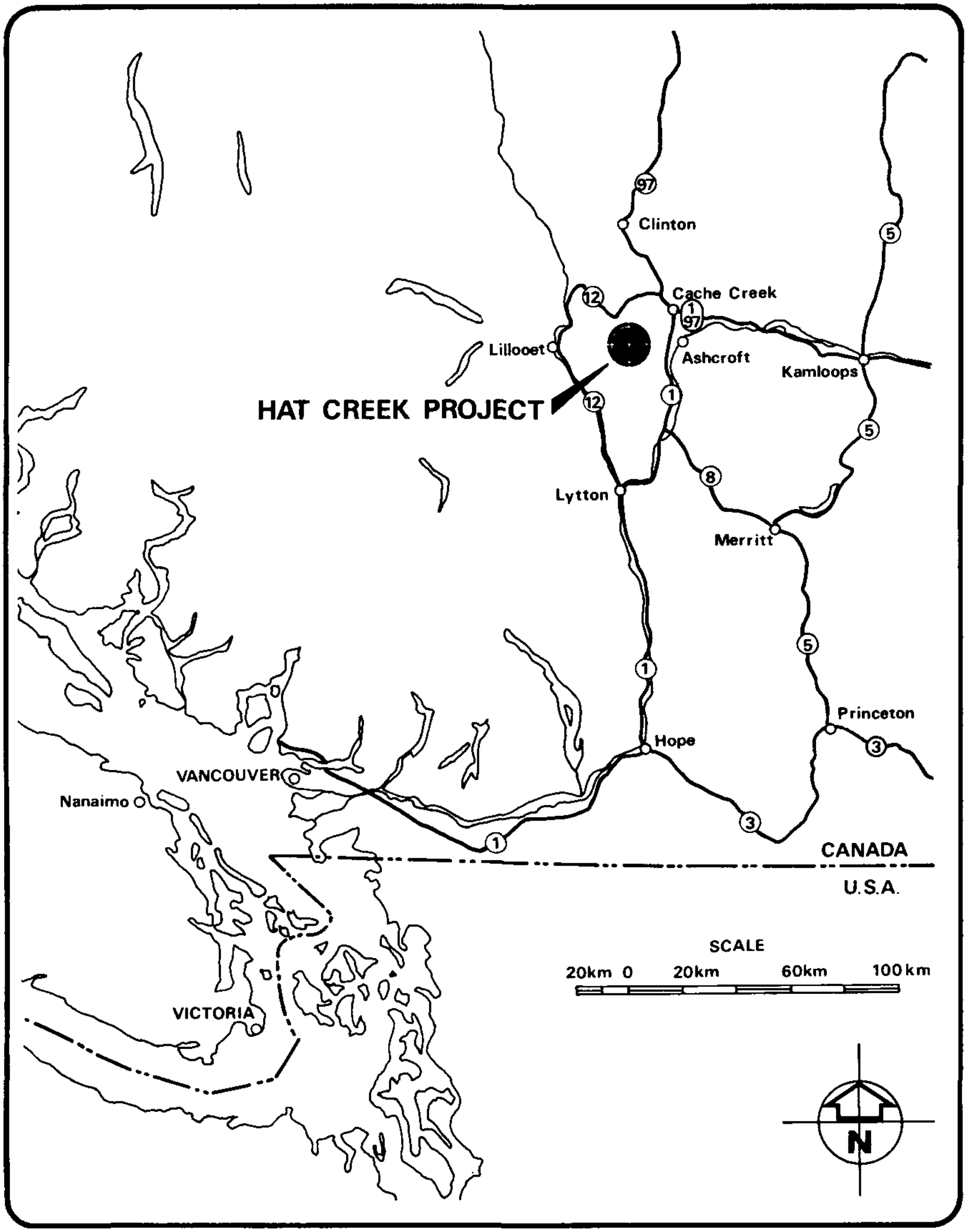
Hat Creek THERMAL POWER PROJECT

Highlights of the Environmental Impact Statement

B.C. Hydro



The Hat Creek thermal power project would be located about 200 kilometres northeast of Vancouver, in the Hat Creek valley.

Hat Creek THERMAL POWER PROJECT

TABLE OF CONTENTS

Figures: (inserted at back)

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INTRODUCTION

Since 1957, B.C. Hydro has considered using Hat Creek coal in the generation of electricity to help to fulfill its responsibility to meet the electricity demands of British Columbians.

A decision now has been made to file application with government authorities for the necessary permits and licences to develop a 2000-megawatt coal-fired powerplant which would burn Hat Creek coal to create steam to power turbine generators and produce electricity.

This decision has been taken because:

1. The project's power is needed to meet British Columbia's demand for electricity, which grows as population and economic activity increase. Electricity load projections at the end of 1980 indicated clearly that the first power from the Hat Creek project will be needed in the province before the end of 1988.
2. The findings of extensive research have demonstrated that the proposed Hat Creek project can proceed with safeguards for human health and with minimal environmental impacts.

An Environmental Impact Statement (EIS), based on the findings of extensive technical, environmental and socio-economic studies, has been prepared by B.C. Hydro to provide information about the proposed project.

This information is for use by the public and by government agencies in the process of detailed public examination that forms part of the government's Energy Review Process.

The studies upon which the Environmental Impact Statement is based include perhaps the most extensive environmental investigation ever carried out in advance of a project such as that proposed at Hat Creek. Their findings are based on conservative — that is, pessimistic — assumptions and so outline "worst case" potential.

For the purpose of preparing the plan, the project was assumed to have an economic operating life of 35 years, subject to extension if later re-evaluation proves that to be economically and socially viable. All of the current studies are concerned only with a 35-year operation period followed by decommissioning of the powerplant and reclamation of areas disturbed in its construction and operation.

Design Flexibility

Based on the findings of all of the studies, B.C. Hydro has proposed a project design which it believes will meet or better all environmental and health safeguards that permits and licences will require in the public interest. This design and its anticipated impacts are described more fully in the following pages and in detail in the EIS and study reports.

The regulatory agencies may, however, require that changes be made in this design before permits are issued. Technically-feasible alternatives for major project components have been studied and the project design is flexible enough to accommodate those alternatives as well as to take advantage of future technological advances.

The following pages provide summary responses to a number of questions about the proposed project, then more detailed and illustrated information on various project components and impacts.

Hat Creek THERMAL POWER PROJECT

SUMMARY

What is the Hat Creek Project?

The proposed project includes a thermal powerplant, an open-pit coal mine and associated facilities such as water pipeline and reservoir, access road, waste disposal area and' stream diversions. The powerplant would burn coal to create steam to drive turbine generators to produce electricity. At capacity, it would produce 2000 megawatts and on average produce 11,800 gigawatt hours, an amount about equal to the 1980 electricity demand in the Lower Mainland region of British Columbia.

Where is it to be located?

The coal is in deposits in the Hat Creek valley, approximately 200 kilometres (120 miles) northeast of Vancouver and about midway between Lillooet on the west and Cache Creek and Ashcroft on the east. (See map inside front cover) The Hat Creek powerplant would use coal from the deposit at the valley's north end and would use only a fraction of the known Hat Creek coal reserves.

Why is the project needed?

Anticipated population and industrial growth in British Columbia will bring increases in the amount of electricity required by residents and businesses in the province. Projections at the end of 1980 — which are subject to continuing update — indicate that the first electricity from the Hat Creek project will be needed in B.C. before the end of 1988.

When is the project to be built?

B.C. Hydro plans to file applications during 1981 for an Energy Project Certificate from the British Columbia government and for all necessary permits and approvals to proceed with construction in time for the first 500-megawatt generator to be in production by August, 1988. If approvals are obtained by the end of 1982, construction could start early in 1983.

What are the impacts?

Economic

Estimated total investment, including allowance for inflation, is approximately $5200 million.

Estimated direct employment is 2800 jobs at the peak of construction; 1200 jobs when in full operation.

Estimated employment induced in local communities by the project is 700 jobs.

Land

Mine, powerplant and other facilities would cover a total of approximately 2500 hectares (6200 acres or about 10 square miles), which is less than four percent of the Hat Creek watershed. The remainder would continue to be available for other uses, including ranching, as it is today.

Environment

The studies upon which the Hat Creek Environmental Impact Statement is based and which are available to the public, have indicated that even with pessimistic assumptions, the impact of powerplant emissions would be minimal and environmental and health safeguards would be met.

The studies also show that:

— Emissions would cause insignificant increase in acidity of rainfall and this would have no significant direct or indirect environmental effects on soils or waters either near the plant (within 50-kilometre radius) or distant from it (up to 200-kilometre radius).

— While drainage patterns in the area of the mine and powerplant would be changed, the hydrology and water quality of Hat Creek and other local streams downstream of the project would remain essentially unaltered.

— Effects on vegetation, agriculture, forestry, wildlife and other resources would be localized and minimal, apart from the direct loss the the land needed for the project.

— Effects on vegetation, agriculture, forestry, wildlife and other resources would be localized and minimal, apart from the direct loss the the land needed for the project.

Health

Effects on human health (epidemiology) were thoroughly studied and in all cases the studies concluded that the planned control of project emissions will provide full safeguards against adverse affect on human health.

Social

About 10 families live on ranches in the Hat Creek valley. Two native Indian bands have reserves near the north end of the valley. Three residences in the valley itself would have to be relocated as a direct result of the project.

The project work force would create needs for expansion in community social services, commercial goods and services and housing supplies and would create some change in the social environment, in part to accommodate the increased population.

B.C. Hydro will fund a socio-economic monitoring program and will work closely with local communities in meeting the needs mentioned above. Provision is made for financial assistance as appropriate. B.C. Hydro expects to pay taxes or grants in lieu of taxes to local governments.

What would the powerplant emit?

The main emissions from the operation are flue gases from the powerplant stack, ash from the powerplant boilers and limestone sludge from flue-gas desulphurization units (scrubbers). Ash and sludge will be disposed of in landfill facilities which will be reclaimed progressively.

The powerplant flue gases will be emitted from a stack up to 366 metres (1200 feet) high after having more than 99.8 percent of the flyash (particulates) removed by electrostatic precipitators and 52 percent of the sulphur dioxide removed by "scrubber" technology.

At maximum load, burning 40,500 tonnes per day of "low sulphur" performance coal, the plant would emit less than 150 tonnes per day of sulphur dioxide, 170 tonnes per day of nitrogen oxides and 17 tonnes per day of particulates. Included also are very small amounts of other elements found in trace quantities.

The proposed project design will ensure the emissions leaving the stack and their impact on ambient (ground level) air quality meet standards within the range of objectives set by the B.C. Pollution Control Board as safe and acceptable for coal-fired thermal generating plants.

