resulted in nuisance bears. While there had always been bears at the garbage dump, some black bears were destroyed because of the Revelstoke Project. However, it is not possible to quantify the impact (Gabrowski, 1988). Tighter control of the operation of the dump by the Waste Management Branch would have alleviated the situation (Waste Management Branch, 1988). The agency was also aware of garbage being dumped illegally by contractors upvalley from the dam site in 1979 and 1980, but was hopeful that its site inspections in 1981 would end this practice (B.C. Hydro, 1977-1984; Water Management Branch, 1977-1985).

Increased fishing pressure (#10) due to the large work force at the Project, the opening up of previously inaccessible areas, and easy poaching below the diversion tunnel impacted the fisheries resource. Effective enforcement of regulations by the provincial Conservation Officer Service was not possible as the office was understaffed and underfunded, the Conservation Officer was not stationed in Revelstoke, and poaching fines ($5.00) were no deterrent (Krause, 1988; Gabrowski, 1988).

Of concern was also the relocation of Highway 23 North (#11). The wildlife biologist recommended mitigation measures to avoid habitat destruction and wildlife conflicts (Bonar, 1978). Information on the specifics of these mitigation measures was not available. High concentrations of suspended sediments were observed in tributaries and the contractors were made aware of the impacts on fish (Mason, 1982).

A dam and diversion of the lower part of Deadman Creek (#12) had been planned because the creek was too close to the westside of the proposed earthfill dam. However, in order to make use of close-by fill material for the latter dam, the original relocation plans were changed. Work started in the fall of 1977. In March 1978 (exact date not given) a very rapid snowmelt and high runoff caused a massive erosion of unstable alluvial deposits from the banks of the diversion channel. Four million cubic yards (85% gravel and coarse sand) were deposited 2-3 km downstream in the Columbia River and suspended fine material was visible as far as Upper Arrow Lake. New diversion work was cut short by a second washout in July 1983, which also deposited a large fan of rock and gravel in the Columbia River. This necessitated another revision of the diversion plans.

Impact monitoring of the first slide was undertaken by the fisheries site biologist from March 23 to June 11, 1978 (Teleki, 1978). It is not

clear how much time elapsed between the event and start of monitoring.[11] Impact analysis was based on water quality data, visual inspection of river pools and examination of historical records to establish whether or not the aquatic system had experienced similar conditions in the past. Data of bottom dwellers was unreliable due to synergistic effects of fluctuating water levels; fish sampling was unsuccessful because no fish were caught. Study results are shown in Table 5 (#12).

Three major concerns arise from the Deadman Creek erosion. First, the diversion work was not mentioned in the EIS. Thus it could not be assessed at the public hearing. Second, rerouting of the diversion channel was not evaluated for its environmental impacts. It appears that the site biologists were not consulted. Third, the two washouts could have been prevented with better initial planning on the part of B.C. Hydro. From the events one can deduce that geological and hydrological conditions of the location had not been evaluated adequately and project design and construction had not been properly adapted to site and weather conditions.

The Comptroller of Water Rights found fault with B.C. Hydro's engineers, who had scheduled the work to coincide with inclement weather to be expected at that time of year. Indeed, the potential danger of the diversion had been recognized in the fall of 1977 by a concerned citizen (Caywood, 1978) and the site biologist who assessed the hazard in a report (B.C. Hydro 1977-1984). The financial costs of this engineering mistake must have been significant.

Another erosion problem resulted from the construction of the transmission line (10.5 km) connecting the Revelstoke Project to the Illecillewaet substation just south of Revelstoke (#13). As the power line was to cross Dolan Creek, the water supply for the community of Big Eddy, environmental guidelines were developed specifically for work in that watershed. Field inspection early in 1981 revealed that several construction practices contravened guidelines. Erosion resulted from inadequate road crossings of some intermittent streams and proximity of log handling facilities to such streams and Dolan Creek. Furthermore, the building of an uncalled for bridge to the north side of Dolan Creek caused debris to constrict the creek channel. Prompt remedial work, ordered by the local office of the Water Management Branch, was eventually completed by December 1983.

Of interest is that the B.C. Forest Service did not seem to be aware of the environmental guidelines (Gorsline, 1987). The timber sales licence authorizing the logging of the transmission line right-of-way did not mention them. Neither was the contractor aware of the provisions and

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11. A large slide at the intake of the diversion tunnel occurred on March 10, 1978, and one cannot help but wonder if the Deadman Creek washout took place at the same time.

regulations of the Water Act (a requirement of the Project's environmental guidelines) and that the transmission tower on the north side of Dolan Creek was to be set by helicopter to prevent damage to Dolan Creek and a bridge was therefore not needed. Although there seems to have been a definite problem of communication, the responsibility for adhering to water licence clause (r) was B.C. Hydro's.

In summary it can be said, that the provisions for monitoring of compliance with environmental guidelines and of construction activities provided by the water licence and B.C.' Hydro were inadequate, as was enforcement by government agencies and administration of clause (r) (B.C. Hydro's adherence to environmental guidelines) by the RPCC. Whereas major environmental accidents of long term effects had not occurred, the general disregard for the environment caused many minor incidents to go unchecked. The most significant observation was succinctly expressed by the site wildlife biologist: "B.C. Hydro had built the Project without any major environmental problems more by luck than foresight--a major accident would have been a mess" (Bonar, 1987).

ENVIRONMENTAL PREDICTIONS AND OUTCOMES

The objective of a post-development environmental analysis is to determine the effectiveness of the EIS as a predictive tool and to serve as a learn-by-doing experience which leads to the improvement of future EISs. However, such a study also is a useful collective documentation of the actual impacts of a project.

It has been well documented that post-development environmental analyses are difficult to carry out, especially for projects which have undergone early environmental impact assessment (EIA) (PADC, 1983; Bi ssett, 1984). As post-development environmental analyses were practically unheard of in the mid-1970s, neither EISs nor effects monitoring programs for project implementation were designed for that purpose and the two were not coordinated. Furthermore, in both the catalogue approach prevails--all components of an ecological system were listed and measured without providing the necessary understanding of the structure and dynamics of that system (Holling, 1978).

The Revel stoke Project post-development environmental analysis has been no exception. Three major difficulties limited the extent of the analysis: (1) EIS predictions were generally nonspecific and not in the form of testable hypotheses; (2) many variables were not monitored as effects monitoring had not been coordinated with EIS predictions; and (3) much of the data collected during project implementation was difficult to work with or could not be used. The Revelstoke EIS was the first such report prepared by B.C. Hydro and the Company stated that they had "some difficulty in adopting the full scope and purpose of the EIS as defined in the literature to the specific needs of B.C. Hydro's planning procedures" (B.C. Hydro,1976b, p. V).

The EIS was found to be very difficult to work with. The large environmental impact matrix and the two long tables, summarizing predicted impacts, were useless because they were so nonspecific. Instead impacts had to be extracted from the EIS text. Predictions generally were imprecise, qualitative, and not in the form of testable hypotheses. Statements concerning the probability of occurrence, magnitude, temporal, and spatial extent, and the significance of the potential impacts were generally vague, or absent. Ecosystem linkages were often not considered. But problems were also encountered with determining the actual impacts. A program for effects monitoring had not been designed before Project implementation, but rather evolved during the first few years of that phase. Some of the resulting reports were more descriptive than interpretive, others were specialized and had to be interpreted with the help of professional biologists. Much of the data could not be used as it is in the form of field notes which have not yet been written up.

The results of the Revelstoke post-development environmental analysis are grouped under three headings: the aquatic environment and fish resource, the terrestri ah environment and wildlife resource, and the atmospheric environment. These are combined at the end of this section to evaluate the effectiveness of the EIS as a predictive tool.

The Aquatic Environment and Fish Resource

The conversion of a river to a reservoir has far-reaching environmental effects because impoundment destroys the riverine ecosystem and initiates the development of a new, lake-like aquatic ecosystem. Unlike lakes, reservoirs have controlled outflows (some also inflows, e.g. Revelstoke). This not only affects the developing ecosystem in the reservoir, but in turn also introduces marked changes in the riverine environment downstream of the dam. The newly created reservoir environment goes through an aging process, often extending over several decades, before its ecosystem reaches a mature stage. The common changes of this development sequence have been documented and combined into a "reservoir paradigm" (Rzoska, 1966). However, site-specific factors must not be ignored in predicting impacts for a specific development.[13]

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12. For a detailed discussion see Missler (1980).

13. Though the reservoir paradigm is widely accepted, Hecky et al. (1984) caution that it is applicable only in impoundments of the same type of environment as that of the original paradigm. The difference in just one environmental factor can result in a wrong or missed impact prediction. Marmorek et al. (1986) examined eleven Canadian hydroelectric developments (including Revelstoke) located in diverse environmental settings. From the results of these post-development analyses they derive a set of "generic

This section presents a comparison of the impacts predicted by the B.C. Hydro EIS (19766) and the actual impacts on the Revelstoke Reservoir and downstream environment. A summary of the results is shown in Table 7, part A refers to the physical limnological system and part B to the chemical and biological systems. Impacts are further subdivided according to their location in the reservoir or downstream of the dam.

For the physical limnological system the EIS predicted four parameters (#1 erosion, sloughing; #2 potential evaporation; #3 density; #4 flow) to be affected in the reservoir, and five (#5 erosion; #6 water turbidity; #7a,b water temperature; #B flow regime; #9 inflow to Upper Arrow Lake) to be impacted in the area downstream of the dam.

The chemical and biological systems have been grouped together as their complex interactions make it hard to separate them (Langford, 1983). In the reservoir seven parameters were to be affected (#10 dissolved oxygen; #11 nutrients; #12 trophic level; #13a,b fish habitat; #14a,b fish distribution; #15a,b fish composition; #16a,b fish production) and downstream of the dam five (#17 nitrogen; #18 dissolved oxygen; #19 fish habitat; X20 fish composition; #21a,b fish production). Impact prediction #18 is excluded from the final analysis as it is a general observation and does not give the direction of the change. Clark et al. (1985) observe that it is not sufficient to state the concentration of a pollutant, but one must go further and either give the ambient concentration or predict the effect on the system.

Significant to the aging process of the Revelstoke reservoir is that the vegetative cover from the reservoir area was almost completely removed and much of the small amount of remaining organic material was mobilized during impoundment and removed as floating debris. Thus, the expected initial trophic upsurge following reservoir flooding was smaller and shorter than predicted. As the reservoir is still going through the aging process, it is too early to verify some of the impacts, such as fish composition and production.

The Terrestrial Environment and Wildlife Resource

The EIS assessed the geology, landforms, soils, and slope stability of the reservoir area, but other than for the latter raised no concerns.

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impact hypotheses and diagrams". These hypotheses, in combination with some further recommendations, are to make EIS predictions more accurate and testable for future development. Duchnisky (1987) used the reservoir paradigm to evaluate the EIS predictions for the proposed Site C dam in B.C. He gives a detailed description of the paradigm. See also Baxter (1977) and Baxter and Claude (1980).

