A Prospect That Became a Mine

R. V. KIRKHAM

Western Miner visited the Gibraltar property early in April 1966 in company with Robert Matthews, secretary of Gibraltar Mines Ltd., and George Cross, Jr., publisher of "George Cross Newsletter". The following is a reprint of page 230 in the April edition of Western Miner and gives our assessment of a "bet" that proved a winner.

93B/9

802107

GIBRALTAR SHOWS PROMISE

● **By FRED H. STEPHENS**
Associate Editor, Western Miner

Two Drills At Work

RECENT drilling results have indicated the mine-making potential of the Copper Creek property of **Gibraltar Mines Ltd.**, 12 miles east of McLeese Lake in the heart of the Cariboo District of British Columbia. The company has for some time believed that its holdings could provide a big-tonnage low-grade copper property with possible grade of 0.4% to 0.5%, and early drilling over a widespread area revealed persistent mineralization but grades slightly below the objective. The property is situated some 30 miles almost west of the Bootjack Lake copper prospect of **Cariboo-Bell Copper Mines**, now under intensive exploration by the Karl J. Springer interests.

Western Miner visited the property on the eve of a brief Easter shutdown to allow the drillers a respite after months of round-the-clock work. Hole 14 was at that time in progress and hole 13 had been collared but assays were considerably behind the accumulation of BQ cores, a situation prevalent throughout British Columbia and Yukon at this time. At the recess hole 14 was suspended at a length of 254 ft. It was drilled at minus 45 degrees to the northeast from a station 1200 ft. west of the adit driven some years ago by a former owner. Assays obtained since give strong indication of a much higher grade of copper deposition than that in the earlier drilling. After penetrating through overburden and capping the first significant copper mineralization was encountered at 50 ft. From that point, each 10-ft. section assayed as follows: 0.15% Cu.; 0.22%; 0.33%; 0.45%; 1.29%; 0.63%; 0.68%; 1.03%; 1.68%; 1.31%; 1.16%; 0.88%; 0.97%; 0.67%; 0.52%; 0.58%; 1.18%; 0.52%; 0.90%; and 1.33%. Drilling has been resumed and the hole will be extended as long as the mineralization of potential ore grade persists. Drilling of hole No. 13 is also in progress.

The adit driven by former operators extends for 110 ft. in a southeasterly direction from Copper Creek. Fifteen chip samples taken from both walls and the face by Alfred R. Allen, consulting geological engineer, averaged 1.28% copper. Several of the early holes yielded average assays of approximately 0.25% Cu. William Meyer, B.Sc., project geologist, states that no hole has failed to find copper mineralization. There is evidence of molybdenum content and it is notable that hole 14 has averaged 0.11 oz. silver per ton to date. Hole B2 from a station 2500 ft. east of the adit and driven at minus 45 degrees to the northeast cut 920 ft. assaying 0.26% Cu. followed by 200 ft. of 0.44% grade; and terminated in mineralization. Hole No. 5 also at minus 45 degrees to the northeast cut 200 ft. from 80 to 280 ft. grading 0.42% Cu. Mr. Meyer says the balance of the 529-ft. length in solid rock carried from 0.1% to 0.4% Cu.

In his report of March 31, 1966, Mr. Allen described the geology as follows:

"The property is located on the central west side of a body of Jurassic granite and granodiorite which outcrops for a distance of approximately 16 miles north-south and two to six miles east-west. Although mapping is incomplete, partly because of heavy drift-covered areas, the east and south sides of the batholithic body are flanked by older Permian Cache Creek rocks, and one roof pendant is located on the property. The west side is overlain by younger Tertiary sediments and volcanics.

