# CONSOLIDATED REXSPAR
MINERALS & CHEMICALS LIMITED

# INFORMATION
ON THE
# PROPOSED BIRCH ISLAND PROJECT

NOVEMBER 1977



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# GENERAL INFORMATION



## INTRODUCTION

This information brochure has been prepared to acquaint interested parties and citizens of the past endeavours and current studies by Consolidated Rexspar Minerals and Chemicals Limited for the proposed development of the Birch Island uranium project.

A brief history of the property, geology, mining, processing, environmental considerations and socio-economic impact of the project on the area are outlined.

## THE COMPANY

Consolidated Rexspar Minerals and Chemicals Limited is a Canadian company incorporated in 1951, with approximately 1800 shareholders and with head offices located in Toronto, Ontario. Denison Mines Limited is a major shareholder in Consolidated Rexspar, holding about 47% of the issued shares. Through this affiliation, Consolidated Rexspar has available to it the knowledge and experience gained over twenty years by Denison in the mining and processing of uranium bearing ore.

# THE BIRCH ISLAND PROJECT

## HISTORY

In 1926 Smuggler Hill Development Company was formed to explore and develop silver/lead deposits. The results of this early exploration activity were reported by H.G. Nichol, 1926 and D.B. Starrett, 1930. A manganese occurrence was examined by Wm. Elliot and N.C. Stines in 1929. Further geological examinations of fluorite occurrences were reported on by D.B Starrett, R.P.D. Graham and M.R. Wilson in the early 1940's.

The presence of uranium mineralization became known in late 1949. Dr. F.R. Joubin studied and reported on the mineral occurrences during 1950 and 1951.

A predecessor company of Consolidated Rexspar acquired the rights to mineral claims incorporating the uranium bearing zones and delineated three uranium deposits in the late 1950's. However, the deposits were not brought into production. Exploration programs and geological reviews were conducted in 1969-1972, directed mainly at determining fluorite reserves.

Additional diamond drilling of the uranium bearing ore zones was carried out in 1976 and the drill core was used in a metallurgical test program undertaken to establish process flowsheets.

Exploration to-date has defined three mineralized zones, referred to as A, B and BD, with combined reserves of 1,228,400 tons of ore grading 1.546 pounds of uranium oxide ($U_3O_8$) per ton. These reserves are sufficient to support the planned facilities at design capacity for about four and one half years, with the possibility of additional reserves to extend the mine life. If proven to be economically recoverable, a fluorite deposit, located adjacent to the uranium ore deposits, could extend the operating life of the mine by an additional four years.

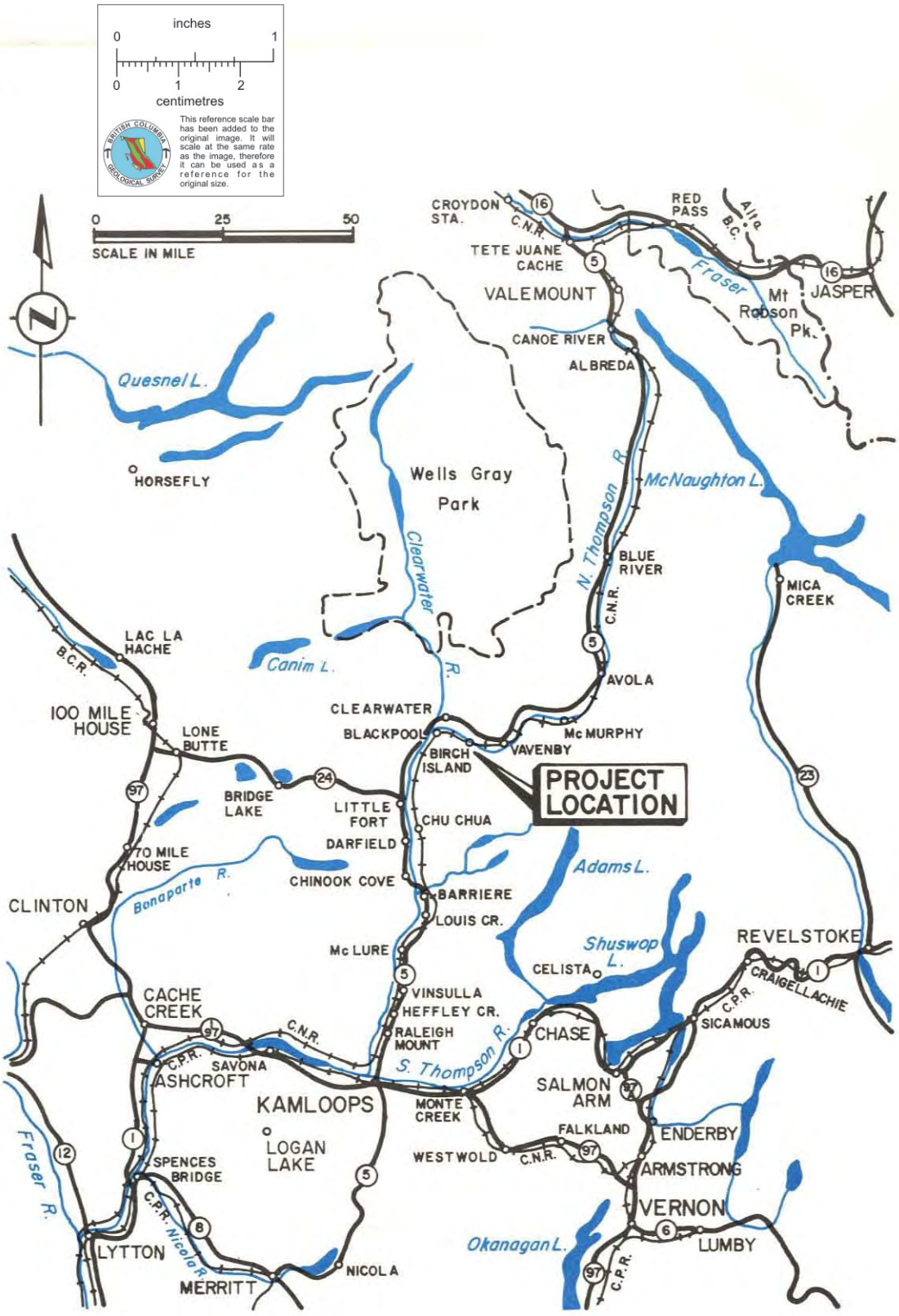
Additional exploration aimed at the location of further deposits of uranium ore is to be expected during the operational years.