Table 7 Comparison of Predicted and Actual Impacts on the Aquatic Environment and Fish Resource

	PARAMETER	PREDICTED IMPACT	ACTUAL IMPACT/VERIFICATION	COMMENT
A.	**PHYSICAL LIMNOLOGICAL SYSTEM**			
	RESERVOIR:			
1	erosion & sloughing	wave action and fluctuating water level to cause erosion of silty, sandy material during first few years	some erosion/partially correct	monitored, but records not examined; should be minimal due to paucity of erodable material
2	potential for vmration	*Increase* by factor of 3.6	not monitored/not verifiable	considered negligible In relation to mean annual flow at the dam
3	density	differences In density may Induce density currents	not monitored/probably correct	likely occurring as Inflow from Kinbasket Lake Is probably interflow below epilimnion
4	flow	mean velocities are likely to be extremely small, *normal maximum flood* conditions Increased by factor of approx. 5 times; reservoir flushing rate 5 times per year	not monitored/not correct	flushing rate appears to be about 12 times per *year*
	DOWNSTREAM OF DAM:			
5	erosion	increased due to higher sediment carrying capacity of water released from dam	not monitored/not verifiable	
6	water turbidity	increased photosynthetic activity dw to decreased turbidity	not monitored/not verifiable	photosynthetic activity is also dependent on available nutrients
7a	water temperature	possible decrease In summer and Increase in winter as power discharges realmost certainly hypolimnetic	mixing of hypolimnetic and epilimnetic water occurs/not correct	
7b		tailwater temperature Increase by spillway releases In summer	surface reservoir water discharged markedly warmer In summer/correct	magnitude of impact depends on magnitude & freqwncy of spillway releases
8	flow regime	negligible	/not verifiable	'negligible' not defined; also time periods of flow not specified - diurnal & seasonal variations may differ markedly from natural river flow regime
9	inflow to Upper Arrow Lake	likely to be affected over 3 months during reservoir filling	during 17 days no water released from dam/not correct	much shorter than predicted, ion9 Interruption would have been too detrimental to downstream cosystea
B.	**CHEMICAL/BIOLOGICAL SYSTEMS**			
	RESERVOIR:			
10	dissolved oxygen	expected to be high due to short retention time & little organic utter	levels at or close to saturation/ correct	retention time of water in reservoir is shorter than predicted; reservoir was cleared of organic material
11	nutrients	upsurge first few years	slight upsurge for 2.5 years /partially correct	little organic material left, nutrients leached from soil; no corresponding upsurge in activity occurred
12	trophic level	oligotrophic	ultra-oligotrophic/needs long term verification	

Table 7 Continued

PARAMETER	PREDICTED IMPACT	ACTUAL IMPACT/VERIFICATION	COMMENT
13a fish habitat	Columbia River (7000 ● cres) lost to river fish	river hebitrt changed to lake-like habitat/correct	
13b	- lower reaches of tributaries lost (24 acres)	hebitet loss underestimated by 5%/ not correct	predict ion Included compensatory habitat development which was not undertaken
14a fish distribution	- resident fish in Columbia River & trlbuterles below 573 m lost	not monitored/not verifiable	fish ● ppeercd ta have stayed In reservoir
14b	considerable numbers of fry & fingerlings lost between river diversion & reservoir filling	no definite data ● vellxblc/ correct	blockage by diversion tunnel and dam
15a fish composition	- expected to support same species	/correct to date but needs long tern verification	
15b	- decrease in Dolly Varden & rainbow trout could lead to increase in Columbia squawf ish	increase relative to decrease in mountain whl ttf ish/needs long tern verification	mountain whitefish decreased from 96% to 81% of total fish population
16a f lsh production	- Increase during first 5-10 years	did not take place/not correct	upsurge In nutrients dld not take piece
16b	- sustained yield will dreg to lower levels; fishery will be qualitatively different	/needs long term verification	
DOWNSTREAM OF DAM:			
17 nitrogen	nitrogen supersaturation dw to spillway discharge could lead to significant f lsh losses	minimal fish losses/not verifiable	cannot be ver if led because predict ion was based on specif lc spillway design which was changed
18 dlsroived oxygen	may be effected with temperature changes of water discharged from dam	not monitored/prediction too vague, excluded from study	● ppe8rs most unlikely es reservoir water Is at saturation level
19 flsh habitat	Columbia River & Its trlbuterles lost to migrating flsh from Arrow Lakes; no recruitement from upstrew populations	/correct	blocked by dam
20 flsh composition	to remain unchanged, upstream losses of migrating flsh (Dolly Varden, kokanee, rainbow trout) could result In increase of other flsh species	/needs long term verification	
21afish production	- ● rtimeted losses: 20-30% kokanee, 1440 golly Verden	/cannot be verified due to lack of data	no estimates possible for mountain whitefish, rainbow trout (especially trophy species), & white sturgeon
21b	- significant losses of Arrow Lake golly Verden, kokanee, rainbow trout: quality of fishery (particularly rainbow trout) probably ● ndengered	/needs long term verification	

Sources: Fleming, 1988; B.C. Hydro, 1976b; Smith, 1986, 1987, 1988; Watson, 1985

Although the slope stability of two areas was monitored, they were considered safe and no impacts were anticipated. As In the EIS, here also initial sloughing and erosion of reservoir banks following impoundment was included in the aquatic environment. However, erosion of the Revelstoke golf course, an unpredicted impact, was evaluated here as a terrestrial impact, though its cause originates in changes to the aquatic environment. The comparison of predicted impacts on wildlife resources and their outcome 'follows; but is limited by the paucity of monitoring data'.

The Land Surface

The City of Revelstoke filed a claim for mitigation and compensation with the CIC for the erosion of parts of its golf course on the east bank of the Columbia River, downstream of the Revelstoke Dam (Sussex, 1985). The City's concern was that full operation of the dam (four turbines) would increase the rate of erosion.

The Rivers Section of the Water Management Branch confirmed, in the fall of 1984, that three sections of the golf course (1 km total) were eroding at a slow rate. Comparison of 1977 and 1980 air photos showed that no land had been lost during those years. A monitoring program was proposed to measure the rate of erosion and the effect of full dam operation (Water Management Branch, 1984).

A consultant's study (Sussex, 1985) commissioned under the water licence (see Section on CIC) could not clearly establish whether the erosion was caused by the operation of the Arrow Lake or the Revelstoke Reservoir. The greatest potential for erosion was a low Arrow Lake level and peak power generation at the Revelstoke Dam. The claim was settled by B.C. Hydro and the City in the summer of 1988 without any monitoring having taken place.

The Wildlife Resource

Climatic and topographic conditions in the Revelstoke Project Study area are harsh for wildlife and determine both the species and their distribution. Moose, caribou, and grizzly are better able to survive, but deer are limited to the southern part of less inclement weather. As part of the Pacific Flyway, the area is utilized by migratory birds, but also by many resident birds.

Despite long lists cataloguing the many mammals and birds of the study area, EIS predictions refer only to waterfowl, deer, moose, and caribou. All predicted impacts are qualitative and extremely vague as little was known about the species' population size, habitat, habitat utilization, and seasonal movements. Seven very general areas of wildlife resource concerns are outlined in the EIS. One of these, the change of wildlife use pattern, could not be analyzed for lack of data. Evaluation

of the six remaining potential impacts is based on data gathered under an agreement between B.C. Hydro and the FWB. The former monitored the valley species such as deer, beaver, and waterfowl, and the latter upland species such as caribou and grizzly bear. Whereas the FWB's work has been published, much of B.C. Hydro's remains in the form of field notes, which are now being analyzed by the Corporation. This task is most difficult because the field notes resemble "hieroglyphics" and some of the field research methodologies employed limit the usefulness of the material (Bradley, 1988).

The comparison of predicted and actual impacts, summarized in Table 8, distinguishes between pre- and post-impoundment data, i.e. actual impacts are those that happened after impoundment. Only the impact arising from illegal garbage disposal relates to the whole construction period. Impacts are grouped as in the EIS under six main concerns: #1 disturbance and removal of habitat; #2 illegal garbage disposal; #3 reservoir surface debris; #4 barriers to movement--reservoir and transmission lines; #5 reservoir drawdown during ice formation; and #6 animal-vehicle collisions mainly on Highway 23 North. Where applicable they are further subdivided into species.

Wildlife was expected to be most severely impacted by the disturbance and removal of habitat (Table 8, #1) in the areas of the reservoir (21,500 acres), the highway right-of-way (about 900 acres), the transmission line and ancillary facilities. This would force animals to relocate in adjacent areas, where increased animal densities and pressure on food sources would result in animal die-offs in critical times of the year, usually winter.[14] Whereas the whole study area was affected, some areas like the highway and transmission line right-of-ways and borrow pits, were altered, but vegetation was expected to reestablish itself.

The reservoir and its operation were predicted to cause ungulate fatalities (#3-5). The EIS warned that even small amounts of reservoir surface debris present problems to swimming moose, caribou and presumably other ungulates, and any significant accumulation usually results in drowning (#3). Critical reservoir crossing sites and times for caribou and moose were identified in the EIS. Caribou could be severely affected. These animals travel in herds and the drowning of one herd could significantly reduce the relatively small population of the area. However, surface debris was not a big problem. The reservoir had been

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14. Grizzly bears were not included in the EIS predictions, but might also be affected if snow-melt were late forcing the bears to look for food at lower elevations. They also shifted from the low-risk reservoir habitat to the margins of Highway 23 North, which are high-risk areas due to hunting and vehicle collisions. These risks are partially offset by the bears' increased secrecy and night-time activity (Simpson, 1987).

Table 8 Comparison of Predicted and Actual Impacts on the Wildlife Resource

PARAMETER	PREDICTED IMPACT	-ACTUAL IMPACT/VERIFICATION	COMMENT
disturbance & removal of habitat	reduced animal numbers	a: waterfowl/no data	-area is part of Pacific Region Flyway, previously affected by Mica and Arrow Lakes Reservoirs
		b: deer/no data	-mainly are in southern area, limiting factor is snow; appear to increase due to mild winters in recent years
		c: moose/inconclusive[1]	-sampling procedures limit usefulness of data; long term effect will be manifested following a severe winter
		d: caribou/inconclusive	-1980 to 1984: possible population increase; trend possibly reversed since reservoir filling, needs more data
2. illegal garbage disposal	removal & the destroying of nuisance bears	some removed, some destroyed	bears were a problem at sites of illegal garbage disposal in the reservoir area and at the regional sanitation fill; the impact could not be quantified
3. reservoir surface debris	ungulate drownings; could affect caribou population	a: deer/no data	
		b: moose-none reported[2]/inaccurate	-recorded reservoir crossings: 3, no fatalities
		c: caribou-none/inaccurate	-recorded reservoir crossings: 6 pre- and 8 post-impoundment to 1985, no fatalities
4. barriers to movement: - reservoir - transmission lines	possibly result in fatalities	a: caribou-none reported/inaccurate	-problems due to flooded landmarks did not occur
		b: caribou/no data	
		c: waterfowl/no data	-largest hazard line from Mica Dam crossing reservoir
5. reservoir drawdown during ice formation	ungulate drownings	a: deer-some reported/accurate	the impact on ungulates was not closely monitored, some fatalities reported due to ungulates unable to climb out of reservoir over ice sheets
		b: moose/some reported/accurate	
		c: caribou-none reported /inaccurate	-cross in fall & April when danger is much reduced
6. animal-vehicle collisions mainly on Highway 23 North	ungulate fatalities	a: deer-some reported/accurate	a minimum of 49 ungulates were killed in 1983/84 to 1986/87 inclusive; this impact was not closely monitored, highway signs warning of hazard have had minimal effect
		b: moose-some reported/accurate	
		c: caribou-some reported/accurate	

1. Long term effects may possibly be determined with more data.
2. None reported - does not exclude the possibility that the species were affected.