Hat Creek THERMAL POWER PROJECT

NEED FOR THE PROJECT

B.C. Hydro, is required to meet the electricity demand of British Columbia. Its present planning forecasts of the electrical energy demand indicates a probable average growth rate of 6.1 percent per year through 1990/91, taking into account conservation measures which B.C. Hydro encourages. Generating projects already committed to construction will only meet forecast needs up to 1985/86.

Plans to meet load growth after that time include construction of the Site C dam on the Peace River, for service in 1987, and the first 500-megawatt unit of the Hat Creek thermal project in August 1988. These are the estimated earliest feasible in-service dates for these projects.

Even with Site C and Hat Creek coming into service at those projected dates, B.C. Hydro will have to purchase significant amounts of energy from sources outside its system to meet demand starting in 1986/87.

B.C. Hydro at present provides residential electrical power service to 92 percent of the population in B.C. and almost all future load growth in the province will be served by B.C. Hydro. Here is the B.C. Hydro system capability:

B.C. HYDRO INTEGRATED POWER SYSTEM CAPABILITY — 1984

Project	Dependable Capacity (MW)	Nameplate Capacity (MW)	Average Energy (GW.h/annum)	Firm Energy (GW.h/annum)
HYDRO				
Existing				
G.M. Shrum (Peace)	2 680	2 416.0	13 180	13 420
Mica	1 600	1 736.0	7 640	6 760
Kootenay Canal	529	529.2	3 150	2 160
Other Hydro	1 594	1 513.0	8 170	7 160
Peace Canyon	700	700.0	3 340	3 510
Seven Mile	529	607.5	3 140	2 640
Subtotal	7 632	7 501.7	38 620	35 650
Under Construction				
Revelstoke (4 units)(1983)	1 800	1 843.0	7 890	6 880
Total Hydro	9 432	9 344.7	46 510	42 530
THERMAL				
Burrard	0	912.5	variable	3 170
Gas Turbines	331	332.4		0
Total Thermal	331	1 244.9		3 170
TOTAL SYSTEM	**9 763**	**10 589.6**		**45 700**

MW = Megawatts *GW.h/annum = gigawatt hours per year*

Electric power loads on the system have more than doubled in the last 10 years. Current expectations are that the growth of power demands will be significantly lower than historic growth rates and this is reflected in B.C. Hydro's forecast.

No single load forecast can be a perfect estimate of exactly what will happen in the future. B.C. Hydro's forecast of future electricity demand has differed in the past from that of Ministry of Energy, Mines and Petroleum Resources. When there is doubt as to the future level of energy consumption, B.C. Hydro considered it more prudent to plan to meet a higher forecast than a lower one. The cost of delaying completion of generating projects is much less than that of electricity shortages or of "crash" construction schedules in the event of underestimating the need.

B.C. Hydro revises and updates its load forecast annually in light of the most recent experience of the actual load on the system and, if future load forecasts are reduced before major project commitments are made, those future projects will be rescheduled and deferred as necessary.

The number of feasible alternatives to the Hat Creek project is limited. Most potential future hydro and thermal power projects in B.C. are not sufficiently advanced to be considered as practical and feasible alternatives to Hat Creek.

With the current probable load forecast, the Hat Creek project is the only one large enough which can be constructed soon enough to supply a significant part of the forecast electricity need for the late 1980s.

Hat Creek THERMAL POWER PROJECT

PROJECT DESCRIPTION

The proposed Hat Creek thermal project would have three basic components: a mine and a powerplant, both located in the upper Hat Creek area, and various offsite facilities in the surrounding region.

Coal would be mined from a large open pit in the No. 1 coal deposit at the north end of the Hat Creek valley. The coal would be blended to a long-term average quality, then conveyed to the powerplant located on high ground 500 metres above and about four kilometres northeast of the mine.

The powerplant would burn the coal to produce steam and use the steam to turn turbines which generate power. The powerplant would have maximum net capacity of 2000 megawatts of electrical power, which would be fed into the provincial transmission grid through the Kelly Lake-Nicola 500-kilovolt line which will pass within about one kilometre of the Hat Creek project.

Project construction activities are proposed to begin in early 1983, with first electricity production scheduled for August 1988.

Figure 3.1 shows an artist's conception of the valley with mine, waste disposal areas, powerplant and water reservoir in place. Figures 3.2 and 3.3 provide maps of the proposed total complex and of the mine and powerplant site details. These are inserted at the back of this book.

THE HAT CREEK COAL RESOURCE

The Hat Creek valley forms part of the Thompson plateau of British Columbia's central interior, a broad region between the Clear Range and the Shuswap Highlands. It consists of rolling uplands with a few deep valleys. The valley is approximately 28 kilometres in length and 18 km in width. Mountains to the east rise to about 2070 metres above sea level while those to the west reach about 2300 metres.

Predominant land uses of the valley at present are agriculture, forestry and wildlife habitat. The 30 to 40 permanent residents comprise about 10 family groups on ranches throughout the valley. The Bonaparte and Pavilion Indian Bands have reserves near the north end of the valley and the Oregon Jack and Ashcroft Bands have reserves nearby to the east.

TOTAL LAND REQUIREMENTS FOR PROJECT FACILITIES (DISTURBED AREAS)

	Area (hectares)	
Powerplant		
Powerplant site	99	
Water supply reservoir and dam	94	
Powerplant construction camp	11	
Service roads and utility corridors	43	247
Mine		
Mine pit (after 35 years)	585	
Waste disposal areas (after 35 years)	1028	
Mine maintenance complex	25	
Coal blending area	42	
Lagoons	23	
Diversion drains	46	
Mine construction camp	5	
Service roads and utility corridors	149	1903
Offsite Facilities		
Main access road	117	
Pit rim reservoir and dam	11	
Headworks reservoir and dam	6	
Creek diversion canals	49	
Water supply pipeline	35	
Airstrip	45	
Off loading facility	3	
Service roads and utility corridors	90	356
TOTAL		2506

Access to the valley is easiest along Highway No. 12, between Carquile and Lillooet. Ashcroft and Cache Creek, both on Highway No. 1, are the regional service centres nearest to the proposed Hat Creek project site. Clinton and Lillooet also are readily accessible from the site.

Coal outcrops were officially recorded in the valley in 1877. Exploration, particularly in the years since 1974, has identified two major coal deposits with total resources estimated at 10 to 15 billion tonnes, making this one of the world's largest known coal resources in such a small area.

The Hat Creek thermal project would use coal mined from the No. 1 deposit, which contains thermal coal ranking between sub-bituminous and lignite. The coal is low in heating value, high in ash, fairly high in moisture content and relatively low in sulphur and contains significant amounts of clay.

For the project, coal would be mined and blended to produce a reasonably uniform powerplant fuel with the following characteristics:

		As Received Basis	Dry Coal Basis
Total moisture	%	23.5	—
Volatile Matter	%	25.2	32.9
Fixed Carbon	%	25.7	33.6
Ash	%	25.6	33.5
Carbon	%	35.3	46.1
Hydrogen	%	2.8	3.7
Nitrogen	%	0.7	0.92
Chlorine	%	0.02	0.03
Sulphur	%	0.39	0.51
Oxygen (by Diff.)	%	11.69	15.30
Heating Value			
Mega-Joules per Kilogram		13.85	18.1
British Thermal Units per lb		5.955	7.784

THE MINE

The mining complex would include five basic components:

— Open pit mine, developed in a series of 15 metre benches; at the end of 35 years it would be about 230 metres (750 feet) deep and about three kilometres (about two miles) across.

— Waste disposal areas, located at Houth Meadows and Medicine Creek and linked to the mine by overland conveyors.

— Coal crushing, stockpiling and blending facility at the north end of the mine area.

— Four-kilometre long single overland conveyor to carry coal to the powerplant.

— Administration and maintenance complex, north of the mine.

A shovel and truck system would be used to work several 15-metre-high benches simultaneously to feed crushing stations and to allow for blending and provide a low-sulphur fuel supply for use when required in the powerplant environmental control system. Two coal-blending piles would be used, one being built while the other is feeding the powerplant.

Drainage systems to collect upstream runoff and discharge it into Hat Creek downstream of the mine, to maintain pit slope stability and to keep the pit dry for mining are included, together with two major environmental control systems — one to maintain downstream water quality and another to minimize dust.

THE POWERPLANT

The powerplant would be located on a broad hilltop overlooking the Hat Creek valley. The site, near Harry Lake and at an elevation of about 1410 metres, is 500 metres above the valley mine site and has been selected because its high elevation would provide better dispersion of flue gases than sites in the valley bottom.

Basic components of the powerplant include:

— Coal handling system, composed of conveyors to carry coal to storage or to the powerplant;

— Four large boilers, each about 90 metres high and 18 metres square (about the size of a 25-storey building covering half a city block).

— Four turbine-gnerators, the turbines driven by high-pressure steam and in turn driving the generators to deliver 500 megawatts of power after the plant's own requirements were met.

— Condensers, one at each turbine exhaust, to condense steam to water after its useful energy had been expended; the water then being returned to the boilers for reconversion to steam.

— Two hyperbolic natural draft cooling towers, each about 135 metres (430 feet) high, to cool the water from the condensers and then be returned to the condensers for reuse.

— A water reservoir, supplied by water pumped from the Thompson River, to supply "make up" quantities to replace evaporation losses from the cooling towers.

— A single exhaust stack, up to 366 metres (1200 feet) high, with separate flues for each boiler, would discharge gases to the atmosphere after they had passed through electrostatic precipitators, which remove fly ash, and desulphurization "scrubbers" to reduce sulphur dioxide emissions.

— An ash-handling system to dispose of bottom ash and fly ash collected in the precipitators, conveying the ash in a moist state to the Medicine Creek dry ash disposal site. Scrubber sludge and ash will be mixed together before disposal.

— Waste water systems, to move water from boilers (blowdown) to the cooling water system, to use cooling tower blowdown for moistening fly ash, to employ ash pile runoff and seepage in dust suppression and ash handling, and to treat sanitary waste in an aeration plant and then re-use it for ash and dust control. There would be no discharge of waste water from the powerplant.

Flue gas desulphurization was chosen over a meteorological control system for management of sulphur dioxide emissions in order to assure that Pollution Control Board objectives would be met.

Design of the powerplant is flexible and new technology which might be proven in the years ahead can be accommodated.

Further details as to the environmental protection standards are set out in the section describing the Impact Assessment, starting on page 12.

POWERPLANT AIR QUALITY CONTROL SYSTEM

The powerplant air quality control system is designed to ensure that emissions released to the atmosphere by the plant's flue gases and ambient (ground level) air contaminant levels are kept to safe and acceptable levels.