## LOCATION

The Birch Island project is located in the Granite Mountain area approximately 81 miles north of Kamloops and 2½ miles south of Birch Island in central British Columbia. (See location map on page 4).

Birch Island is located on the transcontinental line of the Canadian National Railway and on B.C. Highway No. 5. The North Thompson River, at this point, flows from east to west for 20 miles before heading in a southerly direction to join the main Thompson River at Kamloops.

The uranium ore deposits are located on a ridge leading down from Granite Mountain between Foghorn and Clay Creeks on claim holdings extending southward from the Lower North Thompson Valley. The terrain is rugged, with slopes varying from 10 to in excess of 30 degrees. Elevations vary from 1400 feet above sea level at Birch Island to 4500 feet at the southern border of the property, a distance by road of 6 miles.




# LOCATION MAP
# BIRCH ISLAND PROJECT

## THE PROJECT

It is proposed that the three orebodies be mined sequentially by conventional open pit methods at the rate of 7000 tons per week. Ore would be hauled from the open pits to a crushing/grinding plant in 22-ton capacity trucks.

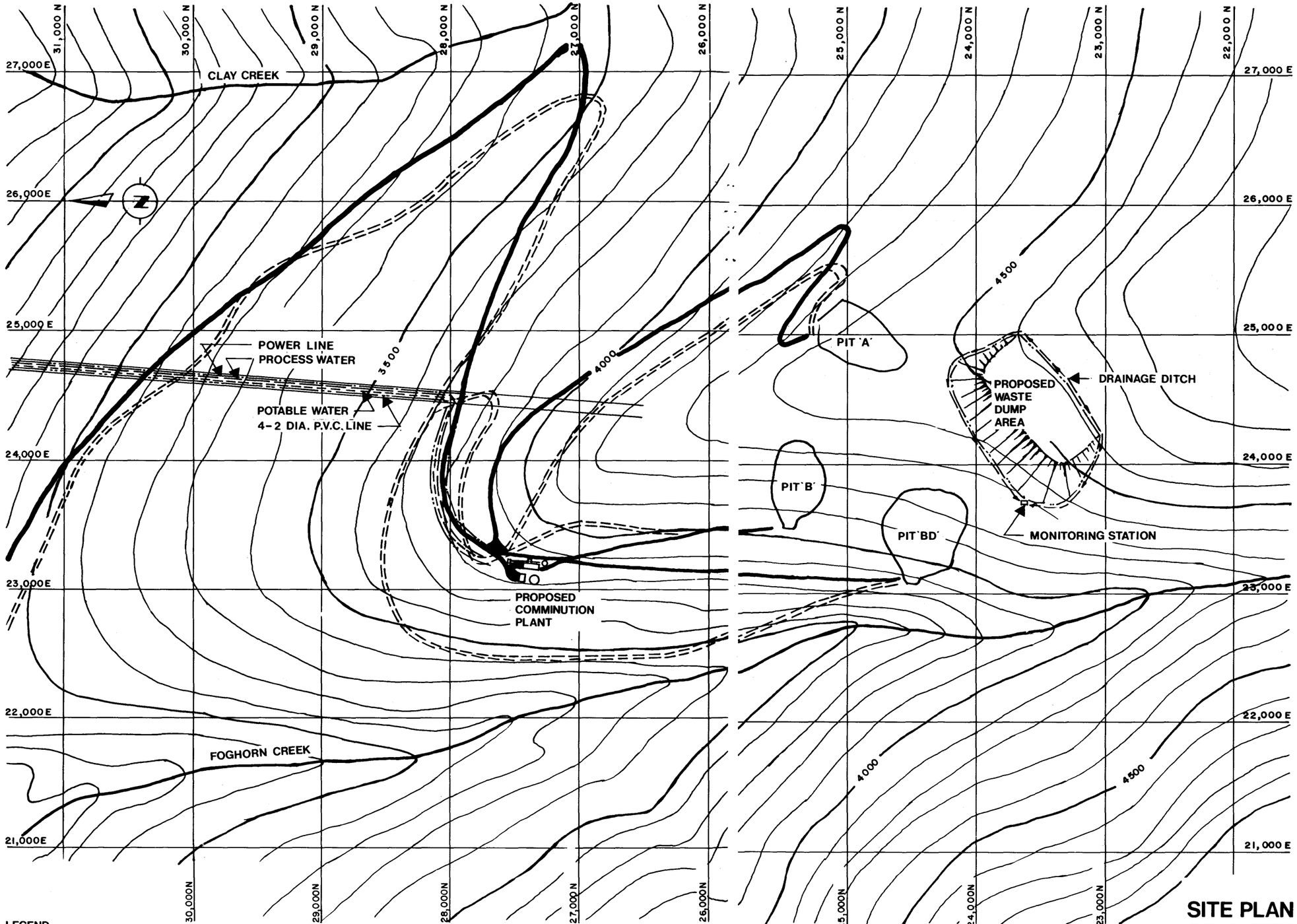
The crushing and grinding plant would be located on the mountain within one mile of the open pits. The resulting slurry of water and ore would be transported by pipeline to a hydrometallurgical plant located at the base of Granite Mountain near Birch Island (see site plans on pages 6 to 9). Output of the hydrometallurgical plant would approximate 1320 pounds of uranium oxide per day.