Sources: Bonar, 1978, 1979, 1987; B.C. Hydro, 1977-1984; Bradley, 1986, 1987; Gabrowski, 1988; Krause, 1988; Mahovich, 1988; Simpson, 1987; Simpson et al, 1987; Sommerville, 1987.

totally cleared and shoreline debris removed. The mainstream of the reservoir was navigable already within one year of flooding (Mahovich, 1988).

An additional hazard to migrating caribou could have arisen from the obliteration of landmarks by reservoir flooding and construction of the transmission line. Animals might become confused and abandon their traditional migration routes, possibly resulting in fatalities (#4a,b). As noted, the reservoir does not appear to be a barrier to caribou movement but no data are available on the effect of the transmission line.

Migrating birds were expected to suffer fatalities from collisions with transmission lines and towers, especially during night migration (#4c). The greatest potential hazard is the Mica transmission line, crossing the reservoir at Downie Creek; that of the Revelstoke transmission line from the Dam to the substation just south of Revelstoke is not known. It depends on the birds' migration patterns and routes. The actual impact on the waterfowl could not be assessed due to lack of information.

The operation of the reservoir in winter was thought to cause ungulate fatalities by drowning (#5). Reservoir drawdowns during periods of ice accumulation result in two dangerous situations: an ice sheet that forms during drawdown slopes inward into the reservoir, and, when drawdown occurs after ice has formed at the reservoir edge, it is left as a shelf above the water. In both cases ungulates can slide or fall into the reservoir and then have great difficulties climbing out over the ice. The magnitude of this impact depends largely on the operation of the reservoir and climatic conditions. Since impoundment (October 1983, ice formation has been spotty in all years except 1985/86. Ungulate fatalities caused by the reservoir ice are not monitored closely (Krause, 1988). The total reported number in the first two winters following impoundment was fifteen, nine of which were identified as deer, and one as moose. No known caribou fatalities resulted from the ice cover. They mainly cross the reservoir in late fall or April, when danger of the ice cover is much reduced (Simpson, 1987). There are no data for the past three winters (19851988). A correlation with dam operation and climatic conditions was not attempted.

The EIS predicted ungulate fatalities from animal-vehicle collisions especially along the relocated Highway 23 North (#6). Moose could be involved any time of the year, caribou in early spring and late fall, and deer at all times. The loss of valley wintering habitat is forcing ungulates to winter close to the Highway, hence more animals are on the road than prior to reservoir flooding (Krause, 1988; Gabrowski, 1988). Highway signs, warning drivers of the presence of animals in the most problematic areas, have had minimal effects (B.C. Hydro, 1977-1984). Road kills have not been monitored closely (Krause, 1988). A minimum of forty-nine winter road kills (deer, moose, caribou) were reported. Figures for

other seasons and for pre-impoundment years are not available, so the impact of the Project cannot be established.

The Atmospheric Environment

Extensive research on reservoir-induced climatic changes in general has not taken place, because the large scale weather regime is not affected (Bandler, 1986). Climatic impacts are considered to be proportional to reservoir size (Baxter, 1977), localized and site-specific (Bandler, 1986), which makes the choice of control monitoring sites problematic (PACK, 1983).

Altogether eight climatic impacts affecting temperature, humidity, and wind regimes of the reservoir and its immediate vicinity were predicted in the EIS. All effects were classified as irreversible, localized and of minor significance. Their magnitude was likely to be minimal as the surface area of the reservoir is small, especially in relation to the adjacent Kinbasket Lake and Upper Arrow Lake. Impacts were called ambivalent because they could affect various interests positively or negatively (B.C. Hydro, 1976b). The effectiveness of the EIS in predicting atmospheric impacts could not be evaluated as all predictions were qualitative and none of the parameters were monitored.

Of interest is the compensation claim by the City of Revelstoke for the uphill relocation of the Mt. McKenzie ski lift (9 km south of Dam), due to warmer temperatures thought to be caused by the reservoir. According to the limited evidence of the literature examined, the reservoir does not appear to be the cause of the warming trend. The EIS, based on impact temperature measurements right at Mica Dam, predicted a small increase of frost-free days in the region of the reservoir shore. Bandler (1986) quotes an Australian source, which states that temperature changes do not extend beyond 1 km of a reservoir.

The Effectiveness of the EIS as a Predictive Tool

The results of the post-development analysis for the aquatic environment and fish resource and for wildlife resource are shown in Table 9. The impact predictions for the terrestrial environment (golf course erosion) and those for the atmospheric environment were excluded. For the former a definite link with the Project could not be established, and the latter were all qualitative and none were monitored.

The overall effectiveness of the EIS as a predictive tool was rather low. Only 25.6% (11) of the forty-three impacts were accurately predicted. This figure could be raised to 27.9% by including the one fish habitat prediction (#13b) which was essentially correct, but had to be classified as incorrect because it included a compensation measure, which was not carried out. Taking wildlife alone, the rate improves to 35.3%

Table 9 Post-Development Environmental Analysis Results

Predictions	Aquatic Environment & Fish Resource		Wildlife Resource		Combined	
	No.	%	No.	%	No.	%
accurate	5	19.2	6	35.3	11	25.6
partially accurate1	3	11.4	-		3	7.0
inaccurate	5	19.2	4	23.5	9	20.9
verifiable in long term & inconclusive	6	23.1	2	11.8	8	18.6
not verifiable (no data, not monitored, etc.)	7	26.9	5	29.4	12	27.9
Total:	26		17		43	

1. Includes one prediction "probably correct".

(6). This probably results from the vagueness of the predictions--the less specific a prediction the more likely it will appear accurate. It is also interesting, that of the 19.2% (5) predictions found accurate for the aquatic environment and fish resource, four (7b, 13a, 14b, 19) were "no-miss" predictions. 7% (3) of the predictions were verified as partially correct.

The EIS did not correctly predict 20.9% (9) of all predictions; the difference (4.3%) between the two categories (aquatic environment and fish resource 19.2%, wildlife 23.5%) is unremarkable. Verification in the long term is possible for 18.6% (8) of all predictions, three quarters of which pertain to the aquatic environment and fish resource. Fish composition and sustained yield both up- and downstream of the dam and the trophic level of the reservoir are expected to stabilize as the reservoir ages. The impact of habitat loss on moose will only become apparent following the first severe winter after impoundment. The critical factor for caribou is the loss of spring habitat, the effect of this is still being monitored. For lack of data, verification could not be undertaken for 27.9% (12) of the predictions. The difference between the two categories (2.5%) was not appreciable.

To summarize, for 53.5 % of all predictions a verification was possible: 25.6% accurate, 7% partially accurate and 20.9% inaccurate. This might be improved in the long term with more monitoring for 18.6% of the predictions. But for 27.9% verification is not possible. Overall the predictive capacity of the Revelstoke EIS was found to be unsatisfactory.

A final observation concerns the application of the reservoir paradigm. Researchers must not preclude the possibility of other potential impacts and they must consider site-specific conditions. As the Revelstoke Project has shown, the removal of all vegetative matter in the reservoir area caused a trophic upsurge that was considerably smaller and of shorter duration than the one expected. Consequently the predicted increase in productivity did not result either.

SHORTCOMINGS OF THE REVELSTOKE EXPERIENCE

As the B.C. government had failed to do justice to the public's concern over inadequate approval procedures for large scale development projects, in 1976 B.C. Hydro's Revelstoke Project was approved under the only existing operational procedure--the Water Act (1960). The shortcomings of the Revelstoke experience have clearly demonstrated that this approval procedure was outdated. The Act had no provisions for project selection, justification and implementation.

During the planning phase the selection and justification of the Revelstoke Dam had been the sole responsibility of the project proponent, who proceeded unhindered in the absence of an explicit provincial energy plan and without consideration of the public policy context and input from

provincial ministries and the public. B.C. Hydro based the choice of the Revelstoke Project on their somewhat superficial assessment of several alternative developments. The need for the Project was justified by the Corporation% electric energy demand forecast, which was significantly higher than that of the B.C. Energy Commission. Neither could these two fundamental issues be addressed in the approval phase of the Project as they were beyond the narrow mandate of the Water Comptroller. Thus it was not established, that a large scale development project, and in particular the Revelstoke Project, was in the interest of the Province.

Assessment of the broad range of environmental, social and economic aspects of the Project were also not covered by the Comptroller's mandate. Nevertheless, these issues were extensively discussed and ruled on at the public hearing. While the Water Act did not require the preparation of an EIS, B.C. Hydro did prepare one. However, the Corporation was free to set its own terms of reference without making allowances for public and governmental concerns and priorities. The resulting data deficiencies considerably impeded the assessment of these concerns at the public hearing and led to the deferral of major mitigation and compensation matters to the implementation phase of the Project. Additionally, the Water Comptroller and his staff lacked the expertise to deal with these complex issues. The retained consultants were inaccessible to the public, who perceived them as biased.

Public participation at the hearing was unsatisfactory. Intervenors neither had any input into determining the format and initial scheduling of the hearing, nor did they receive funding. More significant, though, was the public's perception that the hearing was a sham. This arose from B.C. Hydro's actions and the narrow mandate of the Comptroller. The public saw the hearing as a futile exercise which discouraged rather than encouraged their participation. In the end, the hearing appeared to explicitly approve a project that the government had implicitly approved much earlier.

Of note is that there were no provisions to stop construction of such a major development, while appeals to the issuance of the water licence were heard. These appeals reflected the deficiencies of the Water Act as well as the licensing procedure: the Project's need had not been established and the water licence provisions precluded the efficient handling of environmental matters and public participation in the implementation of the Project. Despite the concerns of the Appeal Committee, Cabinet did not grant a moratorium to better assess the Project, instead it allowed the Project to proceed with an amended licence.

Project implementation under the administrative framework, provided by the amended licence, was far from adequate and effective. The main reasons for this were: (1) the framework consisted of two programs, neither of which had been well thought out, nor integrated with each other; (2) both structures lacked the expertise required for the efficient

administration of such a complex development project; and (3) some of the problems encountered by the official program were inherent in the clauses of the water licence.