Two electrostatic precipitators, which collect fly ash particles on special plates through a process employing electrical charges, are planned for each boiler. The precipitators are located between boiler and stack and would remove ash particles from the gases before they reach the stack. Expected removal efficiency is 99.8 percent.

The other primary component of the air quality control is flue-gas desulphurization (FGD) technology, called "scrubbers". This filters flue gases through wet limestone to remove sulphur dioxide. The process also removes other elements, including fluorine. The FGD technology will ensure that at full load — worst case — emissions and ground level air quality will be within the range of objectives set by the B.C. Pollution Control Board as safe and acceptable and protective of health and the environment.

In addition, an instantaneous monitoring network will report continually on ambient air quality and other impacts of the plant's emissions.

Alternative systems were considered, including "washing" of the coal to remove some impurities before burning and the use of fabric filters (also called baghouse units) to control particulates. Neither is considered as a practical alternative to the processes proposed.

OFFSITE FACILITIES

Offsite facilities are project components located outside the immediate Hat Creek valley or which are not part of the scope of the proposed mine and powerplant complexes.

Major offsite facilities include:

- Access roads, including a 31-kilometre paved two-lane highway from Highway No. 1, near Ashcroft Manor, to the mine and powerplant sites.
- Powerplant water supply system, including intake structure and pumphouse in the Thompson River, upstream of Ashcroft, buried pipeline 21 kilometres long, with two booster pumping stations and a reservoir at the powerplant site holding 70 days' water supply.
- A 69 kilovolt transmission system to supply electric power to the mine, powerplant construction and water supply system, and two short 500 kV lines north from the powerplant about one kilometre to join the then-existing Kelly Lake-Nicola transmission facility.
- An airstrip suitable for small jet aircraft may be built west of Highway No. 1, near Ashcroft Manor, and if it is constructed would be available for use by local residents.
- An equipment-unloading facility, where heavy equipment can be transferred from rail cars to trucks.
- Creek diversions, required to carry streams around the coal mine and waste disposal areas. These include diversion of Hat Creek in a canal system comprising a 16-metre high earthfill headworks dam immediately downstream from Anderson Creek and a lined canal and buried conduit system to return the flow to Hat Creek downstream of the mine. Smaller diversions of Medicine and Finney Creeks and Aleece Lake would also be carried out.
- Two temporary construction camps to accommodate the work force needed at the mine and the powerplant during the construction phases. Locations are shown on the Detailed Site Layout.

CONSTRUCTION SCHEDULE

If the proposed project is licensed by the end of 1982, construction would start early in 1983 with the letting of major contracts for equipment and project work, the setting up of environmental monitoring facilities and the provision of construction-labour camps and related services being among the early major activities.

The powerplant would consist of four units, constructed in sequence, so construction and operating phases would overlap at the powerplant itself. Construction activities are expected to involve one shift working a 7.5-hour day, five days a week. Early powerplant construction years would require primarily general labourers, operating engineers, carpenters and electrical workers while in the peak and wind-down periods, the emphasis would be on plumbers, pipefitters, iron workers, electrical workers, insulators and boilermakers.

The major trades required for mine development would be equipment operators, machinists/millwrights, miners and general labourers. Offsite construction requirements include general earth-moving and light construction skills.

The powerplant construction camp would have peak capacity of 1820 persons; the mine camp 500. An environmental group would be established at the site at the start of construction activities.

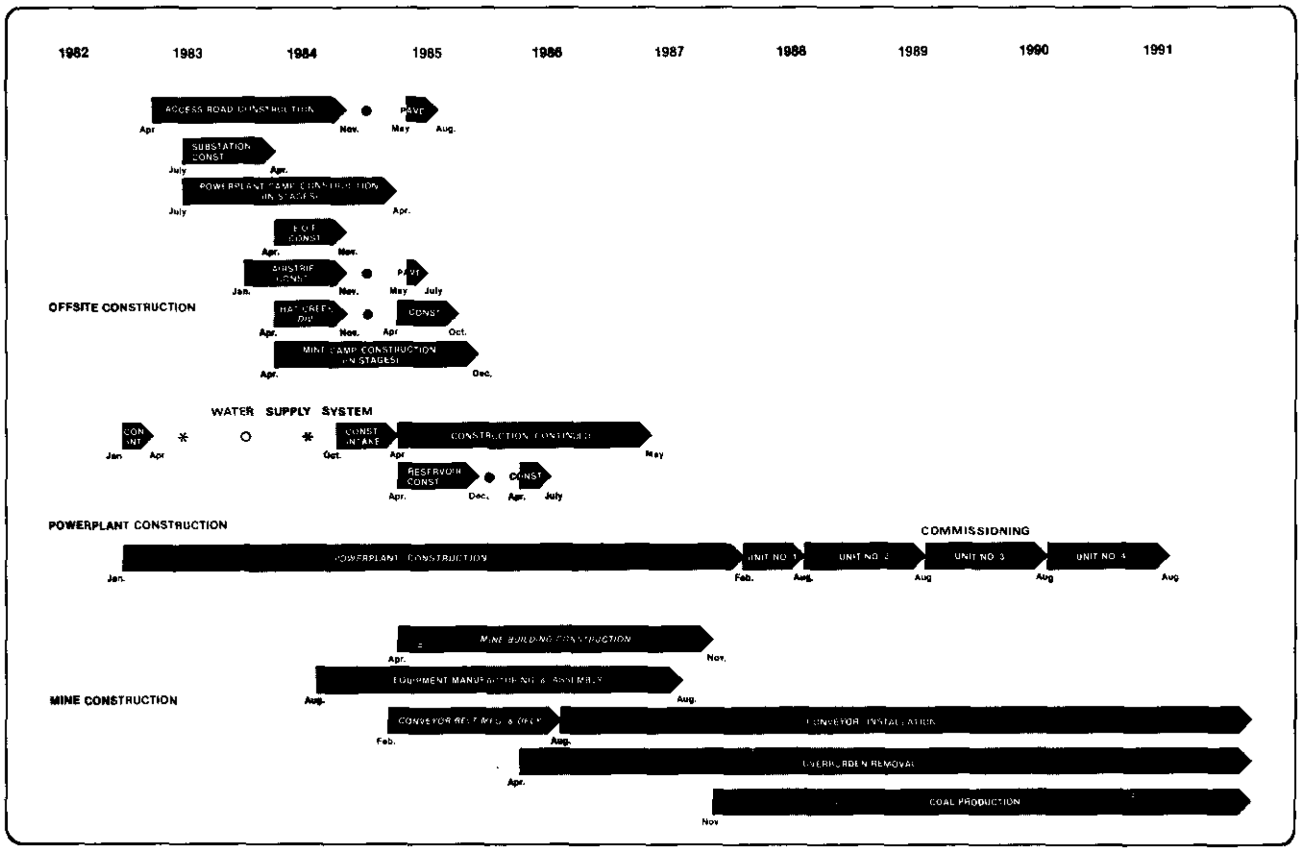


FIGURE 4.1

CONSTRUCTION SCHEDULE

OPERATION AND DECOMMISSIONING

Operation of the mine is planned to begin in late 1987. Over the life of the project, 336 million tonnes of coal would be mined. Details are shown in the following table of approximate production statistics:

APPROXIMATE PRODUCTION STATISTICS

Coal	
Total mined over project life	336 million tonnes (Mt)
Peak annual production	12 Mt
Mine Waste	
Total over project life	430 million cubic metres
Peak annual quantity	20 million cubic metres
Ash and FGD sludge	
Total production over project life	90 Mt
Peak annual production	3 Mt

The powerplant would be commissioned early in 1988 with commercial operation of the first 500-megawatt unit in August 1988 with the other three at one-year intervals. Commercial operation of each unit is planned for 35 years.

The powerplant and mine would operate 24 hours a day, year round.

The project plan calls for operation over a 35-year period. This could be modified, with government approval, during the life of the project. Assuming a 35-year life span, all project structures would be dismantled at the end of that time and removed or disposed of and the land would be reclaimed, except for the open pit as described above.

LAND RECLAMATION

Disturbed areas at Hat Creek would be progressively revegetated. Temporary reclamation would be done on areas stripped of vegetation, waste dump surfaces or material stockpiles left inactive for several years. Waste dump surfaces would be reclaimed as soon as the final surface elevation is reached. Other areas disturbed during construction would be revegetated as soon as possible.

Land in the areas involved now is used for mixed wildlife and agricultural purposes, mostly ranching. It is proposed to revegetate waste dump surfaces to a similar land use. Both laboratory and on-site testing have been under way since 1977 and have proven that surficial materials can be readily and productively revegetated. Waste dumps would be covered with surficial materials prior to reseeding.

Overall, 45 years after the start of operation of the project, about 64 percent of the disturbed lands would be reclaimed and restored to production. The open pit mine would not be reclaimed then because more than half the mineable coal would remain.

IMPACT ASSESSMENT

Introduction

Feasibility of a project using Hat Creek coal for thermal generation of electricity has been studied since the mid-1970s. A preliminary environmental report, completed and made public in 1975, led to a decision that detailed assessments should be made.

A detailed examination of potential impacts began in 1976 and the environmental studies which now are the basis for the Hat Creek Environmental Impact Statement (EIS) are among the most exhaustive ever undertaken for a thermal power generation project. They examined five major areas: Land resources, water resources, socio-economics, air quality and general aspects of the project.