"Within sheared and foliated zones in the granite, pyrite and chalcopyrite occur widely disseminated. A quartz fissure vein along which an adit has been driven contains lenses and stringers of pyrite and chalcopyrite and molybdenite, with which there is associated considerable secondary chalcocite. Elsewhere, particularly on the eastern part of the property, there are quartz veins, some of which carry chalcopyrite, pyrite, and minor sphalerite and galena. Within a roof pendant on the southern part of the property there is bornite, chalcopyrite, pyrite, galena, and sphalerite in altered limestone, and sphalerite with minor pyrite, chalcopyrite, and galena in metamorphosed rocks. To date exploratory investigations have been concentrated on the areas of disseminated pyrite and chalcopyrite in the vicinity of the adit workings on Copper Creek."

Mr. Allen concludes that the magnitude of the deposits are now being outlined and the extent of additional virtually-untested favourable zones necessitates proceeding with major works programmes. "The plans will of necessity be sufficiently fluid to allow much of the work to be contingent upon and tailored to results as it progresses."

The consulting engineer has asked for a monthly budget of $60,000 to perform two schedules, the first estimated to cost $150,000 covering prospecting, soil sampling, photogeologic studies, stripping, percussion drilling ($8,000), and diamond drilling ($100,000 for 10,000 ft.); to be followed by a $350,000 programme consisting of geophysical surveys over selected areas, percussion drilling on selected areas ($15,000), rock trenching and bulk sampling, underground mining and bulk sampling ($50,000), diamond drilling ($200,000 for 20,000 ft.), metallurgical research, overhead, and contingencies. Much of the work can be carried on concurrently, he states, and the full recommended programme should be performed within eight months.

Mr. Meyer advises that the present tent camp houses 14 employees of **Canadian Longyear Ltd.** who are operating two drills and pulling wireline BQ core with remarkably good recovery. Besides the project geologist, Gibraltar Mines has two other employees on the ground.

The company, in preparation for an underwriting, had an audited balance sheet drawn as of March 11, 1966. Current assets included $201,748.92 in cash and $885.60 in prepaid expenses. Current liabilities aggregated $2,827.54. Of the authorized capital of 3,000,000 shares with a par value of 50c each, 2,296,042 shares had been issued.

T. P. Bowes, president, advises that the underwriting will be announced in the next few days. The company will apply for listing of its shares for trading on the Vancouver Stock Exchange.

Western Miner vol 45, no 6. June, 72 p 23-34

Duncan J. Pennington, B.Sc., P.Eng., M.I.C.E., A.M.I., Struct.E., is a principal and chief civil engineer of Ker, Priestman, Keenan & Associates Ltd., Victoria, B. C. He graduated from London (England) University in 1948, and subsequently gained experience as a structural designer before joining the staff of C. S. Allott & Son, consulting engineers, in Manchester. In 1951, he entered the municipal-engineering field and served in a senior capacity with the County Boroughs of Wigan and Bolton where he was for three years a senior lecturer at Bolton Technical College, in heavy civil-engineering design and mathematics.

Mr. Pennington emigrated to Canada in 1957, and for two years worked as design and structural engineer in the B. C. Department of Highways Bridge Office. He joined the B. C. Water Rights Branch in 1959 as a hydraulic engineer and subsequently rose to be chief of the ARDA Division of the B. C. Water Resources Service, Water Investigation Branch. In this post he was responsible for major water use and diversion studies in the Okanagan and Thompson River Basins, and for flood-control plans for the Cowichan and other rivers. He directed the work of a large design and construction group working on irrigation projects throughout the Province and having an aggregate value of some $15 million. He specializes in investigational work and design for water-use projects, including hydroelectric-power plants, irrigation, flood control, main drainage and water supply, and distribution.

Mr. Pennington is a member of the Association of Professional Engineers of British Columbia, the Institution of Municipal Engineers, and the Institution of Civil Engineers; and an associate member of the Institution of Structural Engineers.

Duncan J. Pennington

Gibraltar Mines Ltd.

WATER SUPPLY AND TAILINGS DISPOSAL

By D. J. PENNINGTON, P.Eng.

Ker, Priestman, Keenan & Associates Ltd., Victoria, B.C.

Water supply and tailings disposal for large open pit mines in British Columbia have in recent years become the subject of major engineering and environmental concern. This paper deals with the civil engineering aspects of one such project recently completed.