First, the administrative framework was not based on a holistic planning approach, but rather on the separate and somewhat ad hoc successive efforts of the License and the regulators. This resulted in major shortcomings in both the unofficial and official programs. Duplication of responsibilities existed within each program and between programs. As a consequence of the latter, the potentially useful claims procedure of the official program was not instituted. Thus the official program had no liaison person in Revelstoke--a significant shortcoming. There were no prescribed lines of communication between the two programs. Most RPCC and CIC meetings were held in Victoria and Vancouver, which especially complicated the relationships between the Local Impact Committee and the CIC, between the site biologists and the RPCC, and between the Impact Monitor and the official program.

Another major shortcoming was that authority was vested only in the Water Comptroller and the two Committees of the official program, the site biologists and unofficial program had none. Thus enforcement of environmental preservation and mitigation measures became the responsibility of the Construction Manager and government agencies. The former, not an explicit part of the administrative structure per se, assigned a minor role to environmental concerns. His objective was to finish the Project as quickly and economically as possible. Government agencies often took a laissez faire attitude and were hampered by the paucity of funds and staff. The lack of authority rendered the operations of the Local Impact Committee and the Impact Monitor largely ineffective. The latter was also impeded by the absence of clear directives, accountability to the Regional District, and B.C. Hydro's continuing influence. Jointly, this not only led successive Monitors to entirely different interpretations as to their responsibilities, but also to the limited usefulness of their work and finally to the premature termination of the Office itself.

The administrative structure had no provisions for meaningful public participation; the RPCC was closed to it, and the CIC did not encourage it. The public could only respond to the reconnnendations of the two Committees and the Water Comptroller's approvals and orders. However, this kind of participation was reactive rather than proactive. Furthermore, without the Claims Officer the official program lacked direct local contact. Meaningful public participation through the unofficial program was not possible as the bodies of that program were only advisory.

The second underlying reason for the inefficient operation of the administrative structure was the lack of requisite expertise. As the Project was licensed under the Water Act, the implementation of the water licence was automatically assigned to the Water Management Branch.

However, the agency's staff lacked the essential environmental, social, and economic expertise for such a multi-faceted task.

The operation of both official Committees was affected. Initially, the RPCC and the CIC did not prepare plans of action identifying important issues and their priorities. Instead, the Committees followed an ad hoc approach. The resulting indecisive leadership by the RPCC led to the very slow resolution of issues, the settlement of the fish and wildlife compensation outside the Committee, and the toleration of B.C. Hydro's persistent procrastination. The CIC based its decisions on ad hoc studies or political lobbying (DPA Group, 1986). Furthermore, the site biologists could have benefitted from consultation with experts in their field. Their isolated position in Revelstoke prevented meaningful communication with B.C. Hydro head office biologists and knowledgeable members of the RPCC. Shortage of expertise also rendered the operation of the unofficial program inefficient. The Impact Monitor was handicapped by unclear directives and dearth of advice from his employer. Additionally, both he and the Local Impact Committee had not been provided the necessary support staff by B.C. Hydro.

Thirdly, some shortfalls of the operation of the official program arose from the inadequate provisions of three of the water licence conditions (p, q, r), which pertained to environmental studies, impact monitoring and environmental guidelines. These clauses did not clearly define the responsibilities of B.C. Hydro, the FWB and the site biologists. The water licence did not specify who was to design environmental programs (clause (p)), but assigned their implementation to B.C. Hydro, thereby impinging on the mandate of the FWB and causing a prolonged confrontation between the two. Hence the RPCC's task of integrating environmental effects monitoring and negotiating a compensation agreement for fish and wildlife losses was rendered most difficult.

As some of the responsibilities under clause (p) and (q) were very similar, the RPCC encountered problems in assigning the site biologists' work to the fulfillment of these clauses. This task was exacerbated because clause (q), which broadly outlined the work of the site biologists, was not a responsibility of the Committee. The only directive to be given by the Water Comptroller for that clause was the length of the biologists' employment. In practice B.C. Hydro was given a free hand in all other matters pertaining to the site biologists. Thus they were placed under the authority of the Construction Manager, who did not appear to perceive their role as important. Furthermore, as surveillance of B.C. Hydro's adherence to environmental guidelines (clause (r)) was the task of the Construction Manager, he delegated it to his engineering staff and the site biologists were unable to adequately monitor construction activities and establish liaison with contractors.

As called for in the water licence, environmental guidelines were prepared by B.C. Hydro and, following review by the Ministry of

Environment, approved by the Water Comptroller. The latter stipulated that they be updated as the Project progressed. This study has shown that both the format (contractual requirements and actual environmental guidelines) and the content of the guidelines were inadequate.

Contractual requirements, the main body of the guidelines, outlined only general construction practices, site-specific concerns were referred to the Construction Manager, rather than the site biologists. Additionally, the wording of contract clauses was vague and reference to the relevant government regulations and Acts was incomplete.

The actual environmental guidelines contributed little as they, too, lacked detail and failed to clarify the purpose and administration of the contractual requirements. The section on fish and wildlife protection offered somewhat more specific provisions, but these were not part of the contract clauses.

The guidelines neither covered reservoir filling nor mentioned the separate sets of clearing standards developed for the reservoir area and transmission lines. Almost no provisions were made for consultation with the site biologists, whose role was thus minor. Updating of the guidelines was not undertaken; indeed, it seemed precluded by the binding nature of construction contracts. The environmental guidelines failed to provide the necessary guidance for the conservation and protection of the environment.

A monitoring program to ensure compliance with and enforcement of environmental guidelines, government regulations and Acts, and to integrate the activities of the various regulatory agencies was not provided for the Revelstoke Project. The only provisions were that B.C. Hydro employ two site biologists to monitor fish and wildlife aspects and to prepare environmental guidelines, and that the Corporation adhere to the latter. The Water Comptroller made the Construction Manager, rather than the qualified site biologists, responsible for compliance monitoring and enforcement of the guidelines.

The site biologists could not adequately and continuously monitor the implementation and effectiveness of the guidelines. Contrary to the guidelines, the Construction Manager did not perceive this as their duty. The available information leads to the conclusion that compliance monitoring was insufficient. Assessment of impacts tended to be qualitative and sometimes subjective. The site biologists' monthly reports were skimpy and other data were still in the form of unanalyzed field notes. The monitoring that was carried out was often not instrumental in soliciting enforcement. Insufficient staff and a laissez faire attitude rendered surveillance and enforcement by government agencies inadequate. A strong commitment to the preservation of environmental quality was lacking.

Overall preservation of environmental quality during construction appears to have been relegated to a minor role. That no major accident or long term effects had occurred was more a matter of good fortune than effective environmental management (Bonar, 1987).

The post-development environmental analysis of the Project confirmed that no major environmental impacts resulted from construction per se. It also corroborated that such studies are especially cumbersome for projects with early environmental impact assessments. Three problems confounded the task: The EIS was of poor quality, effects monitoring had not been coordinated with EIS predictions, and much of the monitoring data was difficult to work with or in an unusable form.

The EIS was found to be an ineffective tool for predicting impacts. Just over a quarter of all predictions were accurate. Significant is that the lack of baseline data limited the specificity of predictions for the wildlife resource and appeared to result in a higher predictive capacity (35%) than for the aquatic environment and fish resource (19%). Furthermore, 80% of the predictions for the aquatic environment and fish resource were "no-miss" predictions. While 21% of all predictions were inaccurate and 28% were not verifiable for lack of data, 19% may possibly be verified in the long term. This might, of course, change the predictive capacity of the EIS, which to date is unsatisfactory.

THE CURRENT ENERGY PROJECT REVIEW PROCESS IN BRITISH COLUMBIA

The evaluation of the Revelstoke Project has clearly demonstrated, that the provisions of the Water Act neither met the demands of a changed public value system nor adequately dealt with the great complexities of large scale projects. The contentious approval of such projects as the Seven-Mile (1973-75) and Revelstoke (1976) Dams and the Cheekeye-Dunsmuir Transmission Line to Vancouver Island (1978) prompted the government to introduce the Energy Project Review Process (EPRP) in 1980 (O'Riordan, J., 1988). To date the Site C Dam on the Peace River has been the only large scale hydroelectric development reviewed by this procedure. Following a brief description of the EPRP,[15] its application in the Site C Dam proposal will be examined in order to determine to what degree the EPRP addresses the issues raised by the Revelstoke Case Study.

The EPRP, introduced under the B.C. Utilities Commission Act (1980), provides new procedures for the selection and licensing of "regulated" energy projects, which are major new energy projects or additions to existing ones (pipelines, transmission lines of 500 or more kV, energy storage and use facilities, hydro- and thermal-electric plants of 20 or

15. For a more detailed description see the three sources used here: Ministry of EMPR (1982). Andrews and Higham (1986), and Thompson et al. (1981).

more MW). The Minister of Energy, Mines and Petroleum Resources (Minister of EMPR) administers the EPRP, but makes some decisions jointly with the Minister of Environment. Review of project proposals is the responsibility of the B.C. Utilities Commission (BCUC, set up under BCUC Act) and the Energy Project Coordinating Committee (EPCC). Through the EPRP a project proponent must obtain an energy project certificate and energy operating certificate for project construction and operation., respectively.[16]

The EPRP commences with the application procedure and then goes through the review stage (Figure 5) (Ministry of EMPR, 1982). The application procedure consists of the voluntary pre-application and prescribed application phases (Figure 6), which both facilitate early and ongoing consultation between the proponent and government agencies. If the pre-application route is followed by the proponent, he submits a project prospectus and preliminary planning report to the EPCC for review by this Committee and its three Working Committees (figure 7). Thus concerns of various government agencies, requirements for licences, permits and project planning under the BCUC Act are identified. The proponent then files an application for an energy project certificate with the Minister of EMPR. This must contain the information shown in figure 6. Upon extensive review by the EPCC and its Working Committees in consultation with the proponent to identify and correct data deficiencies, the EPCC advises the Minister of EMPR, who then decides on the disposition of the application.

The Minister has four options: to reject the application or to choose one of the three review procedures shown in Figure 5 (19(l)(a), (b), (c)). With the concurrence of the Minister of Environment he can issue an exemption order (19(l)(c)). This releases the project from any provisions of the BCUC Act and allows construction and operation to proceed subject to any conditions and other statutory requirements.

An application by a public utility can be referred by the Minister to the BCUC as an application for a certificate of public convenience and necessity (19(l)(b)). The BCUC decides whether or not to hold a public hearing and, following review, whether to approve or reject the application. The BCUC decision can be appealed. If approved, the EPCC assists the proponent in obtaining the necessary statutory permits and licences before construction proceeds. The Ministers of EMPR and Environment jointly may exempt the project from any BCUC Act provisions during implementation and operation.

Lastly, the Minister can refer the application for an energy project certificate to the BCUC (19(l)(a)). This agency must hold a public hearing according to their mandate conferred to it by the two Ministers

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16. The Act also regulates public utilities, including B.C. Hydro, and reviews and certifies the export of energy from B.C.