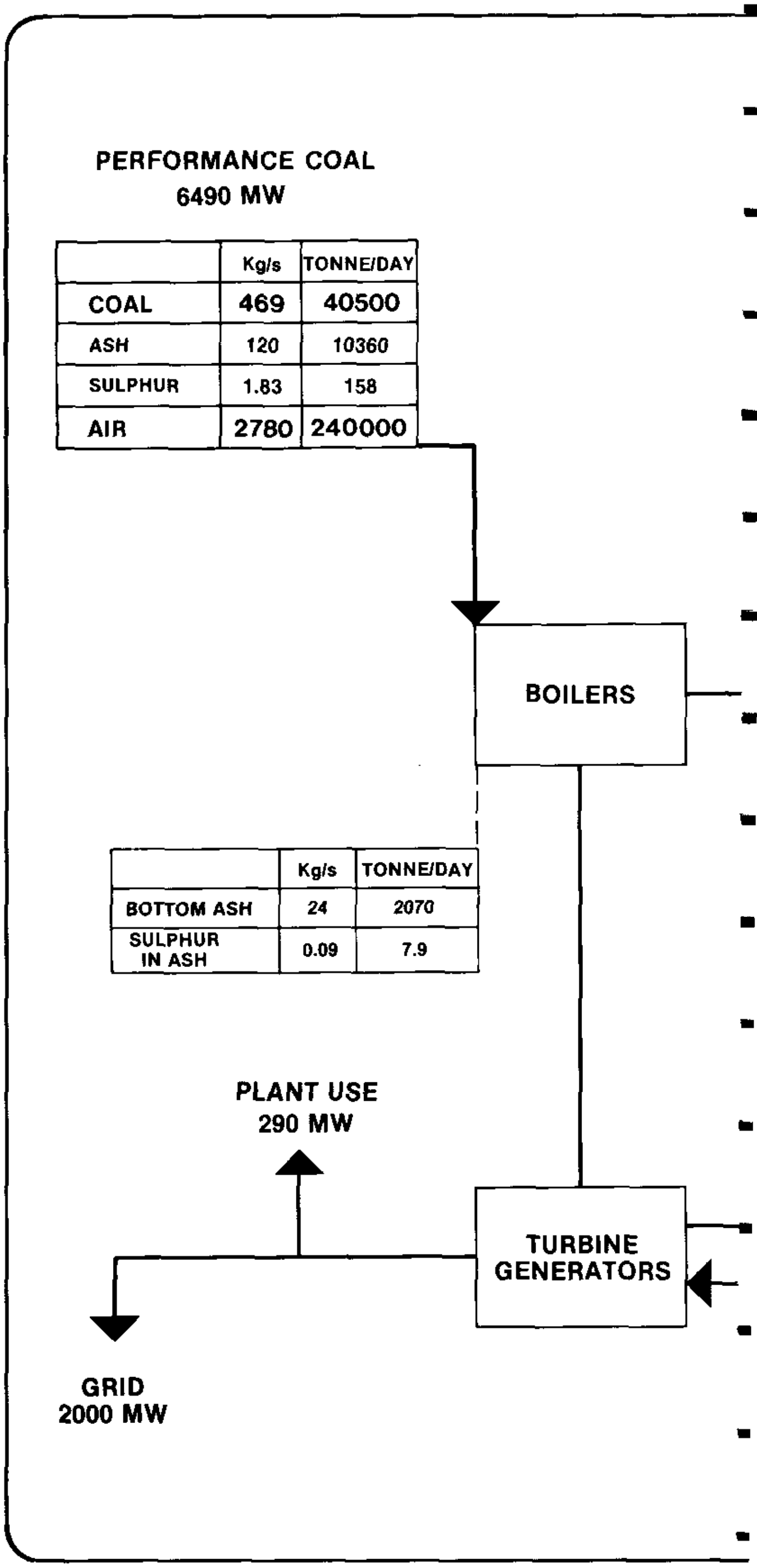
When those studies began, the project was in preliminary design. Only a tentative project description was available then and the consultants who carried out the impact assessments looked at the potential impacts of alternative designs. During the studies, the design of the project now proposed evolved and the 1981 EIS focuses on the potential impacts of that design. Benefits and costs of major options and alternatives that were considered also are discussed in the EIS.

The detailed environmental studies did not, in all cases, address the finally-selected project design upon which the EIS is based, so "bridging" documents were prepared to update the original impact reports and relate them to the project as proposed.

The EIS is based upon the information contained in the detailed studies and the "bridging" documents, all of which are available to the public for review as outlined on page 24.

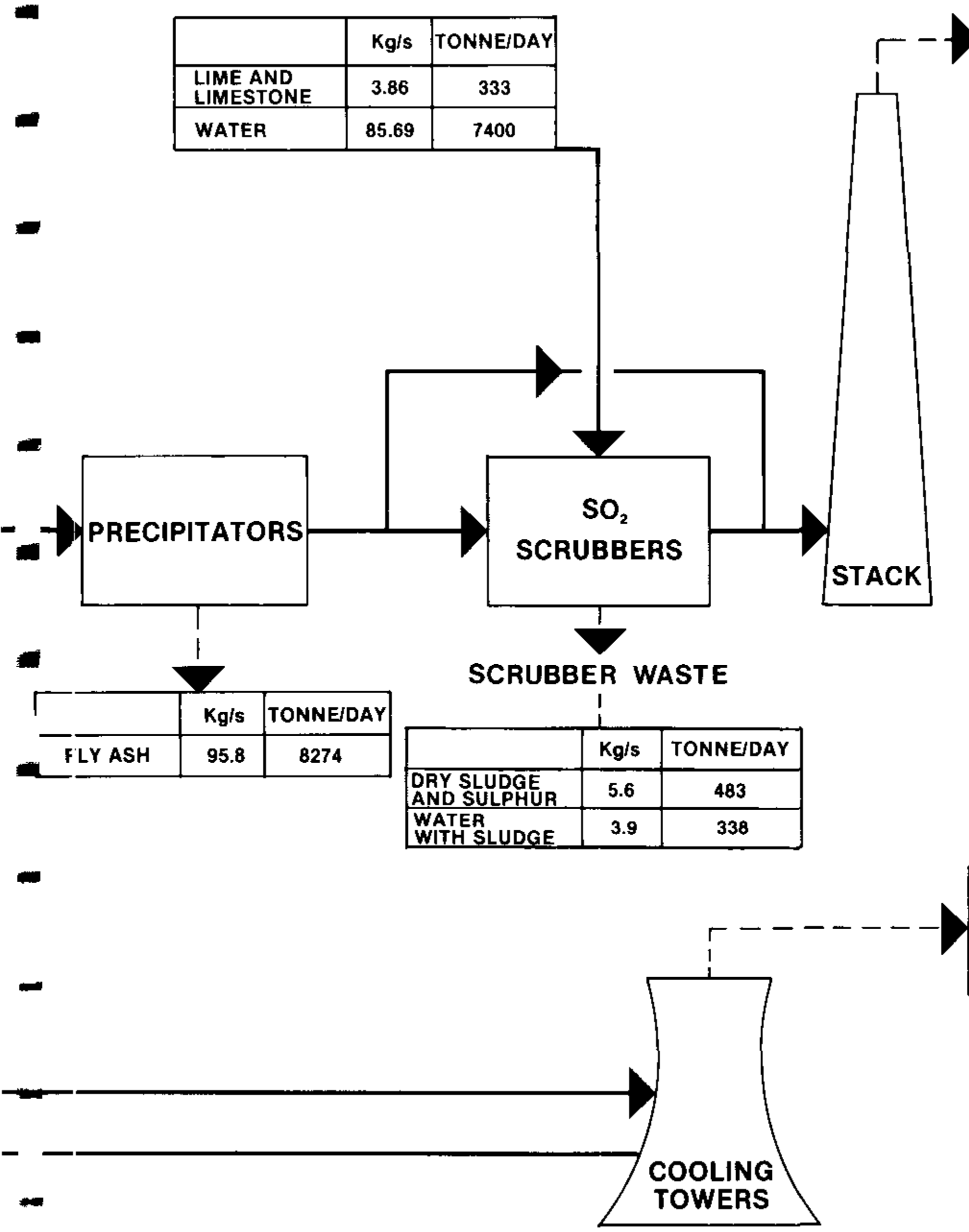
The studies are based on conservative — that is, pessimistic or worst-case — assumptions.

In the following pages, highlights of impact assessments and plans for controls to minimize potential impacts are set out.



	Kg/s	TONNE/DAY
COAL	469	40500
ASH	120	10360
SULPHUR	1.83	158
AIR	2780	240000

	Kg/s	TONNE/DAY
BOTTOM ASH	24	2070
SULPHUR IN ASH	0.09	7.9



SCRUBBER REAGENTS

	Kg/s	TONNE/DAY
LIME AND LIMESTONE	3.86	333
WATER	85.69	7400

	Kg/s	TONNE/DAY
FLY ASH	95.8	8274

SCRUBBER WASTE

	Kg/s	TONNE/DAY
DRY SLUDGE AND SULPHUR	5.6	483
WATER WITH SLUDGE	3.9	338

FLUE GAS 1120 MW

		Kg/s	TONNE/DAY
FLUE GAS	TOTAL	3210	277340
FLUE GAS COMPONENTS	N_2	2123	183430
	O_2	147	12700
	H_2O	330	28510
	CO_2	606	52360
	SO_2	1.74	150
	NO_x	1.94	170
	CO	TRACE	TRACE
	RARE GASES	TRACE	TRACE
	ASH	0.19	17
SULPHUR IN FLUE GAS	S	0.87	75

N_2 = Nitrogen
O_2 = Oxygen
H_2O = Water
CO_2 = Carbon dioxide
SO_2 = Sulphur dioxide
NO_x = Nitrogen oxides
CO = Carbon monoxide

COOLING TOWERS 3080 MW

	Kg/s	TONNE/DAY
EVAPORATION	1156	99900
DRIFT	3	290

kg/s = kilograms per second

FIGURES REPRESENT APPROXIMATE FLOWS AT 2000 MW. NET.
(AMBIENT CONDITIONS: — WET BULB TEMP. 13.9°C, DRY BULB TEMP. 18.3°C)

AIR QUALITY CONTROL

The Hat Creek thermal power project would be the first coal-fired powerplant in British Columbia.

It is designed to ensure that stack emissions and ambient (ground level) contaminants resulting from those emissions would be controlled to levels in compliance with B.C. Pollution Control Board objectives. Those objectives, published by the PCB in 1979 after public hearings, are judged to be safe and acceptable levels for emissions and ambient air quality and to provide safeguards for health and the environment.

The PCB objectives for various emissions are identified in tables in this section of the EIS highlights. They include such limits as the following for sulphur dioxide (SO_2):

Emissions 0.09 to 0.34 mg/kj

Ambient concentrations:

annual average	25 to 75	ug/m^3
24-hour maximum	160 to 260	ug/m^3
1-hour maximum	450 to 900	ug/m^3

In terms of emissions, the PCB objectives are expressed as 0.34 milligrams (mg) of sulphur dioxide per kilo-joule (kj) of heat energy produced in burning the coal.

A kilo-joule is a metric measure of heat energy (one kilo-joule equals 0.947 British Thermal Units). In terms of electricity, a kilo-joule is equal to 1,000 watt-seconds — enough electricity to keep a 100-watt bulb lit for 10 seconds.

In terms of ambient, or ground level, concentrations of sulphur dioxide, the PCB objectives are expressed in micrograms (ug) per cubic metre (m^3). A microgram is one-millionth of a gram.

The Hat Creek project, as proposed, would include controls to keep emissions and ambient air quality at levels within the range of the PCB's objectives, even in worst-case situations, as the tables included here illustrate.

For instance, when the plant is burning its full load of 40,500 tonnes of coal per day, the sulphur dioxide emissions would be 0.28 mg/kj. The top of the PCB objectives range is 0.34 mg/kg.