INTRODUCTION

The Gibraltar project is a low grade copper development located on the northwest slope of Granite Mountain near Marguerite and 27 miles north of the town of Williams Lake in the British Columbia interior. Mill elevation is 2300 feet above the Fraser River at elevation 3700 feet.

Minimum plant design capacity is 30,000 TPD with the expectation that significantly greater throughputs can be realistically achieved.

This paper outlines feasibility studies for fresh water supply; final design of fresh water system; reclaim water system, and tailings disposal, and the procurement of required permits from the Governmental agencies concerned.

FRESH WATER SUPPLY

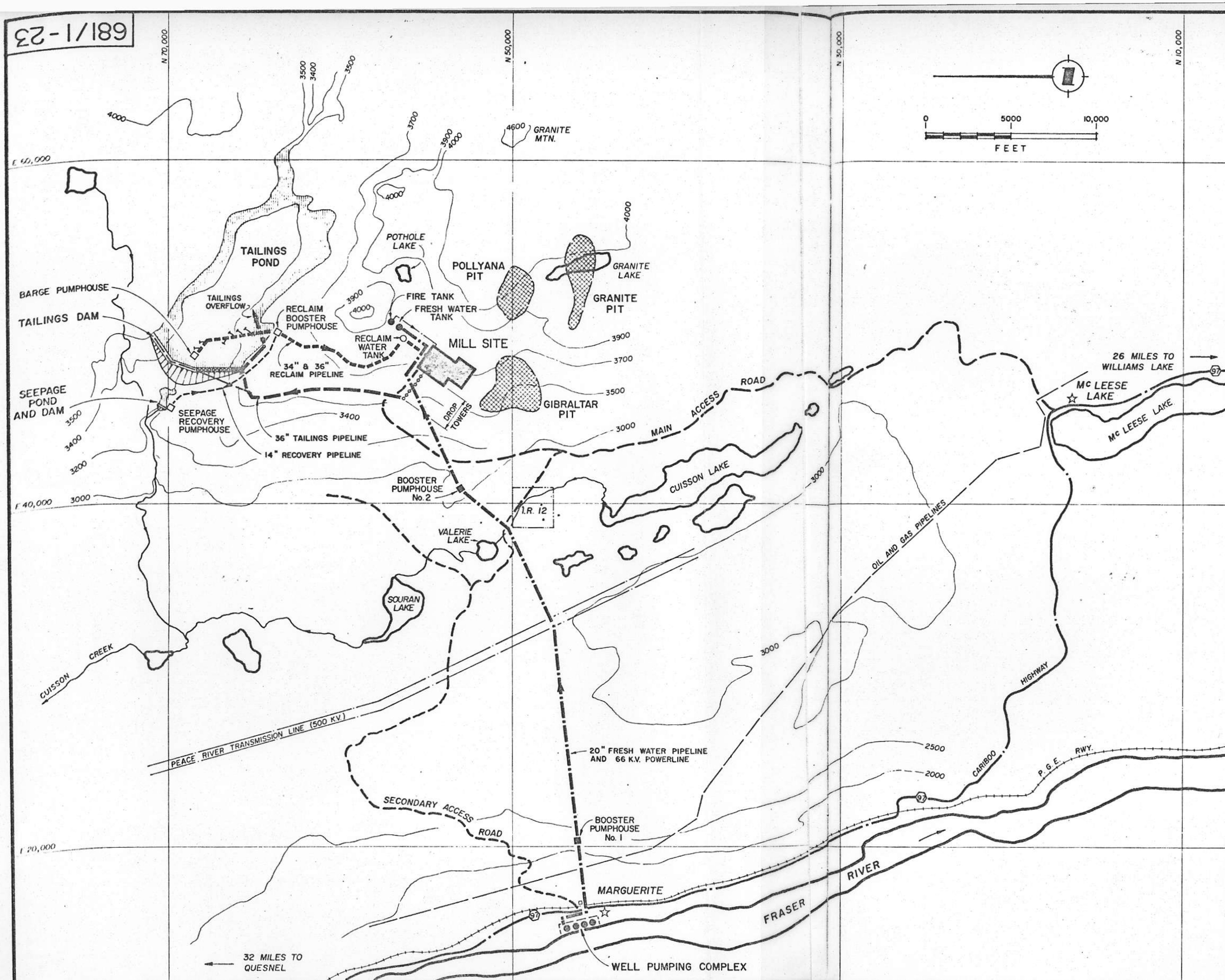
The fresh water demand was conservatively established for design purposes at 5,000 USgpm, which is equivalent to 1 ton of water per ton of ore and represents a total annual requirement of 8,000 acre feet. Actual consumption during normal operation may be less than is provided for in the design.