Figure 5 The B.C. Energy Project Review Process: Certification Procedures (Ministry of EMPR, 1982)

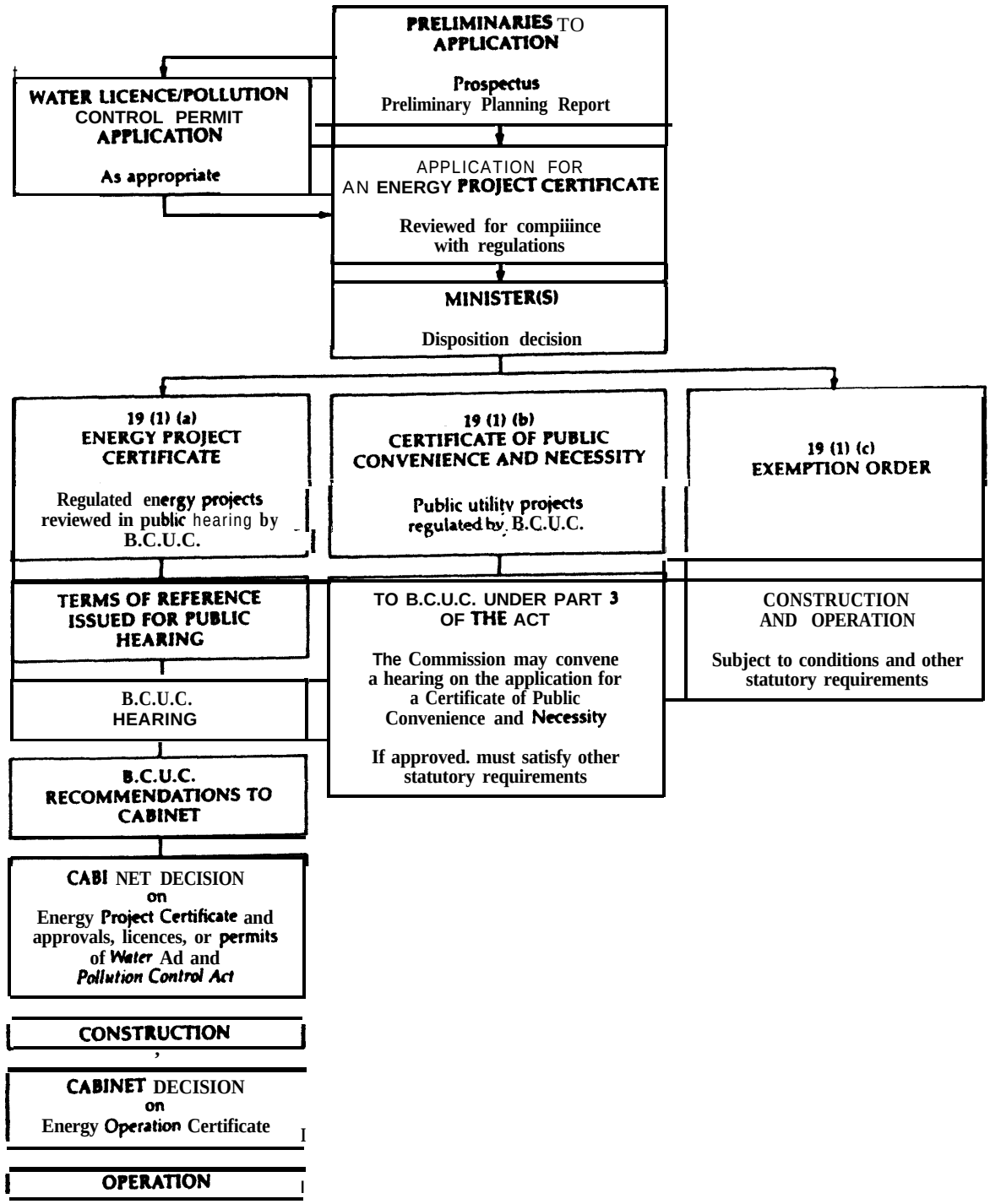


Figure 6 The Energy Project Review Process: Pre-Application and Application Phases (Ministry of EMPR, 1982)

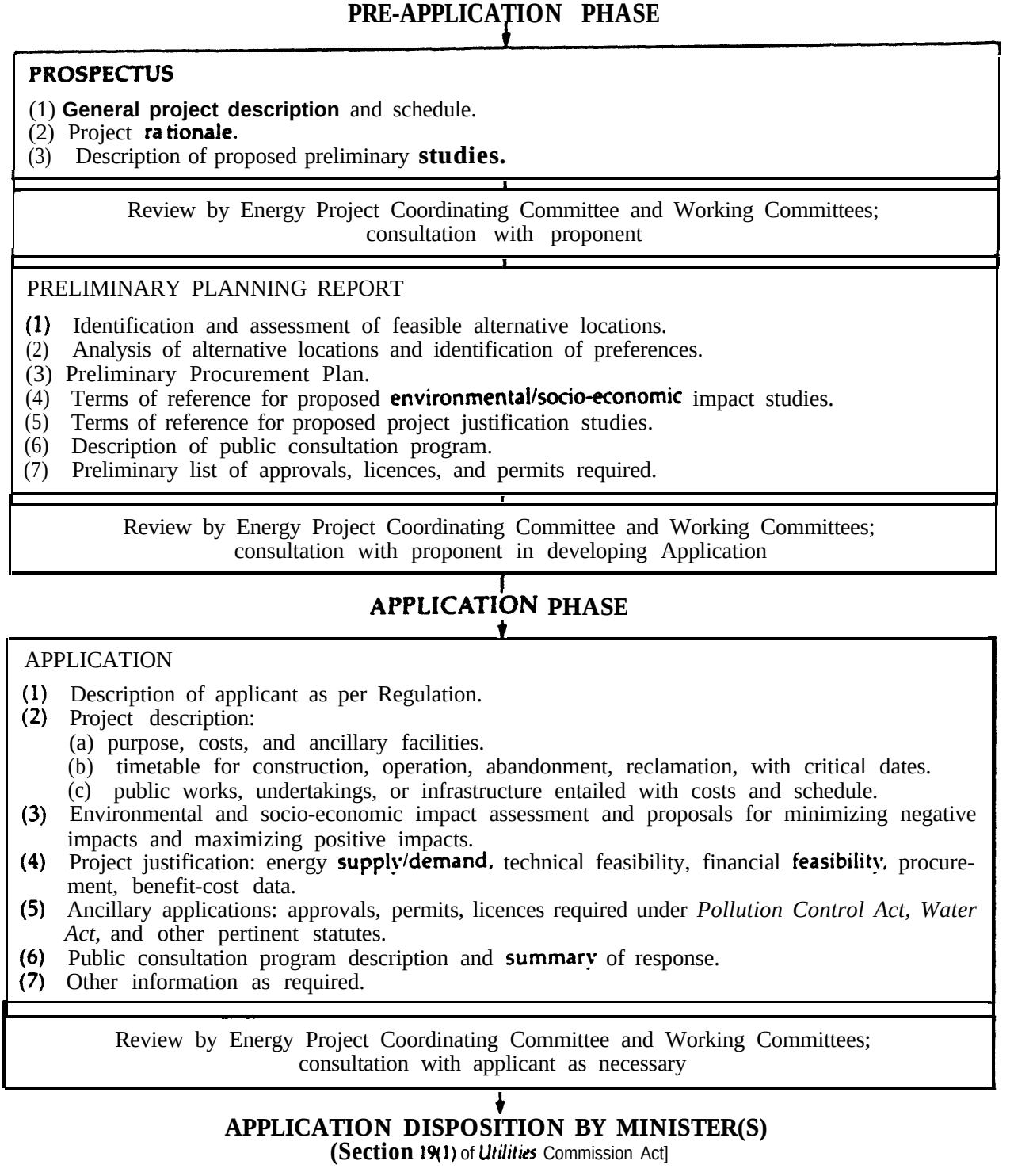
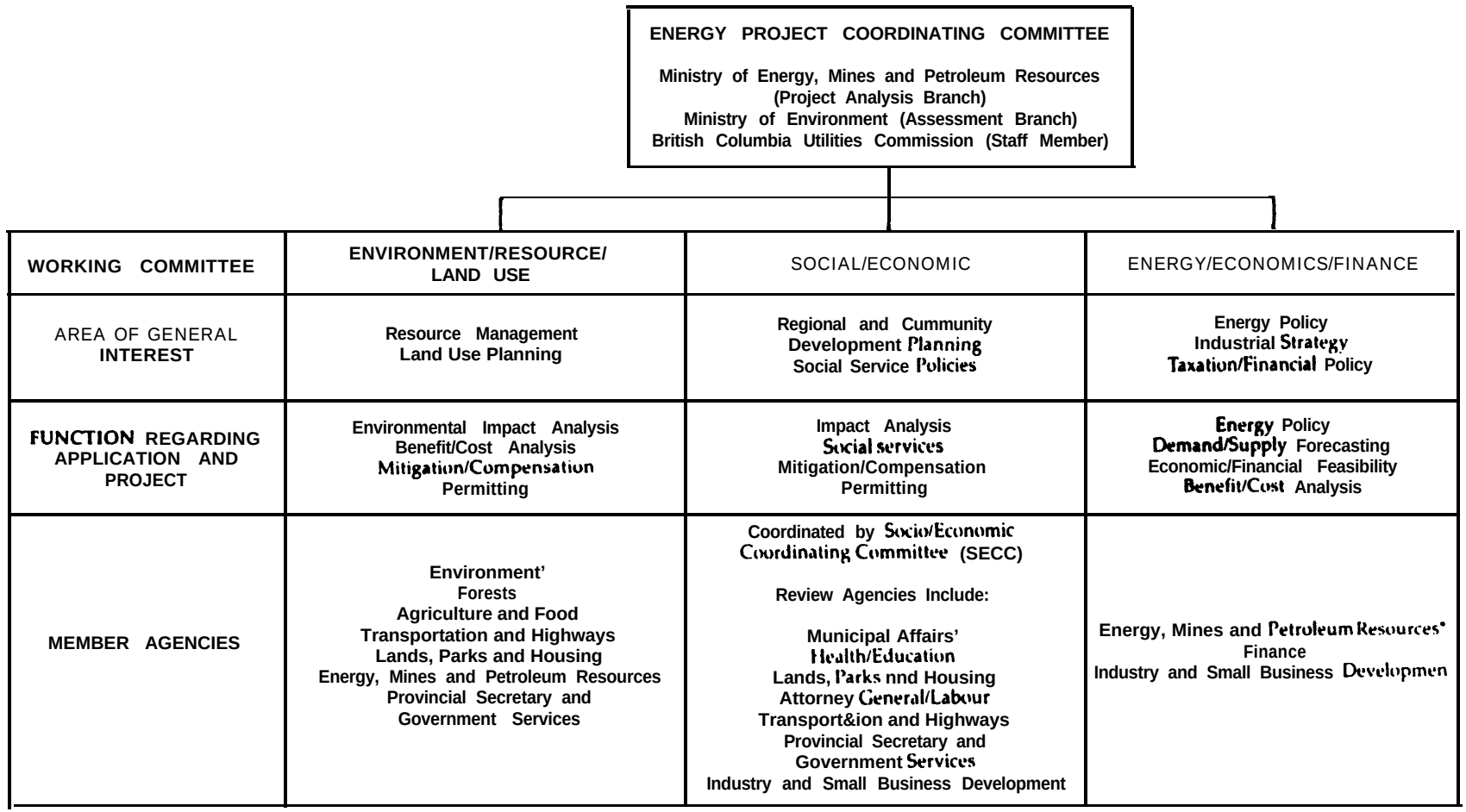