Ambient concentrations of SO_2 would be 4.5 ug/m^3 on the annual average (PCB objective 25 to 75); 208 on the 24-hour maximum (PCB objective 160 to 260); and 825 on the one-hour maximum (PCB objective 450 to 900).

The projected emissions and ambient concentrations of trace elements — elements in quantities of less than 1,000 parts per million in the plant's emissions — are within PCB objectives. In fact, most are less than half the lowest level of PCB objectives. Increases of trace elements in local and regional soils due to powerplant and cooling tower emissions and subsequent deposition would be minor, generally less than one percent enrichment in what already exists. "Local" describes the area within a radius of 25 kilometres of the project; "regional" is within 25 to 100 kilometres of the project.

The project would have to meet or exceed all emission and ambient air quality standards specified by the PCB and other regulatory agencies in permits and licences issued to the project.

PROJECT IMPACTS

The project's main impacts on air quality would result from:

a) the release, through the powerplant stack, of ash particles, sulphur dioxide (SO_2) and nitrogen oxides (NO_X), and
b) the release, through the stack and the natural draft water cooling towers, of other elements in trace quantities, and of moisture.

Impacts from moisture emission from the water reservoir, dust from the ash disposal site and fugitive dust from construction, mining and coal-handling would be minor and localized.

Tables which follow set out details of emissions and ambient air quality anticipated in worst-case situations and provide comparisons with objectives established by the PCB as safe and acceptable.

Powerplant Stack Emissions

The following table is based on stack emissions at full load, with the powerplant burning 40,500 tonnes per day of coal blended to the plant's performance specifications. The projections are based on a powerplant with flue-gas desulphurization (FGD) technology and a 366-metre (1,200-foot) high stack.

Where no Pollution Control Board objective is shown, the PCB has not defined an emission level in its objectives.

POWERPLANT EMISSIONS

Contaminant		Units	PCB Objective	Proposed Project
Sulphur dioxide		mg/kJ fuel	0.09 to 0.34	0.27
Nitrogen oxides as NO2		mg/kJ fuel	0.15 to 0.3	0.3
Total particulates		mg/kJ fuel	0.01 to 0.04	0.03
		% opacity	10 to 40	25
Trace Elements				
Antimony	Sb	mg/mol	0.16 to 0.27	0.000016
Arsenic	As	mg/mol	0.16 to 0.27	0.0018
Beryllium	Be	mg/mol	—	0.000032
Boron	B	mg/mol	—	0.0030
Cadmium	Cd	mg/mol	0.05 to 0.27	0.000023
Chronium	Cr	mg/mol	—	0.0036
Cobalt	Co	mg/mol	—	0.000058
Copper	Cu	mg/mol	0.16 to 0.27	0.0028
Fluoride	HF	mg/mol	0.02 to 0.20	0.13
Lead	Pb	mg/mol	0.16 to 0.27	0.00056
Manganese	Mn	mg/mol	—	0.0078
Mercury	Hg	mg/mol	0.03 to 0.27	0.00044
Molybdenum	Mo	mg/mol	—	0.00038
Nickel	Hi	mg/mol	—	0.0008
Selenium	Se	mg/mol	—	0.00064
Silver	Ag	mg/mol	—	0.0000027
Thallium	Tl	mg/mol	—	0.0000017
Thorium	Th	mg/mol	—	0.000021
Tin	Sn	mg/mol	—	0.000014
Tungsten	W	mg/mol	—	0.0000033
Uranium	U	mg/mol	—	0.000074
Vanadium	V	mg/mol	—	0.0011
Zinc	Zn	mg/mol	0.16 to 0.27	0.0018

(mg/mol = milligrams per mole. A mole is a unit of measurement used by the Pollution Control Board in defining emission control objectives. In this case it refers to the volume of one molecular weight of flue-gas.

Maximum Ambient Concentrations

The following table sets out projected, worst-case, ambient concentrations of contaminants due to powerplant emissions, assuming operation at 100 percent of capacity. Where no Pollution Control Board Objective has been shown, the PCB has not defined an ambient level objective.

In the case of nitrogen dioxide, the federal government has established ambient concentration guidelines as follows (with Hat Creek Project concentrations in brackets): annual average 100 ug/m^3 (2.5); 24-hour maximum 200 (116) and one-hour maximum 400 (460).

Carbon monoxide ambient concentrations shown in this table are equivalent to 0.099 milligrams per cubic metre for the one-hour averaging time and 0.031 mg/m^3 for the eight-hour averaging time. These numbers are far lower than the 35 mg/m^3 for one-hour and 15 mg/m^3 for eight-hour averaging times set by the federal government as the maximum acceptable concentrations guidelines.

MAXIMUM AMBIENT CONCENTRATIONS

Contaminant	Unit	British Columbia PCB Objective	Proposed Project
Sulphur Dioxide (SO2)			
annual-average	ug/m^3	25 to 75	4.5
24-hour maximum	ug/m^3	160 to 260	208
3-hour maximum	ug/m^3	375 to 665	366
1 hour maximum	ug/m^3	450 to 900	825
Suspended Particulates (TSP)			
annual-average	ug/m^3	60 to 70	0.5
24-hour maximum	ug/m^3	150 to 200	23
Nitrogen Dioxide (NO2)			
annual-average	ug/m^3		2.5
24-hour maximum	ug/m^3		116
1 hour maximum	ug/m^3		460
Carbon Monoxide			
annual-average	ug/m^3		0.5
24-hour maximum	ug/m^3		25
8-hour maximum	ug/m^3		31
1 hour maximum	ug/m^3		99

(ug/m^3 = micrograms per cubic metre)

AMBIENT CONCENTRATIONS — TRACE ELEMENTS

The following table sets out projected ambient concentrations of trace elements — elements of minerals which appear in quantities of less than 1,000 parts per million in the coal.

PROPOSED PROJECT

Element		24-Hour (ug/m^3)	Annual Average (ug/m^3)	PCB Objectives (ug/m^3)
Antimony	Sb	0.00021	0.0000045	0.1 - 0.5
Arsenic	As	0.024	0.00051	0.1 - 1.0
Beryllium	Be	0.00042	0.0000090	0.005 - 0.1
Boron	B	0.039	0.00084	—
Cadmium	Cd	0.00029	0.0000063	0.05 - 0.3
Chromium	Cr	0.0046	0.000099	0.05 - 0.1
Cobalt	Co	0.00075	0.000016	—
Copper	Cu	0.036	0.00078	0.25 - 2.5
Fluorine	F	1.6	0.035	0.1 - 2.0
Lead	Pb	0.0072	0.00016	1.0 - 2.5
Manganese	Mn	0.10	0.0022	—
Mercury	Hg	0.0055	0.00012	0.1 - 1.0
Molybdenum	Mo	0.0048	0.00011	0.1 - 2.5
Nickel	Ni	0.010	0.00022	0.01 - 0.1
Selenium	Se	0.0082	0.00018	0.1 - 0.5
Silver	Ag	0.000028	0.00000060	—
Thallium	Tl	0.000028	0.00000060	—
Thorium	Th	0.00026	0.0000057	—
Tin	Sn	0.00018	0.0000039	—
Tungsten	W	0.000042	0.00000090	—
Uranium	U	0.0094	0.000020	0.01 - 6.0
Vanadium	V	0.014	0.00030	0.05 - 1.0
Zinc	Zn	0.022	0.00048	1.0 - 2.5

(ug/m^3 = micrograms per cubic metre)

Regional Concentrations

The earlier tables present figures for concentrations projected for the "local" area — within 25 kilometres of the powerplant. The following table presents average ambient concentrations projected for the "regional" area — 25 to 100 kilometres from the plant. All figures assume operation at full capacity. Ambient levels for sulphate and nitrogen dioxide are not defined in PCB objectives.

Contaminant	British Columbia PCB (ug/m^3)	Proposed Project (ug/m^3)
Sulphur Dioxide (SO2)	25 to 75	1.7
Sulphate (SO4)	—	0.1
Total Suspended Particulates (TSP)	60 to 70	0.2
Nitrogen Dioxide (NO2)	—	1.0

Trace Element Soil Accumulations

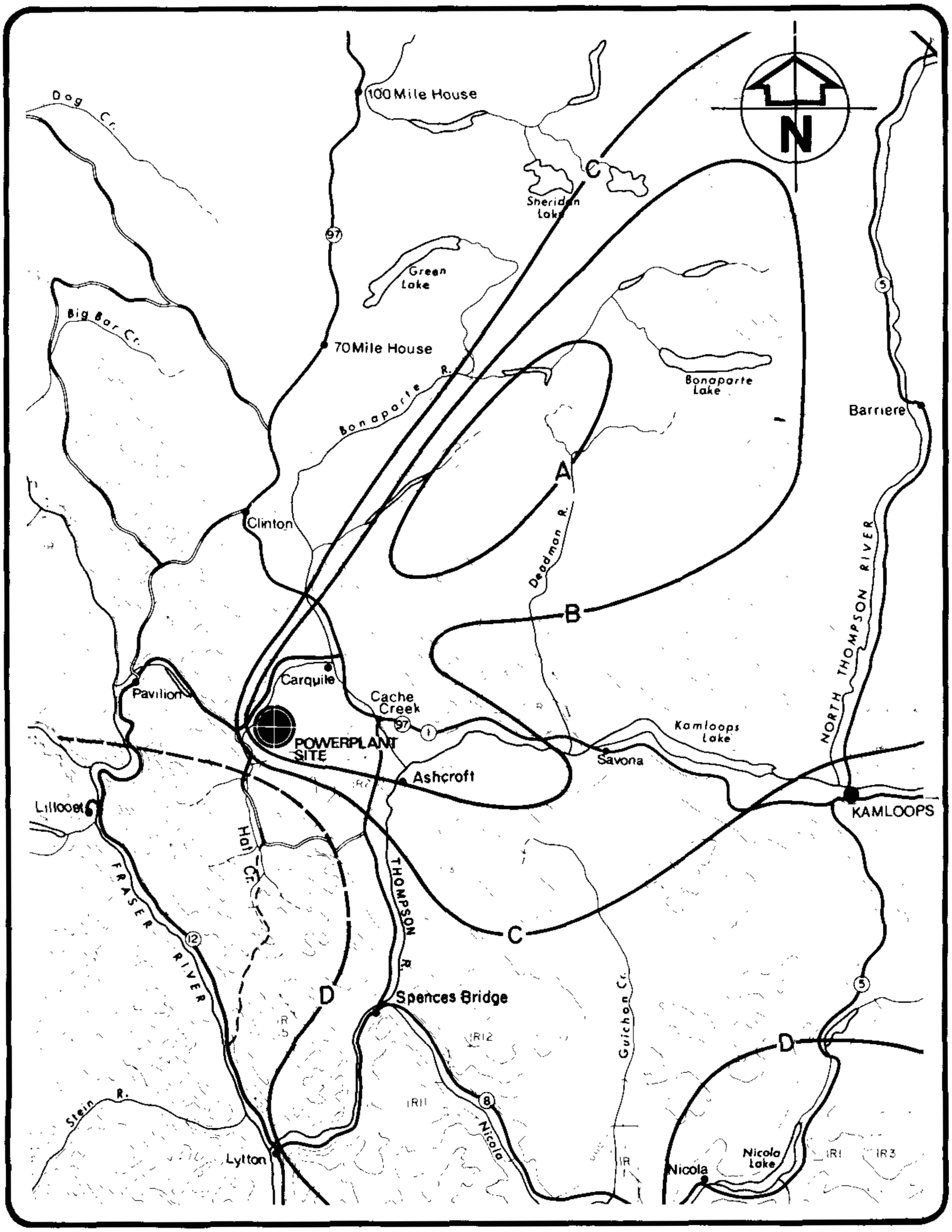
In the following map and table, soil accumulations of trace elements after 35 years of operation are shown by geographic zones. These projections are based on average annual powerplant operation at 65 percent of capacity and they assume that all deposited elements will remain in the soil. The zones are described in the map and the concentrations by zones are stated in micrograms per kilogram of soil.