At the feasibility stage, all available sources were investigated, as follows:

1. Fraser River (high lift pumping)

ize the Fraser River as the source. A predesign appraisal established the advantages of a well grouping alongside the river compared to a conventional intake facility and pumping plant in view of the severe winter ice conditions, and exploration drilling on the selected site was soon underway.

The final plan adopted for the fresh water system consists of a 7½-mile long pressure pipeline delivering 5,000 USgpm from a complex of four wells



PROJECT DESIGN DATA

- **CAPACITIES OF FRESH WATER SUPPLY SYSTEM**

WELL PUMPING COMPLEX
4/VTP, 9 STAGE, 400 HP UNITS, 1250 USGPM AT 873 FT. TDH.

FRESH WATER BOOSTER PUMPHOUSE No. 1
4/VTP, 10 STAGE, 400 HP UNITS, 1250 USGPM AT 1014 FT. TDH.

FRESH WATER BOOSTER PUMPHOUSE No. 2
4/VTP, 9 STAGE, 400 HP UNITS, 1250 USGPM AT 873 FT. TDH.

20" DIA. FRESH WATER PIPELINE
CAPACITY - 5000 USGPM.

FRESH WATER STORAGE
FRESH WATER TANK - 200,000 IMP. GALLONS. TWL ELEV. 3872 FT.
FIRE TANK - 200,000 IMP. GALLONS. TWL ELEV. 3937 FT.

- **CAPACITIES OF RECLAIM WATER SUPPLY SYSTEM**

FLOATING BARGE PUMPHOUSE
6/VTP, 3 STAGE, 400 HP UNITS, 3000 USGPM AT 315 FT. TDH.

RECLAIM BOOSTER PUMPHOUSE
6/VTP, 4 STAGE, 400 HP UNITS, 3000 USGPM AT 400 FT. TDH.

RECLAIM WATER STORAGE
RECLAIM WATER TANK - 200,000 IMP. GALLONS. TWL ELEV. 3837 FT.

SEEPAGE RECOVERY PUMPHOUSE
3/VTP, 5 STAGE, 200 HP UNITS, 1100 USGPM AT 510 FT. TDH.

14" DIA. RECOVERY WATER PIPELINE
CAPACITY - 3300 USGPM.

- **CAPACITIES OF TAILINGS SYSTEM**

36" DIA. TAILINGS PIPELINE
CAPACITY - 18,000 USGPM.

CYCLONES
MOUNTED ON CREST OF TAILINGS DAM.