Figure 7 The Energy Project Coordinating Committee and Its Three Working Committees (Ministry of EMPR, 1982)



WORKING COMMITTEE	ENVIRONMENT/RESOURCE/ LAND USE	SOCIAL/ECONOMIC	ENERGY/ECONOMICS/FINANCE
AREA OF GENERAL INTEREST	Resource Management Land Use Planning	Regional and Cummunity Development Planning Social Service Policies	Energy Policy Industrial Strategy Taxation/Financial Policy
FUNCTION REGARDING APPLICATION AND PROJECT	Environmental Impact Analysis Benefit/Cost Analysis Mitigation/Compensation Permitting	Impact Analysis Social services Mitigation/Compensation Permitting	Energy Policy Demand/Supply Forecasting Economic/Financial Feasibility Benefit/Cost Analysis
MEMBER AGENCIES	Environment' Forests Agriculture and Food Transportation and Highways Lands, Parks and Housing Energy, Mines and Petroleum Resources Provincial Secretary and Government Services	Coordinated by Socio/Economic Coordinating Committee (SECC) Review Agencies Include: Municipal Affairs' Health/Education Lands, Parks nnd Housing Attorney General/Labour Transport&ion and Highways Provincial Secretary and Government Services Industry and Small Business Development	Energy, Mines and Petroleum Resources* Finance Industry and Small Business Developmen

*Currently chairs working committee.

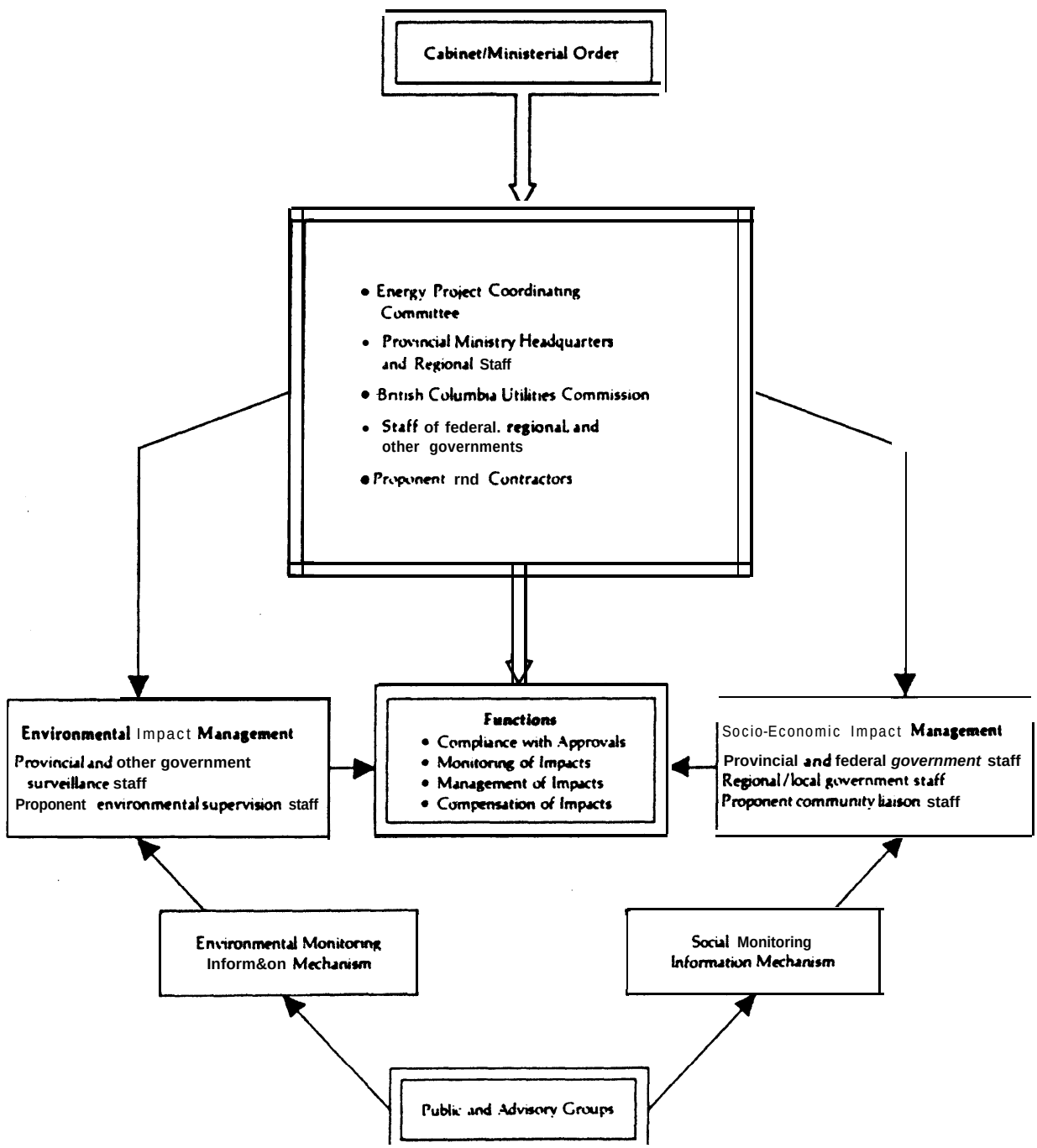
on the advice of the EPCC. A report and recommendations for the disposition of the application and conditions of the energy project certificate is submitted by the BCUC to Cabinet, who then makes a binding decision to reject or approve the proposal. The energy project certificate may impose any conditions as well as orders to obtain approvals, licences or permits of the Water Act (1979) and Waste Management Act (1980), and the proponent must satisfy other statutory requirements. Upon "substantial" compliance with the terms of the energy project certificate, Cabinet issues an energy operating certificate, which can specify conditions of project operation (Ministry of EMPR, 1982; Andrews and Higham, 1986; Thompson et al., 1981).

The EPRP has no provisions for an administrative framework for the management of environmental and socio-economic impacts during project implementation. However, the Ministry of EMPR (1983a) proposed a general structure (Figure 8) which can be adapted to specific project requirements. The framework relies heavily on government agencies, especially local branches, and to some degree on the staff of the proponent. A ministerial or cabinet order sets up a steering committee and two impact management bodies, which oversee project implementation according to approvals and policy directions. Site-specific problems are to be resolved in a coordinated, cooperative manner and unresolved issues referred to senior headquarter staff. Whereas a procedure for large compensation claims is to be prescribed by the energy project certificate or order, minor claims could be handled by the two management bodies. Public input is to be informal as well as via advisory committees with set terms of reference and relationships to the two impact management bodies. A more detailed administrative structure will be developed by the Ministry of EMPR with more practical experience in the EPRP (Ministry of EMPR, 1983a).

THE SITE C EXPERIENCE

Soon after the EPRP was established in September 1980, B.C. Hydro applied for an energy project certificate for the Site C Dam on the Peace River in northeastern B.C. Early in 1981 the Ministers of EMPR and Environment referred the application to the BCUC for a review (Figure 5, 19((1)(a)). A panel of five commissioners and terms of reference for a public hearing were established by the BCUC. Following public hearings, the Panel submitted its report and recommendations to Cabinet (BCUC, 1983 a,b,c). Their eighty recommendations pertained to such issues as the Panel's terms of reference, conditions of the energy project certificate, review of northern river development, and policies for electricity exports and industrial development. Whereas Site C was found to be technically feasible and impacts could be mitigated and compensated, the need for and selection of that particular development had not been justified by the proponent. The Panel's decision was not unanimous: one commissioner recommended rejection of the application, the other four the deferral until such time when the project could be justified (BCUC, 1983a).

Figure 8 **General Framework for Managing Environmental and Socio-Economic Impacts (Ministry of EMPR, 1983a)**



Cabinet decided to shelve the project for at least ten years at which time smaller projects might be preferred (Ministry of EMPR, 1983b).[17]

An evaluation of the processing of the Site C application by the BCUC and the Panel's recommendations for a monitoring program for implementation of the energy project certificate follows.

The Hearing Process

The hearing process was extensive, taking half a year for pre-hearing activities and nearly a year for the hearings. The BCUC Panel reviewed the application, retained legal Counsel and technical consultants, and conducted two pre-hearing meetings in Fort St. John (near Site C)--an informal one to explain review procedures and obtain public input, and a formal one to hear submissions on and establish procedures for the hearing.

The Panel received and reviewed submissions by intervenors and coordinated their requests for more information from B.C. Hydro. Data deficiencies noted by the Panel were made up by B.C. Hydro in a two volume report, and various government ministries were asked to outline their concerns in "blue papers". The latter delayed the start of the hearings three weeks.

To minimize duplication of data and effort, most of the formal hearings were divided into six phases: (1) electric energy demand; (2) electric energy supply; (3) project cost and adequacy of design; (4) environmental, land use, social and economic impacts, and. economic benefit-cost evaluation; (5) financial impacts on B.C. Hydro and on electricity users; and (6) final arguments. The Panel commissioned reports on each of these issues and distributed them to all parties. Intervenors were to coordinate their activities as much as possible. At the end of each hearing stage the Panel awarded costs (paid by B.C. Hydro) to intervenors depending on their need and value of contribution.

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17. Simultaneously, the government announced a new electricity export policy, which advocated the sale to the U.S.A. of firm, long term surplus electricity rather than interruptible short term power. The Ministry of EMPR gave the following reasons "the severe recession has thrown all demand forecasts out the window, the Revelstoke Dam is coming on stream, and we are facing a surplus considerably larger than anticipated" (Ministry of EMPR, 1983b). However, these sales to the U.S.A. could not be realized as the U.S.A. transmission lines were later virtually closed to the transmission of electricity from B.C. It remains to be seen how the Free Trade Agreement will affect such policies.

The hearings took four formats: phased and unphased hearings with formal presentation and cross-examination, less formal community meetings, and special informal meetings requested by the Indians Tribal Counsel. Intervenors were heard in order of government levels, organizations, individuals, applicant, Commission Counsel and Commission. Most meetings were held in Fort St. John and area.

Throughout the hearings problems resulted from the inadequacy of data. As mentioned, the lack of early governmental input delayed the hearings and the requested "blue papers" only formally identified data deficiencies just before the start of the hearings. Other information filed before the hearings was outdated. Thus delays were caused when participants had to study updates and new data filed during the hearings. Cross-examination to better identify issues and clarify evidence took up more than seventy percent of the formal hearings. Lack of data did not allow the evaluation of many impacts on resources, such as forestry losses under transmission lines and fisheries and recreational fishing losses. furthermore, a number of socio-economic impacts on the native population, local communities and regional districts could not be identified; hence also the determination of mitigation and compensation measures had to be deferred. Most of these matters were to be addressed by the monitoring program recommended by the Panel.