The hydrometallurgical plant would house all processing facilities, laboratories, offices, changehouses and repair shops.

The uranium oxide concentrate from the hydrometallurgical plant, referred to as "yellow cake", would be packed in drums, sealed and shipped by rail to a uranium refinery located in Port Hope, Ontario for further processing.

Consolidated Rexspar retained Kilborn Engineering (B.C.) Limited, A.H. Ross & Associates, B.C. Research, Piteau & Associates as well as other specialists to prepare a feasibility study of the Birch Island project. This study will be finalized when further metallurgical testing is completed and the environmental requirements have been carefully reviewed.

The cost of bringing the Birch Island project into production in 1977 dollars has been estimated to be in the order of $27 million.




LEGEND

EXISTING ROAD

PROPOSED RELOCATED ROAD

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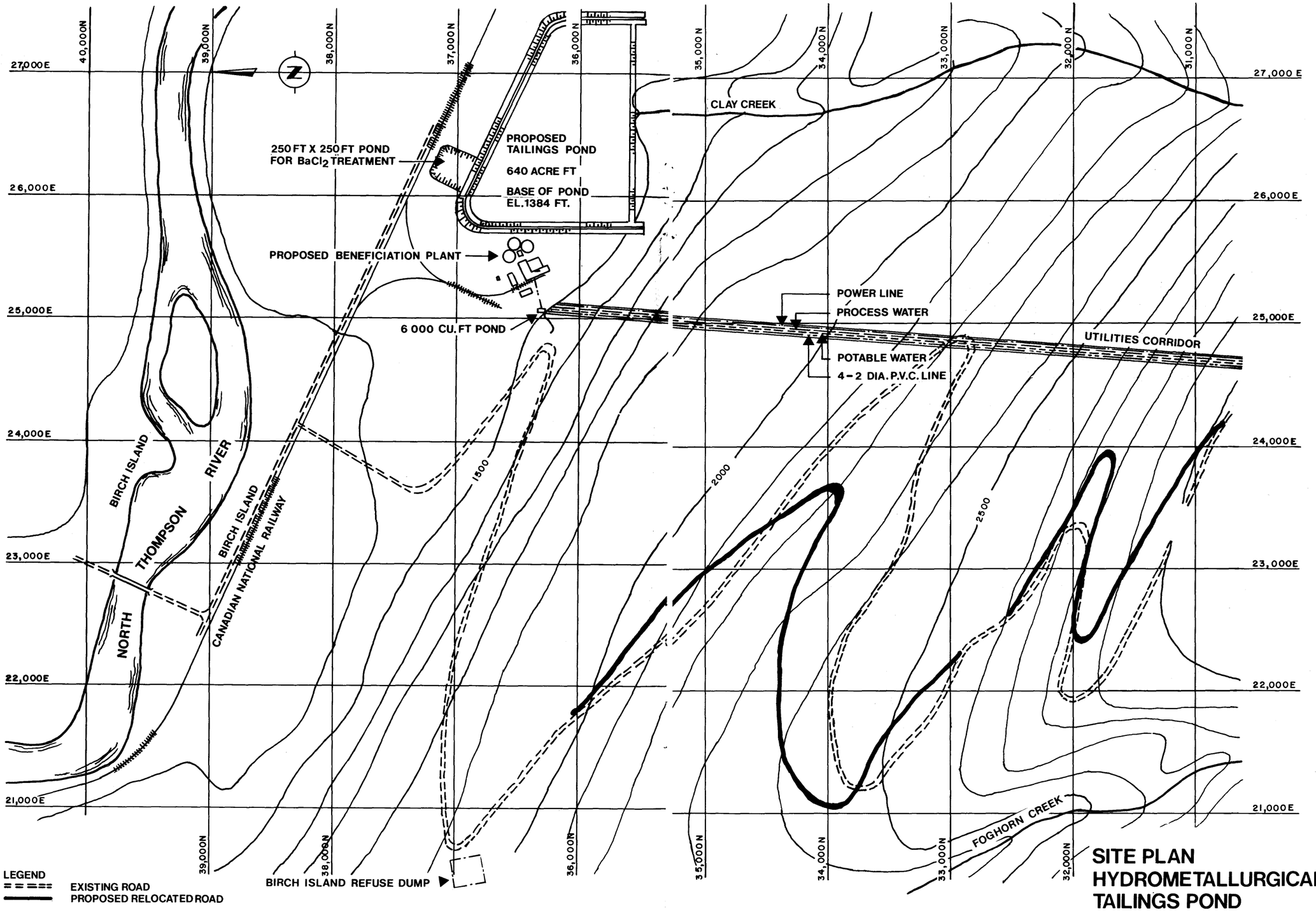
BRITISH COLUMBIA GEOLOGICAL SURVEY