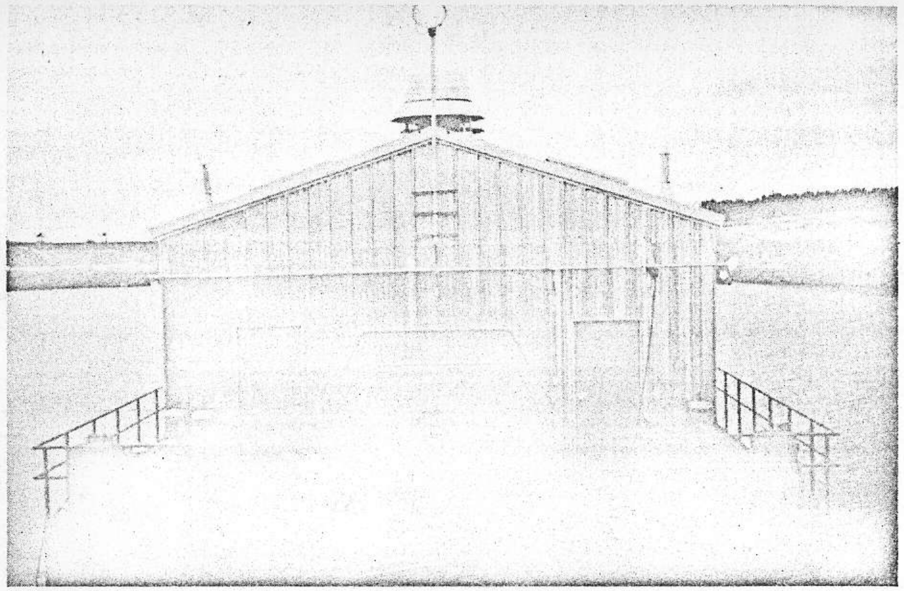
DWG No | REFERENCE DRAWINGS | DATE | No | DATE | REVISIONS | BY | APPROVED

PLACER DEVELOPMENT LIMITED
GIBRALTAR MINES PROJECT

KPK KER, PRIESTMAN, KEENAN & ASSOCIATES LTD.
consulting civil engineers
400-880 DOUGLAS STREET VICTORIA BRITISH COLUMBIA

GENERAL PLAN

DESIGNED D.E.B. | DRAWN L.S.
CHECKED | APPROVED
DATE DEC. 1970 | SCALE 1" = 3000'
DWG No 681/1-23
FILE 681/1 C



Reclaim-water pumping barge (18,000 gpm)

by the Fraser River to the mill site water storage tanks, some 2,450 feet higher in elevation. The following main components are described.

Fraser River Wells

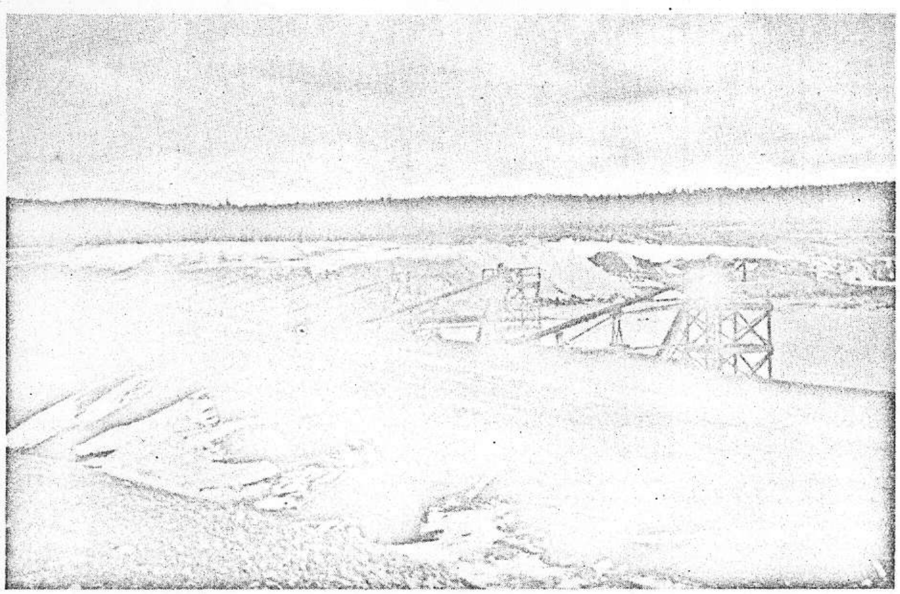
After satisfactorily completing a 250-feet deep test well, four 16-inch production wells were drilled to a depth of about 135 feet, each being fitted with 15 feet of 12-inch 200 slot screen set at about 120 feet in water bearing sands and gravel. These wells were spaced 50 feet apart in a line parallel to, and 80 feet away from, the river bank.