Mandate and Expertise of the BCUC Panel

The Panel was given a very broad mandate. In the context of B.C.'s energy policy (Ministry of EMPR, 1980) they were to address project justification; design; environmental, land use, social and economic impacts; and other matters.

A brief outline of particular concerns of each of these topics was also prescribed. In this paper, project justification will be described in a later section. Project design included such items as adequacy and technical feasibility of the project, public works, and ancillary undertakings, as well as design, safety and schedule for construction and implementation. Under impacts the Panel was to examine their short and long term effects, mitigation and compensation proposals and their implementation. The review of environmental and land use impacts was to cover the local climate, hydrology, terrain resources, forestry, wildlife, fisheries, agriculture and outdoor recreation. Social and economic issues were: heritage sites; present and future land alienation; regional and provincial labour markets; community and regional settlement, land use, infrastructure, and stability; and regional and local economies. Statutory obligations under the Water and Waste Management Acts were to be reviewed. The Panel could also address any issue they deemed relevant. Although some intervenors demanded a discussion of the Site C impacts on northern development in general and cumulative impacts of all Peace River developments, the Panel felt that the former was beyond their mandate, and

for the latter an aggregate assessment was too late as development of the River's potential was almost complete.

The Panel was required to submit to Cabinet a report and recommendations, including the rationale supporting their final decision, conditions for the energy project and energy operation certificate, and a list of approvals, licences or permits and necessary conditions, under the Water and Waste Management Acts.

The expertise of the Panel was mainly in the engineering field with work experience in senior positions in water resource conservation and development, forestry and land survey, school system, and civic and regional government. As before mentioned, the Panel retained legal counsel and private consultants for technical, environmental, and socio-economic matters.

Project Selection

In the EPRP project selection can first be addressed in the voluntary pre-planning stage. The proponent submits a preliminary planning report including comparison of alternative sites; preferred alternative(s) based on preliminary environmental and socio-economic impact assessment; criteria and methodology used, and proposals for detailed studies of the preferred site.

Review of project selection becomes compulsory in the application phase of the EPRP, where it is part of the environmental and socio-economic impact assessment. Major environmental and socio-economic impacts of all alternatives and a preferred site, selected on the basis of technical engineering, environmental, socio-economic, and cost-criteria, are identified (Ministry of EMPR, 1982).

In the Site C hearings, project selection and justification were examined jointly. B.C. Hydro had proposed only one alternative, the Hat Creek thermal-electric generating plant. This the Panel ruled out as a viable alternative due to the much reduced energy growth forecast. Following consideration of other conventional and nonconventional alternatives, the Panel concluded that smaller hydroelectric generating plants were preferable to Site C. B.C. Hydro had not demonstrated that Site C was the only possible source to be developed next.

Project Justification

The EPRP is not designed as a two-stage approval procedure. There are no provisions for the separate, consecutive assessment of project need in the broad policy context leading to an approval-in-principle and of project design, resulting in a conditional licence, should a project be approved. As with project selection, also project justification is

initially voluntary. In the prospectus of the pre-planning phase the proponent broadly defines the project's purpose, supply and demand implications, benefits to the Province and known issues and constraints. The preliminary report outlines the terms of reference for proposed justification studies required to be submitted in the application phase. The actual studies must cover the economic and financial viability of the project, overall benefits and costs to the Province, and potential effects on energy resources and use. Data requirements may vary depending on the type of project, the potential for externalities, and government subsidies (Ministry of EMPR, 1982).

Justification for Site C was reviewed at the public hearings under a very broad mandate that required evaluation of:

> "electricity demand forecasts relative to supply in a total energy context, and industrial development opportunities made available in the Province, the project's financial impacts on the Applicant and electricity users; and the project's overall impact on the Province, specifically its social benefit-cost, including environmental, land use, social and economic impacts." (BCUC, 1983b, p. 6)

It also stipulated that the Panel use as a reference ELUC's Guidelines for Environmental and Social Impact Compensation/Mitigation (1980) and for Benefit-Cost Analysis (1977). In the context of the provincial energy policy and their mandate, the Panel concluded that their objective was to determine whether the Site C project was in the interest of the Province as a whole. Though the EPRP did not provide a two-stage project approval, the Panel was able to review project justification and design separately by prescribing phased hearings.

Several of the Panel's findings are most relevant. The criteria for and the results of project selection and evaluation used by B.C. Hydro and those proposed by the government conflicted. Based on their private corporate criteria, B.C. Hydro established the need for Site C. However, the Panel, using social benefit-cost criteria, which considered all foregone resource uses and the social value of capital and labour, showed that the project was not in the public interest. Another finding was that while Site C was financially feasible, customers' rates would be significantly impacted, if the project were built prematurely and/or exogenous factors, such as interest rates and electricity export markets, changed for the worse. The Panel's final recommendation was not to approve Site C and for the BCUC in 1984 to review B.C. Hydro's system plans to determine if the project was needed then, and if so, whether it was the best choice of all alternative system plans.

The Proposed Monitoring Program

At the hearings both the applicant and intervenors called for a program to monitor project impacts and deal with claims. Whereas the

municipalities of the region preferred an open-ended one including all impacts and areas, the Panel proposed a program limited to unresolved and unanticipated impacts and to monitoring compliance with the conditions of the energy project certificate.

The program was to be readily accessible to the public and local provincial ministries and agencies, not to be impeded by bureaucracy, and to have clearly defined lines of communication in order to respond quickly and efficiently. Other than a commissioner, appointed by Cabinet, and a small office staff, both stationed in Fort St. John, the program was to depend on private consultants and resources of existing government ministries and agencies. Liaison persons were to be appointed from the latter as well as from local government and B.C. Hydro. To prevent conflicts, Panel recommendations clearly specified who was to design and implement environmental studies and compensatory enhancement and management programs.

The commissioner's function was to be adjudicative. It appears that he was not to initiate action himself, but was to resolve disputes and concerns referred to him. He was to deal with the following issues which had not been resolved at the hearings: identification and determination of (1) mitigation and compensation for socio-economic impacts on some of the local communities, the region and native people, and (2) compensation for wildlife impacts caused by highway relocation and transmission line development; and determination of compensation for the impact on fisheries based on studies recommended by the Panel and to be carried out by B.C. Hydro.[18] The program was not to monitor long term effects of flooding because many of the impacts related to the reservoir were the responsibility of the Water Comptroller and the compensation for such impacts had been generally determined by the Panel. Also inspections (not specified what type)[19] were not to be the responsibility of the program, but rather of the relevant ministries or local government.

While the program was to resolve disputes of a public nature, private conflicts were to be settled with B.C. Hydro directly. In coming to decisions, the commissioner was to employ the same principles for mitigation and compensation as those used for determining the conditions of the energy project certificate. The commissioner was to advise

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18. In contrast to the Revelstoke Project, the costs of these studies were not counted as compensation payments. The studies were to determine the compensation payments and, therefore, should have been completed before the application for an energy project certificate was filed. Thus B.C. Hydro should bear the costs.

19. The Panel did not specify what these inspections were. One can assume that they referred to the surveillance inspections of compliance with approvals, licences, and permits to be issued to B.C. Hydro.

government ministries of his decisions and any required action, and was to have authority over B.C. Hydro to enforce his decisions.

An appeal procedure, such as that of the B.C. Utilities Act, was to be instituted. Furthermore, B.C. Hydro could request Cabinet to order the BCUC to review any of the commissioners' decisions. A claimant was to bear the costs of his- claim unless the commissioner decided differently. B.C. Hydro was to fund the whole program. The program was to terminate when construction of the projectwas completed.

ASSESSMENT OF THE ENERGY PROJECT REVIEW PROCESS IN LIGHT OF THE REVELSTOKE EXPERIENCE

The Energy Project Review Process (EPRP) has efficiently dealt with some of the issues raised by the Revelstoke Case Study while leaving others partially or entirely unaddressed. As the focus on the Revelstoke experience has shown, improvements and shortcomings arise from both the design and application of the EPRP.

In sharp contrast to the Water Act, the Energy Act with the EPRP prescribes a definite structure and procedural sequence for the selection and licensing of large scale energy projects. The pre-application and application phases provide for the orderly screening and assessment of the proposed project and its alternatives in the public policy context. Early public and government participation is to lead to the identification of concerns, issues, and information needs. Review of the application by the Energy Project Coordinating Committee (EPCC) is to ensure that all relevant issues and information requirements have been adequately addressed. Two Cabinet Ministers then decide on one of four possible dispositions of the application: rejection; approval exempt from a review; review by the BCUC, which may call a public hearing, and makes the final decision; and review by the BCUC, which must convene a public hearing, but the final decision is made by Cabinet. If a project is approved under the latter procedure, the EPRP requires the applicant to obtain an energy project operating certificate.

The EPRP, however, does not detail all licensing procedures and lacks provisions for some of the major procedures of project implementation and operation. While it is important to retain flexibility in the licensing procedures in order to address project-specific circumstances, there should be some indication of the general format and mandate the BCUC public hearings are to take. The EPRP does not address either. The adverse effects of too narrow a mandate were noted in the Revelstoke Case Study.

Whereas the BCUC is responsible for ensuring compliance with the certificate of public convenience and necessity (Figure 5, 19(l)(b)), no such provisions are made for the implementation of projects under the energy project certificate. The responsibility for monitoring compliance

with and enforcement of the conditions of that certificate has not been assigned to any agency in particular. But "substantial compliance"--a term not defined--is a requisite for obtaining an energy operating certificate under the EPRP. The need for adequate monitoring and enforcement was also demonstrated in the analysis of the Revelstoke Project, as was the importance of a well designed administrative framework for environmental and socio-economic impact management and a well structured claims procedure. These issues have only been tentatively addressed by the Ministry of EMPR, the EPRP does not prescribe definite provisions.

An energy operating certificate is necessary for the operation of a regulated energy project, but procedures for obtaining it are not outlined (Ministry of EMPR, 1982). Furthermore, the EPRP does not incorporate post-development environmental and socio-economic analyses as a requirement either in the energy project certificate or the energy operating certificate. The shortcomings resulting from the total lack as well as the lack of early planning of post-development analyses were noted in the Revelstoke Case Study.