# SITE PLAN
# OPEN PITS AND
# CRUSHING/GRINDING PLANT

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BRITISH COLUMBIA GEOLOGICAL SURVEY

# SITE PLAN HYDROMETALLURGICAL PLANT/ TAILINGS POND

# GEOLOGY AND MINEROLOGY

## REGIONAL GEOLOGY

The Consolidated Rexspar ore deposits lie on the southeast side of the North Thompson River valley between Foghorn Creek and Clay Creek between 3000 and 4500 feet elevation. This region is part of the Shuswap Highland which is generally characterized by gently to moderately sloping plateau areas which are dissected by larger river valleys. The valley sides are commonly steep because of glacial erosion and total relief may be fairly great even though local relief in the uplands is moderate.

The minesite occurs on the upper flanks and crest of a narrow steep ridge between Foghorn and Clay Creeks. This ridge drops off to the north into the valley of the North Thompson River. Foghorn Creek occurs in a steep gorge and probably occupies a north trending fault zone. Only minor glacial effects are noted at the minesite and overburden generally consists of 3 to 20 feet of highly weathered residual soil. This particular aspect is somewhat uncommon in terrain in British Columbia.

The valley of the North Thompson River at Birch Island is generally steep sided, U-shaped and has most of the typical characteristics of glaciated valleys. The valley is covered, to depths in excess of several hundred feet in some locations, with deposits of glacial and alluvial materials composed mainly of tills, silts, sands and gravels. Alluvial terraces, meander scars (remnant river channels) and alluvial fans are common in the area.

Bedrock in the mine area consists mainly of flat-lying, highly altered sedimentary and volcanic rocks which represent consolidated sands, muds and lava flows. These rocks are overlain in the mine area by light-coloured volcanic rocks called trachytes consisting of lava flows and volcanic ash.

## ORE ZONES

The trachytes contain the uranium ore lenses which constitute the ore bodies. The lenses are darker in colour than the enclosing rocks due to the presence of black mica and pyrite (fool's gold). The ore bodies are believed to have been formed by the passage of thermal waters which deposited uranium and other minerals in the trachyte. When the waters reached surface they formed hot springs.

The three uranium ore bodies contain an average of 0.077% $U_3O_8$ in the ground with some rare earth metals. Minerals identified in the ore bodies are fluorite, pyrite, small amounts of torbernite containing copper, uranium and phosphorus, uraninite, and a light green mineral identified to be bastnasite which contains rare earth metals.

# OPERATIONS

## MINING

Surface mining by the open pit method has been proposed for the Birch Island project because the ore is near the surface and is covered with a relatively easily removed overburden.

The three uranium bearing deposits will be mined sequentially. Stripping of waste rock from the A pit would tentatively be scheduled for the Spring after the production decision has been made.

The mining of the A zone would be followed in sequence by the mining of the B zone and finally the mining of the BD zone.

Prior to stripping of waste overburden, the commercial timber on the pit sites would be harvested and the underbrush and slash material disposed of. The surface soils would be removed and stockpiled for later use during reclamation.

The waste rock from the A and B zones would be deposited in the proposed waste dump area. The waste rock from the BD zone would be deposited in A and B pits after the completion of mining in these pits.

The ore removal and waste removal would be done on a five day per week basis. Initial operations would be on a three shifts per day basis until waste stripping has advanced sufficiently so that operation on a one shift per day basis is adequate. Ore would be hauled to the crusher during one shift per day. The second and third shifts would be used for waste removal.

During the pre-production period the following operations would take place:

1. A contract would be let for logging the areas affected by the construction and mining. Local contractors would cut and recover any economical timber in these areas.

2. The logged areas would be cleaned up by bulldozing the remaining stumpage and small trees and by disposal through either burning or burying.

3. Haulage roads (approximately 3.6 miles) from the pit areas to the crushing plant and disposal areas would be constructed. These roads would be 30 feet crown width and would require excavation in both overburden and rock. Present roads would be utilized as far as possible.

4. Removal of overburden from all pits would start during the pre-production period. Overburden removal from A and B pits would be completed during the pre-production period while the stripping of overburden from BD pit would be completed during the first year of production.