The projections are also based on the conservative assumption that all 35 years' depositions remain in the top three centimetres of soil with no take up by vegetation or loss by erosion.

TRACE ELEMENT SOIL ACCUMULATIONS

Concentration
(ug/kg — micrograms per kilogram)
Zones (see map)

Element		A	B	C	D
Antimony	Sb	0.23	0.18	0.14	0.07
Arsenic	As	29	22	14	7.3
Beryllium	Be	0.52	0.39	0.25	0.01
Boron	B	44	33	22	11
Cadmium	Cd	0.32	0.25	0.16	0.07
Chromium	Cr	5.3	4	2.7	1.3
Cobalt	Co	0.91	0.68	0.46	0.20
Copper	Cu	38	29	20	9.6
Fluorine	F	2000	1500	1000	500
Lead	Pb	8.7	6.6	4.3	2.2
Manganese	Mn	120	87	61	29
Mercury	Hg	6.8	5.2	3.4	1.6
Molybdenum	Mo	6.1	4.3	3.0	1.4
Nickel	Ni	12	9.1	6.1	3.2
Selenium	Se	10	7.3	5.2	2.5
Silver	Ag	0.034	0.025	0.015	0.009
Thallium	Tl	0.034	0.025	0.015	0.009
Thorium	Th	0.3	0.21	0.15	0.07
Tin	Sn	0.21	0.16	0.11	0.06
Tungsten	W	0.05	0.04	0.02	0.01
Uranium	U	1.2	0.91	0.61	0.32
Vanadium	V	16	13	8.2	4.2
Zinc	Zn	27	22	14	7.3



100 Mile House
Dog Cr.
Sheridan Lake
Green Lake
Big Bar Cr.
70 Mile House
Bonaparte R.
Bonaparte Lake
Barriere
Clinton
A
Deadman R.
B
NORTH THOMPSON RIVER
Carquile
Pavilion
Cache Creek
POWERPLANT SITE
Kamloops Lake
Savona
Ashcroft
KAMLOOPS
Lillooet
Hat Cr.
FRASER RIVER
THOMPSON R.
C
D
Spences Bridge
Guichon Cr.
Stein R.
Nicola
Lytton
Nicola Lake
N

ACID RAIN

The Hat Creek Project has been studied extensively to determine how it might affect the acidity of precipitation — rain and snow — in the region and how this could affect the natural environment.

Essentially, the research has indicated that there would be no significant effect on soils or water bodies as a result of the proposed thermal project's operation. The research also has established an extensive information base for use in monitoring project effects.

The "acid rain" phenomenon is a matter of considerable attention world-wide because sulphur, nitrogen and other oxides emitted to the atmosphere can form acidic compounds which dissolve in precipitation and subsequently reach the earth.

The acidity of a solution, such as rain water, is measured on a pH scale, pH being a term used to describe the hydrogen ions of a solution. On the pH scale, a value of 7.0 is neutral; values below that show acidity and values above it show alkalinity. Normal rainfall around the world is slightly acidic and has pH readings ranging from 4.6 to 5.7.

Rain in equilibrium with atmospheric carbon dioxide has a Ph level of 5.65. Research indicates that project emissions could cause this to change to 5.58 in areas beyond 50 kilometres from the project and 5.08 in areas within 50 km of the project.

The research also found that the "buffering" ability of soils and water bodies within the short-range (50 km) area — that is, their ability to neutralize the acidity depositions — is high to moderate because of their high levels of alkaline material. Soils and water in the mountainous regions 150 to 200 km downwind have lower alkalinities and thus proportionately less capacity to buffer against acid precipitation.

However, the deposition of acidic material from the project has been estimated and evaluated. It is concluded that there would be no significant effect on biophysical systems, including aquatic life.

The studies included investigation of 205 water bodies in the areas extending to 200 kilometres downwind from the project. They indicate that, after 35 years of project operation, the pH levels of water bodies analyzed in detail would change as follows:

pH LEVELS OF WATER BODIES

	Existing Average pH	Calculated Change of pH with Project	Final long-term Average pH
Clearwater River	7.56	-0.02	7.54
Pennask Lake	7.6	-0.07	7.53
Loon Lake	8.7	-1.38	7.32
Boss Creek	7.1	-0.02	7.08
Adams River	7.6	-0.13	7.47
Deadman River	8.2	-0.56	7.64
Thompson River	7.56	-0.02	7.54

The research into "acid rain" also indicated that:

—Transport of acid-forming powerplant emissions would primarily occur to the northeast of the project;

—there would be little interaction between emissions from the powerplant stack, the cooling towers and the mine;

—there is little chance for interaction of Hat Creek emissions with those of existing sources of sulphur oxide emissions, mainly found in the Kamloops area;

—it is very unlikely that the project's plume would have any significant effect on Kamloops;

—5.5 pH is area of concern for deleterious effects on aquatic systems (i.e. fish).

The Hat Creek "acid rain" studies represent the first published attempt to develop quantitative estimates of pH reduction in lakes and streams due to emissions from a proposed source. In the absence of verified methodology and in view of the importance of British Columbia's waterways in the economic and recreational life of the province, the studies were deliberately designed to over-estimate effects.

A monitoring program to study acid precipitation would begin two years before the start-up of the first of the project's four boilers and would continue through the life of the project.

OTHER IMPACTS

The environmental studies have included assessment of project effects on vegetation, land, forestry, agriculture, wildlife, water, fisheries and aquatic life, minerals, noise, recreation, aesthetics, archaeology and socio-economic conditions.

The studies estimate that the value of fishing, hunting, general recreation, forestry and agriculture resources in the area affected could be reduced — at worst — by approximately $4 million (in 1980 dollars) over the project's 35-year life. Most of this reduction results from the fact that project land requirements would remove 2506 hectares (about 10 square miles) from other resource use.

Emissions from the powerplant are expected to cause some injury to vegetation which could result in slight reductions in forest growth rates and in productivity of some agricultural land. Overall, however, the effects are not expected to be significant. Monitoring programs will be carried out, starting two years before the first boiler goes into operation, to ensure that emissions are controlled to meet the projected levels and to meet or exceed the standards required by licenses.

HUMAN HEALTH

Epidemiology is defined as the study of diseases as they affect human health. Epidemiological studies undertaken for this project considered potential effects from primary contaminants such as sulphur dioxide and suspended particulate matter and secondary contaminants such as sulphate, nitrates and ozone which may be produced due to atmospheric chemical reactions of primary emissions. The studies also considered trace element emissions, radioactivity and the potential of pollutants in combination.

In every instance, the findings indicate the project's effects would have no adverse effect on human health.

SOCIO-ECONOMICS AND COMMUNITY RESOURCES

The major social and economic impacts of the project will result from the employment opportunities it would create and from the population increases it would generate in the local and regional areas surrounding the project.

At the peak of construction activity — in the 1986-88 period — about 2800 people would be employed and it is anticipated that about 85 percent of the workers coming from elsewhere to the project would occupy single-status construction camps at the mine and powerplant sites.

An estimated 1200 permanent jobs will exist in the operation of the facility when it is completed and it is expected that about 80 percent of the poeple in these jobs will reside in the Ashcroft-Cache Creek area, 15 percent at Clinton and the balance at Lillooet and in rural areas.

Indirect employment stimulated by the project is expected to result in some 700 additional new jobs in the local and regional areas, including Kamloops.

The Environmental Impact Statements sets out various detail related to anticipated effects on the area communities, their social and recreational facilities and service infrastructure, including housing, schools, hospitals, fire and police protection and taxes. The data is based on studies completed in 1977 and B.C. Hydro has initiated additional studies to bring the information up to date before public hearings begin into its application for licence to build the project.

Three residences in the Hat Creek valley would have to relocate as a direct result of land requirements for the mine and noise impacts. Several others, including residences on the Bonaparte Indian Reserve No. 1, would be affected by noise.

The EIS says effects of the project upon the socio-economic conditions of Native Indian people cannot be accurately predicted, but that B.C. Hydro will make every effort in association with Native Indian organizations, government agencies and the construction and operating unions involved, to maximize Native Indian participation in the project.