Evaluation of the implementation of the pre-application and application phases of the EPRP in general and with respect to Site C provides an additional perspective. A most significant shortcoming is that the pre-application phase is not compulsory. By-passing it would, in effect, eliminate early participation by both government and the public. Whereas later input by government is assured in the application phase, that of the public is not if a public hearing is not called and if Thompson et al. (1981, p. 23) are correct in stating that a public consultation program is not a necessary requirement of the application.[20]

In the case of Site C, B.C. Hydro's by-passing the pre-application phase severely impeded the public hearings. Significant data deficiencies, especially in the EIS (based on B.C. Hydro's terms of reference) and inadequate government input were only noted just prior to and throughout the hearings. As in the case of the Revelstoke Project, the Site C hearings served largely as an information gathering and issue clarification function that was costly in time and money. Many data deficiencies could not be rectified, thus major decisions had to be deferred to the implementation of the project. The Panel concluded that early consultation in the EPRP by government, applicant, and interested parties would result in a more efficient review process. Issues would be identified and their priority established before the hearings. Up-to-date information should be submitted two months before the hearings and, should new data be required during the hearings, to allow two to four

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20. Whereas it appears from Figure 6 that the proponent is required to submit a description of a public information and consultation program, Thompson et al. (1981, p. 23) point out that this only applies "if such a program exists."

weeks before its cross-examination. Thus the quality of all evidence would be improved. For Site C, however, the EPRP had not dealt with one of the serious shortcomings of the Revelstoke Project review procedure.

In contrast to the Revelstoke experience, some procedural aspects of the public hearings were significantly improved in the review of Site C. Timing and format of the hearings were set by the Site C Panel in consideration of the needs of all participants. Intervenors were allowed sufficient time and ready access to all data to adequately prepare for the hearings. Unlike at Revelstoke, B.C. Hydro was responsible for some funding of intervenors. While the Panel thought the method of funding (partially based on the value of participation at the hearings) satisfactory, Roberts (1984) states that the late reimbursement imposed limitations, especially with respect to the retention of expert witnesses.

The format of the hearings was tailored for the orderly examination of issues (formal phased hearings) and to facilitate the participation of all segments of the public (formal unphased and informal community hearings), including the native Indian population (special hearings)--a need that did not arise at Revelstoke. The Panel observed that the hearings also served as an outlet for built-up frustrations from inadequate public participation in the decision making process of other major energy projects. Whereas holding most hearings in the Peace River area established local confidence in the hearing process, it proved too costly and interruptive to other participants. For future projects the Panel recommended to review only matters of local concern in the area of a proposed project, and technical and justification issues in larger cities, such as Vancouver. Overall and in contrast to the Revelstoke hearing, public participation in the Site C review process had been meaningful.

Another shortcoming raised in the analysis of the Revelstoke Project was properly addressed in the review of the Site C application. Adequate legal counsel and technical consultants had been retained prior to the hearings to advise the Panel and actively partake in the hearings. Notwithstanding their wide range of professional work experience, the commissioners recommended that frequent briefings by Commission counsel and consultants before and during the hearings "on the progress and direction of the hearings" should be held to enable the review panel to better understand "the thrust of the evidence and cross-examination" (BCUC, 1983c, p. 14).

An outstanding improvement over the Revelstoke Project review process was the wide mandate developed by the Ministers of EMPR and Environment for the Site C hearings. It not only included project selection and justification in the public policy context, which had been excluded at Revelstoke, but also allowed the Panel to examine any other relevant matters.

Project selection and justification were extensively addressed at the Site C hearings. The Panel rejected B.C. Hydro's only alternative project proposal as no longer applicable and proceeded to evaluate other conventional and nonconventional alternatives. They determined that smaller hydroelectric projects rather than Site C would be in the interest of the Province. However, the need for such projects would have to be established first by the electric energy growth forecast. While it was found that the methodology employed by B.C. Hydro for these forecasts had been considerably improved since Revelstoke, considerations of total energy context and conservation, and the use of econometric techniques were still inadequate. In future, data inputs and references were to be standardized to facilitate the comparison of B.C. Hydro's forecasts with those of the Ministry of EHPR. A persistent conflict was also noted between the selection and justification criteria used by B.C. Hydro and the government. Whereas the former based their judgments on private corporate criteria, the government's decisions were guided by social cost-benefit concerns. The Panel recommended that government advise B.C.Hydro of the evaluation criteria to be adopted.

Similar to the review of the Revelstoke Project, that for Site C, too, was troubled by an apparent lack either of a policy of resource interests or of an overt statement of such a policy (Roberts, 1984). Both projects were not related to the regional and river basin contexts. The Panel reviewed the Site C proposal in the provincial context, but ruled that evaluation in the context of northern development was beyond their mandate. Neither did the Panel assess cumulative impacts of developments on the Peace River, including Site C, because they felt that development had already progressed too far. These issues had not been specifically included in the terms of reference but could have been discussed under "any other matters". Two important recommendations were made by the Panel. First, the government was to clarify its industrial development policy and reevaluate the electricity export policy so that future planning and review of energy projects would proceed in a definite policy context. Second, northern river developments were to be assessed for the cumulative impact of all proposed projects in each separate basin. Despite the limitations imposed by the noted shortcomings, the Panel's assessment of project selection and justification represents a significant improvement of the Revelstoke Project review.

A further improvement was the EPRP provision for making the final decision with respect to an energy project application. In contrast to the Revelstoke Project, which had been approved by a senior bureaucrat and then appealed to Cabinet while the Project was already being constructed, the Site C Panel submitted their recommendations and rationale to Cabinet, which then made a final and binding decision and subsequently released the BCUC Panel Report (BCUC, 1983a,b,c). Whereas the Revelstoke Project review had been perceived a sham, the Site C review clearly demonstrated the integrity of the EPRP.

Yet a final difference was noted between the two review procedures. Unlike the Revelstoke review, under the Water Act, the format of the EPRP facilitated the Panel's use of the Site C review as a learning experience. In their report to Cabinet (BCUC, 1983a,b,c) the Panel made recommendations for the implementation of Site C, if approved, as well as for the improvement of the EPRP. In addition to those recommendations already discussed two others are particularly relevant to this study.

Firstly, the Panel proposed an administrative structure (monitoring program) for Site C and recommended that this be implemented upon approval of the project. On hand of the Revelstoke experience, it appears that this program would not have provided the integrated management of either environmental or socio-economic matters needed for such a complex development. The fact that the commissioner does not appear to have to take an active part in initiating monitoring precludes the establishment of a plan of action, and implies that matters are to be dealt with on an ad hoc basis. The assignment of responsibilities and lines of communication are not well thought out. However, the commissioner has authority to enforce his orders. Provisions are not made for effects monitoring and post-development analysis.[21] A more appropriate administrative framework for regulated energy projects in general was proposed by the Ministry of EMPR early in 1983 (Ministry of EMPR, 1983a). It seems to answer the criticisms raised in the Revelstoke Case Study. But, since Site C was not implemented, the question of whether the EPRP offers an improvement over the administrative framework of the Revelstoke Project cannot be answered.

Secondly, the Panel recommended a significant change in the EPRP. While the Site C experience had demonstrated that the one-stage EPRP was capable of assessing both project need in the policy context, and project design and impacts, it had also shown that this process was rather inefficient. The Panel, therefore, recommended that a two-stage review process be adopted in which the need for a new energy project would be identified and the task of the BCUC hearing panel limited to the assessment of the particular project chosen to meet that need. Thus, for the following year (1984), the Panel proposed a major review of the need for Site C and a comparison of alternative system plans, addressing such issues as load forecasting, sequence and timing of new generating plants, and nonstructural alternatives. This was to determine whether Site C would be the best choice, should a new energy project be needed (BCUC,

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21. However, the Panel did recommend that the appropriate government agency study existing provincial reservoirs to gain a better understanding of the productivity and other biological impacts of reservoirs.

1983a). Subsequent annual reviews of B.C. Hydro's up-dated system plans were to be undertaken by the BCUC under the Utilities Commission Act.[22]

The Site C Panel concluded that this two-stage approval process would lead to a better assessment of the whole system plan and the justification of each project, and a more efficient and speedy evaluation of each specific project proposal (BCUC, 1983c).

To summarize, the evaluation of the EPRP and its application in the Site C project proposal lead to several conclusions. The current EPRP, a one-stage approval procedure, provides a structure and procedural sequence for the review of the selection and approval of large scale energy projects. If the EPRP were applied efficiently in its entirety and with such broad terms of reference as issued for the Site C review, then meaningful public and governmental participation would be assured; the lack of establishing issue priorities and data problems, that persist to bog down public hearings, would be overcome; project justification would be assessed in the policy context; and the design and impacts of the specific project proposal would be examined. Regrettably, the implementation and operational procedures for large scale energy projects remain a moot point in the EPRP.

FURTHER DEVELOPMENT OF THE ENERGY PROJECT REVIEW PROCESS

The foregoing assessment of the review of the Site C application has demonstrated that, while many of the shortcomings of the Revelstoke review process were corrected, others persisted and rendered the process difficult and costly, both financially and in time. To date none of the BCUC Panel's recommendations has been formally incorporated in the process. However, the Ministry of EMPR had various provincial ministries review the recommendations and then prepared a summary position paper. On the basis of this paper, the Ministry gave B.C. Hydro new directives for the Corporation's planned second application for an energy project certificate for the Site C Dam.[23] The Site C Report is also considered in the preparation of the implementation/monitoring process for the recently approved Vancouver Island Natural Gas Pipeline (Mullen, 1989a,b).

In view of the impending review of a second Site C Dam proposal--projected cost of the dam is $3-3.5 billion--it appears essential that the EPRP be revised. The conclusions reached in this study confirm this and lead to the following recommendations for the improvement of the current EPRP:

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22. Annual reviews of B.C. Hydro's updated systems plans are now conducted by the BCUC.

23. Both the summary position paper and the directives for B.C. Hydro's Site C energy project certificate application are not available.

(1) The pre-application phase of the EPRP should be made compulsory.

(2) All information requirements of the application should be made compulsory.

(3) Sufficient time should be allowed for an efficient and adequate review of the application by the EPCC.

Particular attention should be paid to the identification of major issues, the possibility of resolving minor issues before the hearing, and the correction of data problems, such as outdated and insufficient data.

(4) An administrative structure for the management of environmental and socio-economic impacts and claims during implementation of projects should be worked out in detail and included in the EPRP.

A structure similar to that proposed by the Ministry of EMPR seems appropriate. However, an evaluation of the experience at other major projects, e.g. the Kelly Lake-Nicola Transmission Line Project and the Vancouver Island Natural Gas Pipeline, should be carried out. Such an administrative structure, possibly reduced in size, could also be extended to the operational phase of a project.

(5) A post-development analysis should be made a compulsory requirement of the EPRP, either in the energy project certificate 'or the energy operating certificate.

The type and scope of the post-development analysis could be worked out by the administrative management of a project. Based on this learning experience, all facets of the review and implementation of large scale energy projects could be evaluated and, if so indicated, improved.

(6) The EPRP should be changed to the two-stage review process recommended by the Site C Review Panel.

The first stage should assess project need in the context of provincial and regional policies, and river basin development, while the second stage should review project particulars such as design, safety and impacts. If the EPRP were changed to a two-stage review process then the requirements of the pre-application and application phases would have to be adapted accordingly.

The analysis of the procedures in place at the time of the Revelstoke Project have pointed to inadequacies which were only partially corrected by the current Energy Project Review Process. The recommendations given in conclusion of this paper are made to further improve this continually evolving review process. The implementation of these recommendations would give B.C. an adequate and efficient review process for large scale energy projects.

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