5. The A pit would then be prepared for start of production. Sufficient waste would be removed during pre-production development to permit uninterrupted production during the operational phase.

All pits are on hillsides sloping at various gradients. The A and B pits would have elevation differences from the top to the bottom of 175 and 225 feet respectively. The BD pit would be on a steep hillside, in places approaching the angle of repose of the overburden material. The difference in elevation from the bottom bench of this pit to the higher wall of the pit would be 475 feet.

The mining schedule proposes that ore be produced from one pit at a time with stripping being carried out, concurrently, in the next pit to be mined. The method selected and the equipment to be used considers flexibility of working area, selectivity of mining and manoeuverability of equipment necessary for the operation of several small open pits.

Geological control would be required in conjunction with the mining operations. To aid in ore grade control the blast holes would be logged radiometrically prior to charging and blasting. This, plus radiometric scanning of the broken rock, would be used to determine the destination of material to waste, low grade stockpile or crushing plant.

Blasthole drilling would be primarily 4-inch diameter holes.

Drilling would be done using a crawler drill unit mounting a 4-3/4-inch piston diameter pneumatic percussion drill with a chain feed on a hydraulic boom. The unit would be equipped with a dust collector to eliminate the necessity of using drilling water or detergent. Compressed air to operate the drilling unit would be supplied by a portable diesel powered 750 cubic feet per minute compressor.

The primary blasting agent for dry holes would be ammonium nitrate. Aluminum slurry explosives would be used in wet holes.

The removal of broken ore and waste from the pits would be accomplished with a 4½ cubic yard rubber tired front-end loader and two 22-ton off-highway trucks. Two bulldozers would be supplied for bench cleanup and waste dump construction. A motor grader would be required for road maintenance and winter snow removal.

ORE PROCESSING

Ore from the open pits would be trucked to the crushing/grinding plant situated at an elevation of 3900 feet and within one mile of the open pits.

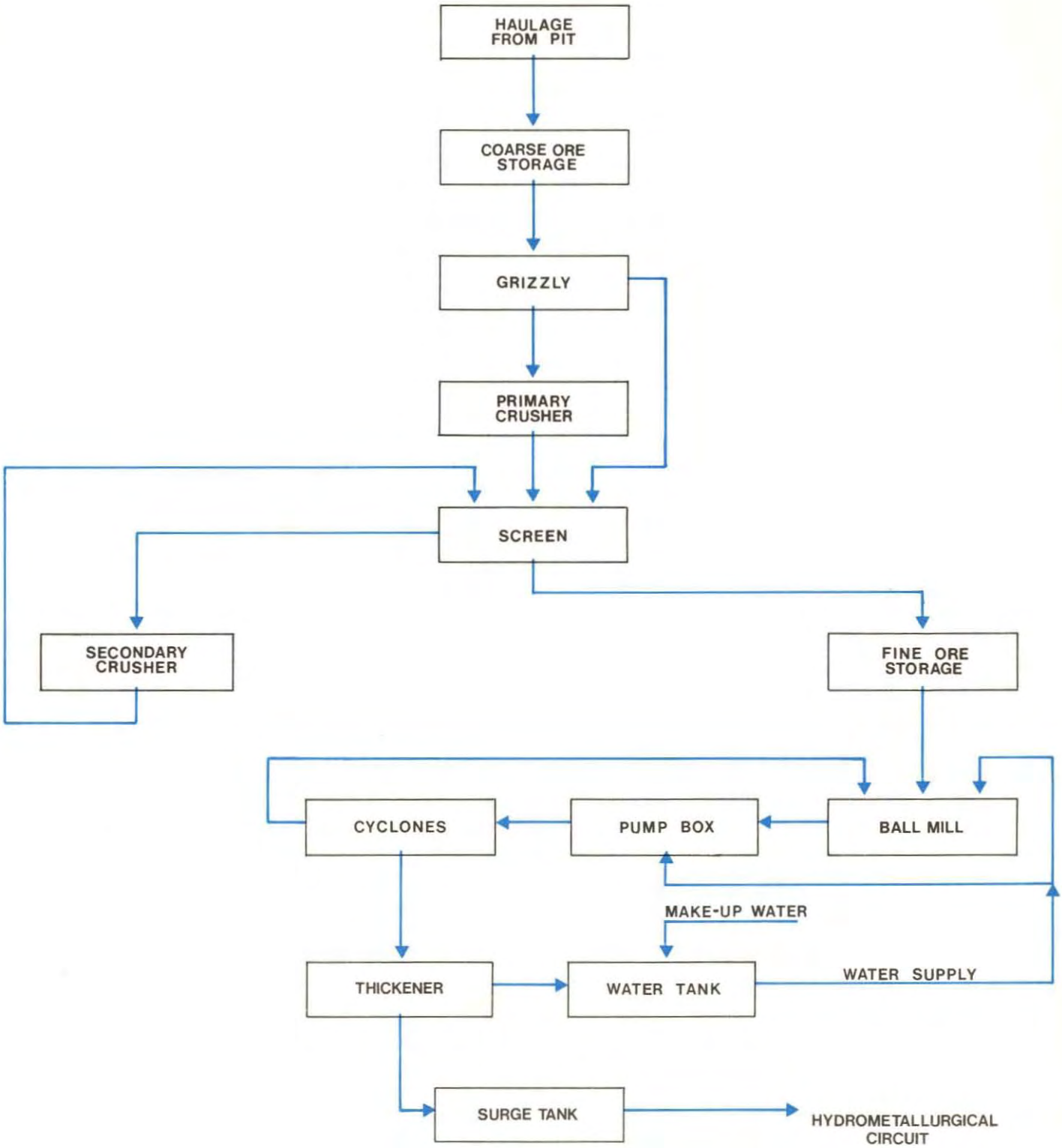
The crushing plant would reduce the ore received from the pits to approximately 3/8 inch (see flowsheet on page 16). The product from the crushing plant would be stored in a bin with 2000 tons of ore capacity which would be sufficient feed for two days continuous operation of the grinding circuit.