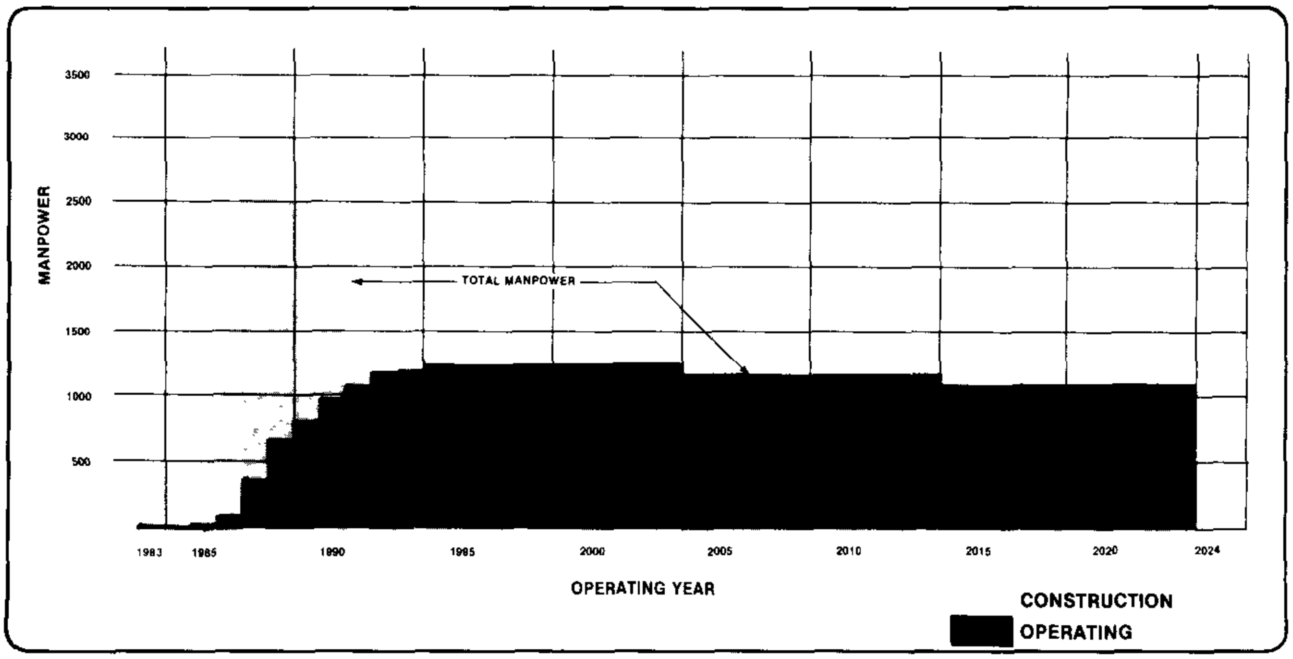
In conjunction with the project, a socio-economic monitoring program will be funded *by B.C. Hydro* and an appropriate implementation plan will be determined through discussions with the Thompson-Nicola Regional District, provincial agencies and the local communities.

B.C. Hydro will provide financial compensation to local governments if it can be demonstrated that the costs incurred in providing services to the project-induced immigrant population exceed the revenues those governments get from taxes, levies and fees. Further recommendations for compensation are expected from the socio-economic study update and these will form the basis for discussion with local, regional and provincial governments.

B.C. Hydro expects to pay taxes or grants in lieu of taxes to local governments and the regional district on all project components except the generating facilities, which are exempted by provincial legislation.

MANAGEMENT OF IMPACTS

B.C. Hydro plans to manage the impacts of the project in three ways — by selected design and operational mitigation measures to reduce adverse impacts; by a compensation policy for impacts which cannot be mitigated; and by monitoring of impacts to ensure that the project's effects do not exceed levels predicted or deemed acceptable by licensing authorities.



MANPOWER REQUIREMENTS

HAT CREEK PROJECT STUDIES

Following are locations where copies of the Hat Creek Project Environmental Impact Statement and detailed impact studies are available for public viewing:

B.C. HYDRO OFFICES:
Headquarters Building
Main floor
970 Burrard Street
Vancouver, B.C.

Hat Creek Project Office
555 West Hastings Street,
Vancouver, B.C.

Hat Creek Information Office
Cache Creek, B.C.

Public Office
322 Seymour Street,
Kamloops, B.C.

LIBRARIES:
Vancouver Public Library, Victoria Public Library, Kamloops Public Library, Ashcroft Public Library, Cache Creek Public Library.

Requests for copies of the full Environmental Impact Statement or for any or all of the detailed support studies should be directed to:

Hat Creek Information Officer
Box 12121
555 West Hastings Street
Vancouver, B.C. V6B 4T6

Telephone (604) 663-3660

PUBLIC PARTICIPATION

When engineering and environmental studies for the Hat Creek Project were initiated in 1974, communication was established between B.C. Hydro and people resident in the region. The program had two main objectives: To provide timely information about the project to interested groups and individuals, and to provide a forum through which public concerns could be voiced during project planning.

Public information bulletins and background reports have been distributed and numerous meetings have been held involving concerned groups in the area. Continued liaison will be maintained during the review of the Environmental Impact Statement and the period of the licence application.

The Hat Creek project falls under the jurisdiction of the Energy Review Process established in the Utilities Commission Act of 1980. B.C. Hydro will file an application for an Energy Project Certificate, applying through the office of the Minister of Energy, Mines and Petroleum Resources. After initial appraisal by the Ministers of Energy and Environment, joint terms of reference will be established for a public hearing review. Public hearings will be conducted by the B.C. Utilities Commission.

Figures: (inserted at back)

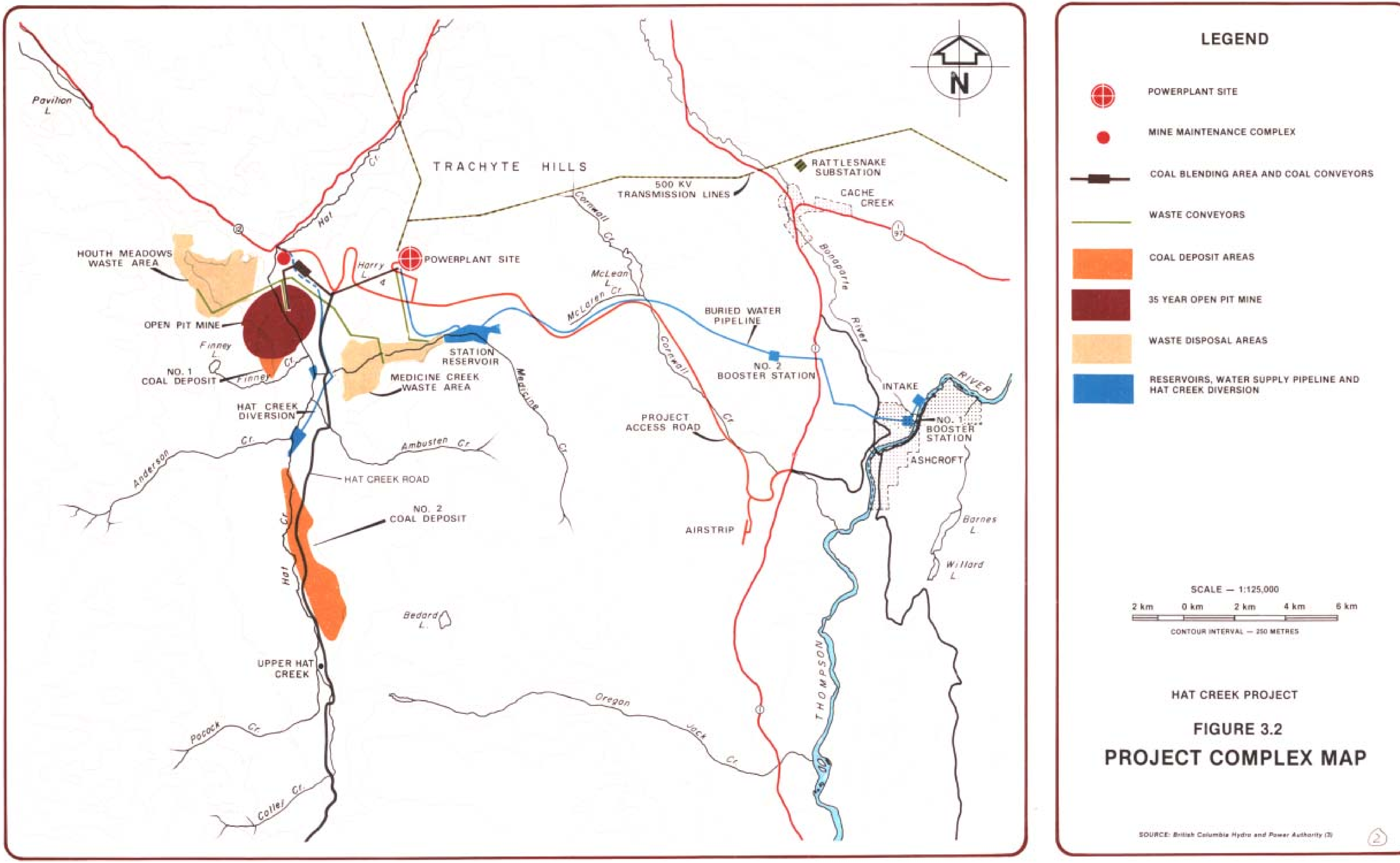
HAT CREEK PROJECT

FIGURE 3.1

PROJECT OVERVIEW FROM SOUTH EAST

SOURCE: Toby, Russell, Buckwell and Partners Architects (2)

(1)