A dust collection system would be provided to collect particulate emissions from the crushing, screening and conveying equipment. All dust collected would be treated in the grinding circuit.

Fine ore would be removed from the 2000-ton storage bin by belt conveyors and delivered to the grinding circuit for further size reduction. The size to which the ore is ground is determined by laboratory tests for maximum recovery of the uranium. The grinding unit proposed for the Birch Island project is a rotating cylinder 9½ feet in diameter by 15 feet long called a ball mill. The ball mill would contain steel balls to grind the ore to a fine powderlike consistency as it rotates. At this point, the process becomes wet with the addition of water to the ball mill along with the ore. The mixture of ore and water is commonly referred to as a slurry.

Grinding equipment would be located in a common building with the crushing and screening equipment.

The product of the grinding circuit would be transported to the hydrometallurgical plant via four 2 inch pipelines, two operating and two on standby. The pipelines would be routed along a corridor originally cut in 1957 through the bush to accommodate an aerial tramway. They would start at an elevation of 3,900 feet and terminate at the hydrometallurgical




## PROPOSED CRUSHING/GRINDING CIRCUIT

plant located at an elevation of 1400 feet above sea level. Total line length would be approximately 10,000 feet.

To eliminate the possibility of introducing slurry into a broken or leaking pipeline, a flow comparing circuit would be installed on each pipeline. Flowmeters would be installed at the feed and discharge ends of each pipeline. If a differential flow is detected, automatic valves at the feed end would actuate to reroute the slurry to a standby pipeline immediately.

Slurry received from the grinding circuit would be leached in a sulphuric acid circuit in the hydrometallurgical plant (see flowsheet on page 18). The sulphuric acid dissolves the uranium contained in the ore and takes it into solution. Leaching would be accomplished in 22½ feet diameter by 50 feet high air-agitated tanks known as pachucas.

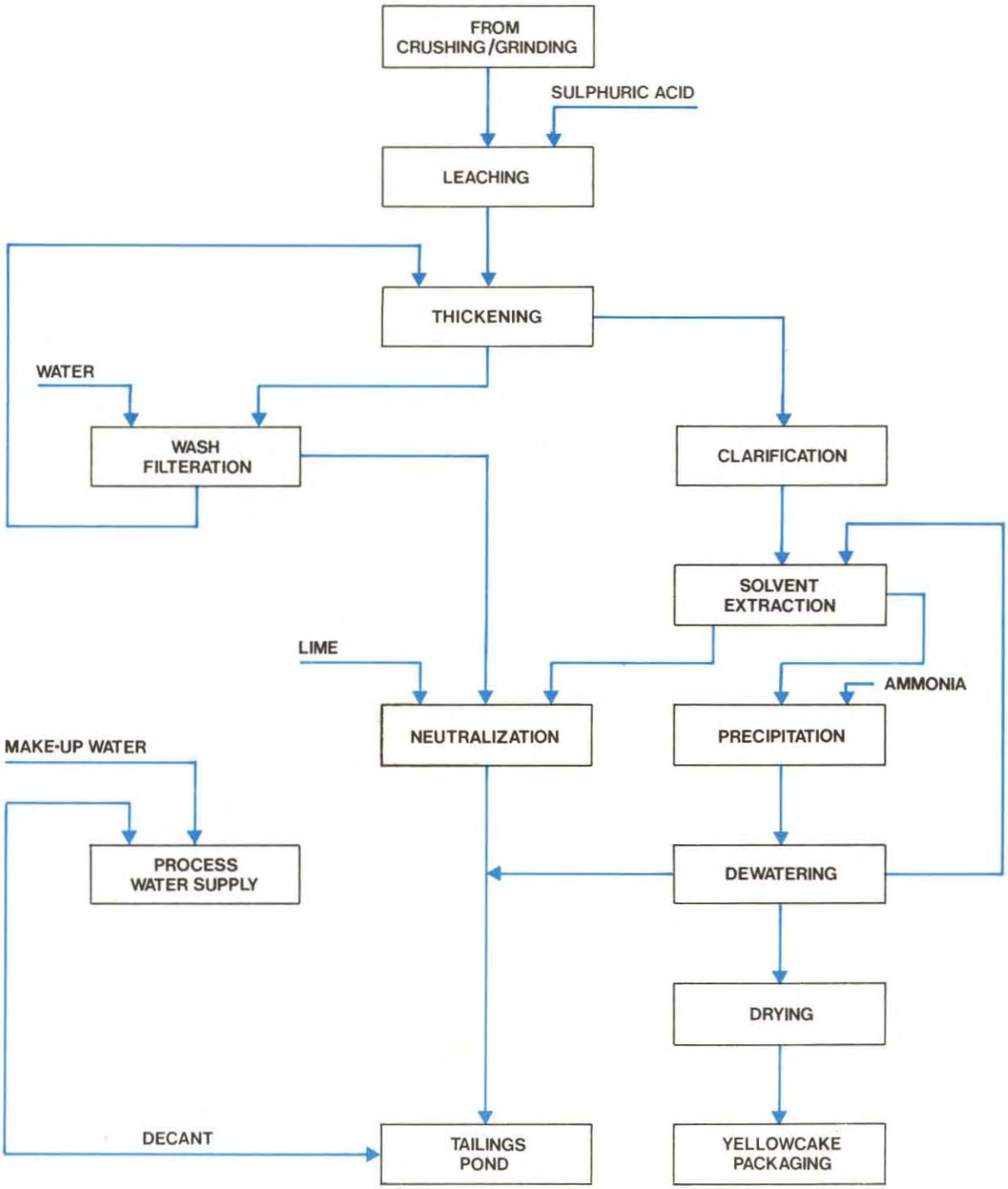
After leaching, the slurry would be partially neutralized using milk of lime.