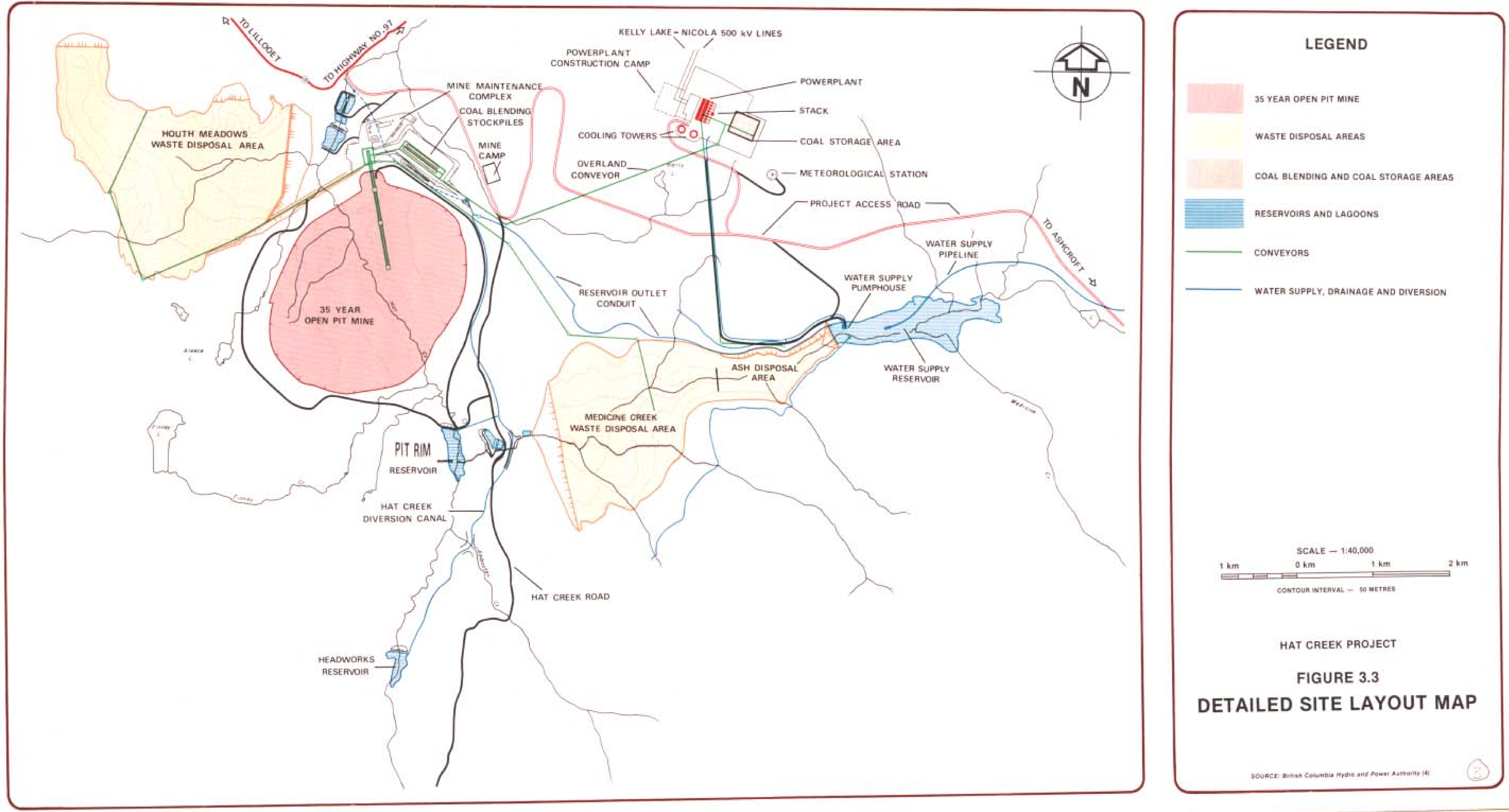


HAT CREEK PROJECT

FIGURE 3.2

PROJECT COMPLEX MAP

SOURCE: British Columbia Hydro and Power Authority (3)

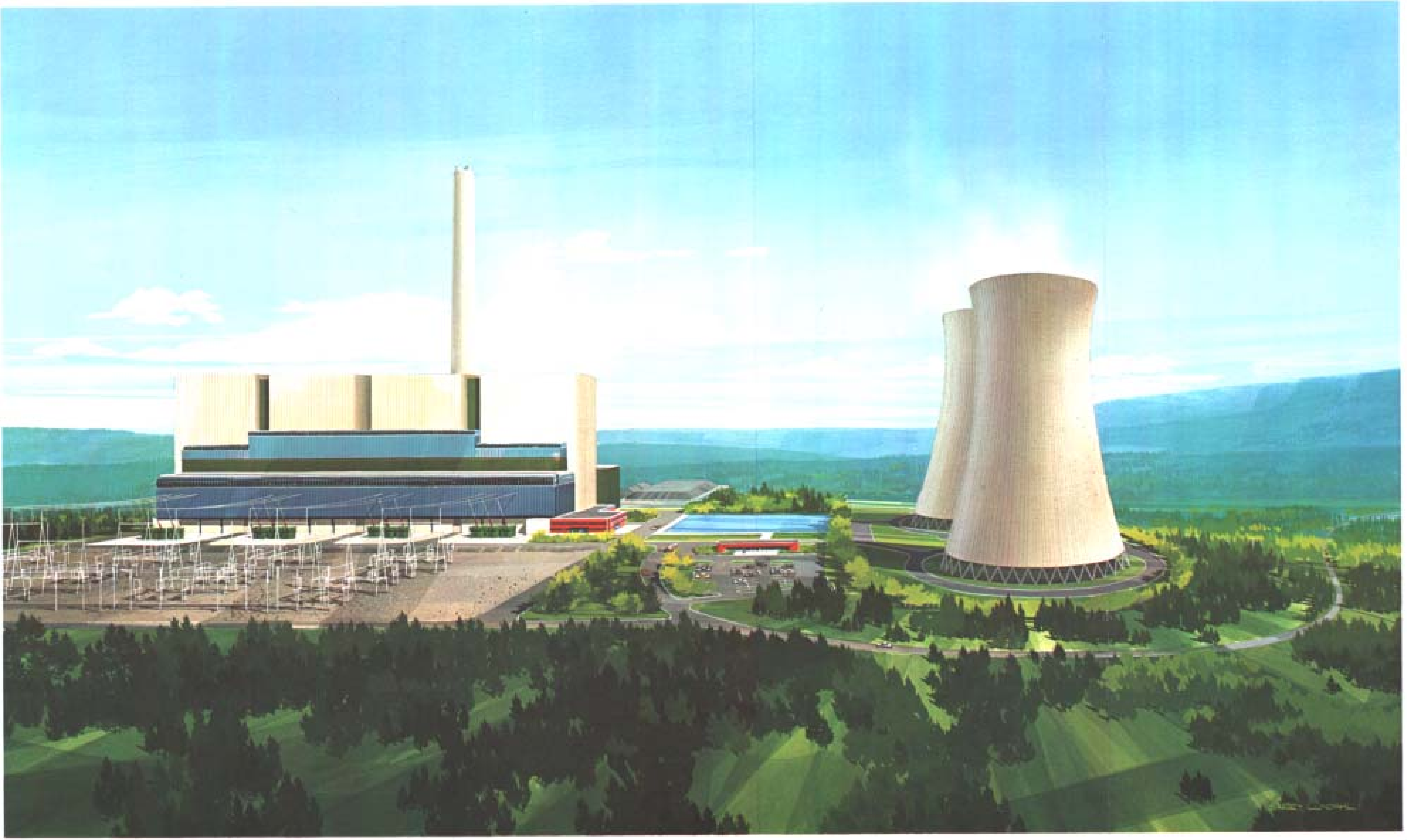


HAT CREEK PROJECT

FIGURE 3.3

DETAILED SITE LAYOUT MAP

SOURCE: British Columbia Hydro and Power Authority (4)



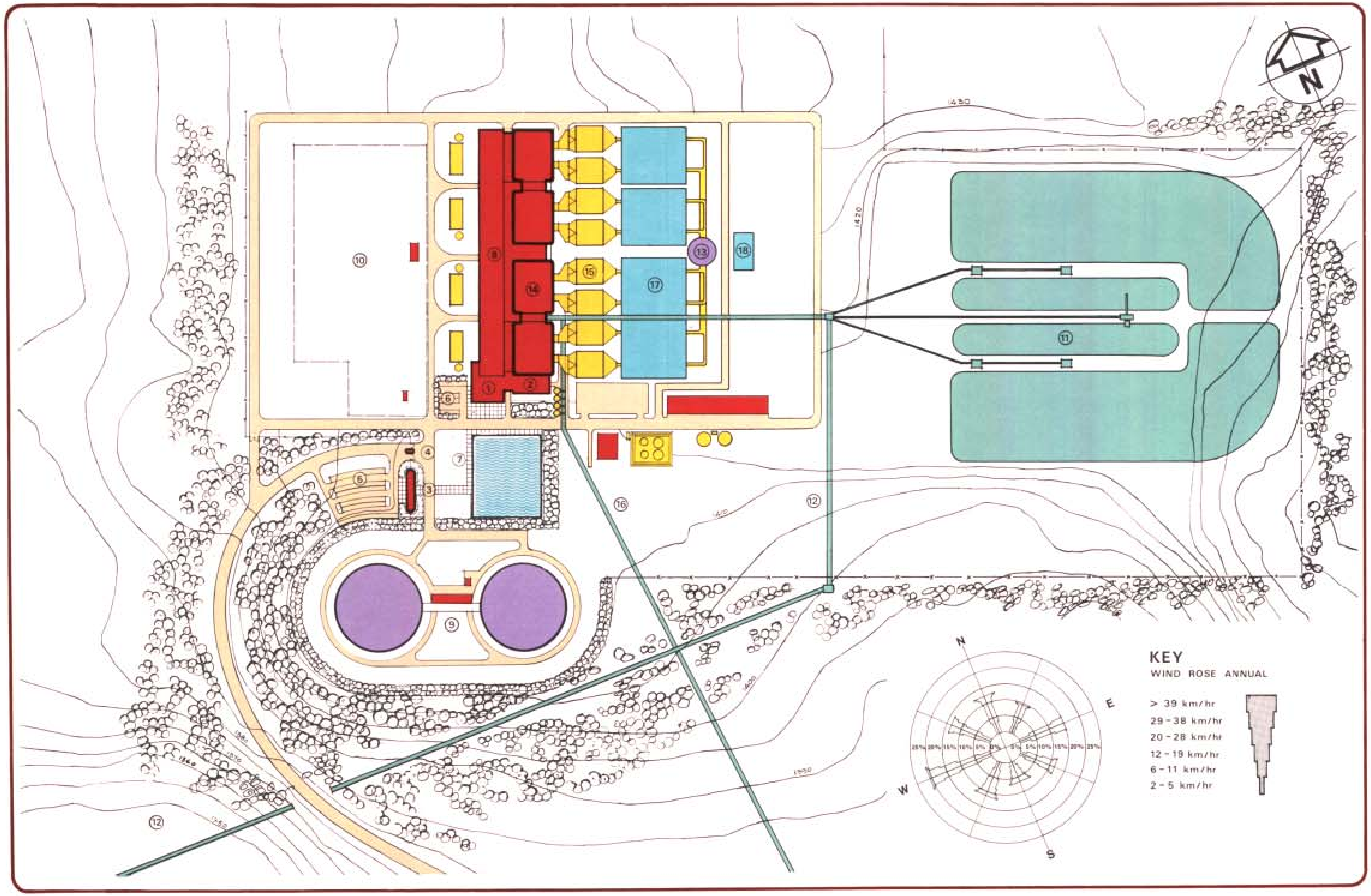
HAT CREEK PROJECT

FIGURE 3.9

POWERPLANT FROM WEST

SOURCE: Toby, Russell, Buckwall and Partners Architects (2)

4



LEGEND

1. ADMINISTRATION BUILDING
2. WORKSHOP
3. TOURIST INFORMATION CENTRE
4. GUARD HOUSE
5. VISITOR PARKING
6. ADMINISTRATION PARKING
7. LANDSCAPED AREA WITH REFLECTING WATER SURFACE
8. TURBINE HOUSE
9. COOLING TOWERS
10. SWITCHYARD
11. COAL STORAGE
12. COAL OVERLAND CONVEYOR FROM MINE
13. STACK
14. BOILER HOUSE
15. ELECTROSTATIC PRECIPITATORS
16. ASH & SLUDGE DISPOSAL CONVEYORS
17. FLUE GAS DESULPHURIZATION SYSTEM
18. FGD SYSTEM SERVICES

SCALE — 1:400

50 m 0 m 50 m 100 m 200 m 300 m

CONTOUR INTERVAL — 50 METRES

HAT CREEK PROJECT

FIGURE 3.10

POWERPLANT SITE PLANT

SOURCE: Toby, Russell, Buckwell and Partners Architects (3)

5