The next step in the process involves the recovery of the uranium bearing liquid from the leached slurry. This would be accomplished in a washing thickener tank 75 feet in diameter followed by two stages of vacuum filtration.

The uranium bearing solution recovered, referred to as pregnant solution, would be clarified to a crystal clear appearance in a sand clarifier before the process of recovering the uranium from the solution takes place.

Upgrading of the uranium concentration would be carried out by a process known as solvent extraction. Solvent extraction is a two-stage process wherein the uranium in the clarified pregnant solution is contacted with and transferred to a second liquid phase during the extraction phase.

The liquid phase containing the uranium removed from the clarified pregnant solution during the extraction phase proceeds to the stripping phase. During the stripping phase, a third liquid phase is contacted with the uranium bearing solution from the extraction phase. The uranium




PROPOSED HYDROMETALLURGICAL CIRCUIT

passes into the third phase and proceeds to the precipitation circuit for recovery of the uranium as a solid.

To precipitate the uranium out of the up-graded third phase solution obtained from the solvent extraction phase, ammonia is added to decrease the acid content of the solution. This causes the uranium to precipitate out of the solution. This precipitate is known as "yellow cake".

The yellow cake is dewatered, dried and packed into steel drums for shipment to the uranium refinery located at Port Hope, Ontario.

The solids removed during the vacuum filtration stage are a waste product commonly referred to as tailings. They would be treated in neutralization tanks to destroy any free acid remaining in them prior to being discharged to the waste storage area commonly referred to as the tailings pond. Milk of lime is added to the solids to accomplish the neutralization.

## TAILINGS DISPOSAL

All waste material from the hydrometallurgical plant after neutralization with milk of lime would be pumped to the tailings pond. The tailings pond will be of sufficient size to contain all waste produced from the hydrometallurgical plant. The tailings area would be comprised of 4000 lineal feet of 19 feet high dykes containing 180,000 cubic yards of locally selected material and an impervious membrane pond liner placed over a sand cushion.

Design of the impoundment area would result in an essentially watertight storage area. Before the commencement of production, documentary evidence of an acceptable tailings disposal system would be submitted to the various provincial and federal regulating agencies.

The process would be designed to maximize the reuse of water reclaimed from the tailings pond. Reclaimed water would be pumped to a process water tank for reuse in the hydrometallurgical plant. Any excess water from the tailings pond would be treated chemically and stored in a final settling pond before being released to the natural water courses.

## FRESH WATER SUPPLY

Fresh water for both process and domestic use would be supplied by two deep wells developed near the hydrometallurgical plant. It is estimated that 200 U.S. gallons per minute of fresh water would be required. Sufficient water should be available from these wells as they are fed by the gravels forming part of the North Thompson River basin.

Well pumps would deliver fresh water to a 300,000 U.S. gallon capacity storage tank. Three services would be drawn from this tank; process make-up water, domestic water for all facilities at the hydrometallurgical plant site and fire protection.

Water supply for facilities in the crushing/grinding plant would be supplied from two sources; mine drainage and Clay Creek. Use of the mine water would eliminate the need to have a water treatment facility. A 100,000 U.S. gallon capacity process water tank would be provided which would include a reservoir for fire protection. Domestic water would be taken directly from Clay Creek.

## ENVIRONMENTAL CONSIDERATIONS

From the very first planning stages, Consolidated Rexspar established a policy of considering all environmental aspects in every planning and design decision and of using the most modern equipment, techniques and operating procedures to avoid detrimental effects on environmental conditions. These considerations have included the social, visual and atmospheric aspects of the environment, including, more specifically, attention to usage of water resources, the effect of the operation on fish and wildlife, on the surrounding air, on noise levels and on the landscape.

A report to the Deputy Minister of Mines of British Columbia titled "Preliminary Environmental Study of the Proposed Birch Island Project" was prepared for Consolidated Rexspar jointly by Kilborn Engineering (B.C) Limited and B.C. Research in March, 1977.

Detailed safety precautions are required by the Atomic Energy Control Board and the pertinent Provincial agencies. These precautions will be applied by the Company to ensure personnel safety and to minimize discharge of contaminants to the environment.

All sanitary wastes would be treated from the construction camp and from the mine/ore processing operations.

To avoid acidic runoff water directly entering natural watercourses, Consolidated Rexspar would provide drainage channels and pumping systems for the mine, crushing/grinding plant and hydrometallurgical plant sites.

Storm water from the site including runoff from ore stockpiles and waste dumps would be collected in channels and pumped to the tailings pond.

Because of sequential mining, the proposed waste dump would be comprised of material from the A and B pits only. These pits would then be used to contain material from the last pit developed in the BD zone.

Information derived from the acid producing potential of waste rock would be used to design the waste pile configuration, drainage control and reclamation objectives.

A reclamation program including research, solidification, experimental revegetation and planning for long-term reclamation would be undertaken. Research and definition of objectives (presently being investigated in similar situations in various areas in Canada and other countries) would be conducted with the assistance of consultants and with the aid and consultation of provincial and federal resource departments. Experimental revegetation would be conducted with the ultimate objective of determining optimum revegetation procedures which would return as much of the disturbed areas to an acceptable condition. Experimental work could include seeding, studies of fertilizer application and the study of plant growth under various conditions as well as other acceptable alternatives.

Because with the exception of tailing dam faces, not much can be accomplished on reclamation of tailing area surfaces during active operations, experimental revegetation would be conducted on test plots of tailings. As portions of the disturbed area become "inactive" they would be reclaimed.

The mine waste dump would be terraced and ultimately smoothed along the down dip side. Overburden and topsoil from the pits would be stockpiled for future covering of the waste dump prior to revegetation.

## SOCIO-ECONOMIC IMPACT

Capital cost for the project has been estimated at approximately $27 million in 1977 dollars. As far as possible, monies for equipment and services will be spent in British Columbia.

A significant portion of the gross payroll estimated to be in excess of $6 million over the production period would be spent locally on consumer goods and services. In addition, Consolidated Rexspar would spend additional sums for trades contractors, catering and transportation.

An average construction force of approximately 60 persons would be required over a period of approximately one year. The project would act as a stimulus to the local economy with a corresponding increase in jobs in the commercial, industrial and social sections. In total, the project would generate approximately 86 direct jobs and about 17 indirect jobs.

A construction camp to house the entire construction workforce is proposed in the immediate vicinity of Birch Island. This would later serve as single-status quarters during the operational phase.

Additional accommodation in Clearwater for approximately 10 senior staff would also be provided.

Assuming approximately 50 additional school age children, existing facilities would be adequate. School taxes on the mine property would be an important source of revenue for the local school board.

A 10 bed hospital designed to provide minor surgery, maternity, emergency, acute care and x-ray services with a staff of 16 including 4 medical doctors is available. Other medical services include:

A provincial ambulance service
A public health nurse
A visiting optometrist
A visiting social worker
A visiting human resources official
A school board psychologist.

The area now lacks a resident dentist. Recently, the Board gave its approval to study the feasibility of doubling the size of the hospital about two years hence.

The Clearwater Improvement District administers the following services: fire; street lighting; water; sewer; dyking; cemetery; parks and playgrounds.

Zoning services are provided by the Regional District. The Sportsplex (3 curling sheets and an arena) is also the responsibility of the Regional District.

The 20 man volunteer fire department operates a 500 gallon pumper, a 1000 gallon tanker, a rescue van and two ambulances.

The impact of the proposed development on these services is not likely to be significant.

The RCMP Detachment in Clearwater is responsible for law enforcement from McMurphy to Little Fort. The Detachment consists of five officers on general duty, three officers on highway patrol, two clerical staff and one part-time. The workload and staffing requirements are based on local population and only to this extent will they be affected by the

development. No special circumstances relative to traffic or crime are to be expected with this particular project.

Other services which tend to be of a regional nature (e.g. transportation, communication and the judiciary) are not likely to be affected significantly by the project. Because of the project's concentrated timing and scope, impacts would tend to be limited to the immediate area.

As indicated previously, local retail and commercial services will be affected to the extent that employment for 15-20 persons will result over the life of the project.

## INQUIRIES

Consolidated Rexspar Minerals and Chemicals Limited and their consultants, would be pleased to receive your questions, comments and suggestions concerning any aspects of a proposed mining operation on its property in the Birch Island area.

For your convenience the full name and addresses and telephone numbers of the companies are:

Consolidated Rexspar Minerals & Chemicals Limited,
P.O. Box 40,
Royal Bank Plaza,
TORONTO, Ontario
M5J 2K2 (416) 865-1991

Kilborn Engineering (B.C.) Limited,
1199 West Pender Street,
VANCOUVER, B.C.
V6E 2R1 (604) 669-8811