The 400 horsepower vertical turbine pumps installed in the wells each deliver 1,250 USgpm in parallel, against a total head of 870 feet to the sump of the first booster station 7,000 feet along the pipeline. Motors are 1760 r.p.m., 4160 volts, with power supplied by underground cable from a remote substation, and operation is fully automatic with telemetry and telephone connections to the mill control centre. Start-stop surges are relieved by automatic valving manifolded to waste, and pipeline surge relief is provided for by an electrically controlled double acting relief valve, which also serves as a blow-off.

Well-head equipment is protected within prefabricated metal buildings and electrical controls are separately housed in a masonry block structure. All of the structures at the well site are enclosed within a fenced compound and a convenient access road was constructed from Highway 97 near Marguerite.

Booster Stations and Pipeline

Water is pumped a vertical distance of 2,500 feet to the mill site in three approximately equal pumping lifts, using two booster stations on the pipeline at locations selected to equalize as much as possible the pumping head at each station.



Cyclones on tailings-starter dam

reinforced-concrete sump to receive the incoming flow and provide some storage for pump control purposes, and a prefabricated metal superstructure housing the mechanical and electrical equipment. Each sump has a capacity of 40,000 gallons between normal high and low water levels. The four vertical turbine pumps in each station are similar to those at the well site, so that in all, a total of 12 - 400 horsepower pumping units with either 9 or 10 stages each are installed on the fresh water delivery pipeline. Automatic control employing float switches for start-stop sequencing, and conventional alarm and protective de- ... between all stations and the mill, so that the system is fully automated under normal operating conditions.

Electrical supply to the booster stations is by overhead 4.16 KV line located within the water line right-of-way, and telephone and telemetry cables are buried underground throughout.

The water pipeline is 20-inch O.D. steel pipe to A.P.I.-5L Grade B specification, coal tar enamel coated externally and butt welded throughout. Overall length is 40,322 feet, of which the majority is 0.250 inch wall. Where working pressures exceed about 325 psi (about 9% of the total distance), wall thickness is increased to 0.281 inches. Design capacity of the line is 5,000 USgpm. Protection against freezing was provided for by burying the line full length with a minimum of 3 feet of cover, housing air valves in insulated pits and taking special precautions at the pumping plants. Completed sections of the installation were air tested at 50 psi, followed by a leakage test at 500 psi maximum.

Where underground power, telephone and telemetry cables were installed, they were laid in the pipeline trench alongside the pipe, and special provisions were made for highway, railway, gas line and oil line crossings. Test beds were provided for cathodic testing of the water pipe under gas and oil lines, and aircraft warning marker poles were required for the project power line crossing of these facilities.

Three 230,000 US gallon wood stave storage tanks for freshwater, process water, and fire protection were installed on high ground adjacent to the mill site, and are connected by a system of pipes and valving for operation by remote control. The fresh water tank at elevation 3850 feet is the terminal point on the fresh water pipeline, and the process tank at elevation 3815 is located on the delivery end of the reclaim water pipeline. The fire tank serves also for domestic water storage and is located at the highest elevation of 3915 feet. Water level in this tank is maintained by a small pump located in the plant area and the temperature is maintained at 38 degrees by electric heaters. Each tank is provided with an overflow to adjacent natural drainage and inlet/outlet piping arrangements vary according to the type of control installed. All tanks are 48 feet in diameter and 25 feet high, set on reinforced concrete bases through which pass the various inlet and outlet pipes sized between 12-inch and 36-inch diameter.

RECLAIM WATER SYSTEM

This system consists of the main pond return water installation and the seepage water recovery works. Both systems are fed into a booster pumping station where the combined flow of up to 18,000 US gallons per minute is returned to the mill process water tank against a total pumping head of 400 feet through 12,000 feet of 34-inch and 36-inch diameter steel pipeline.

Tailings Pond Barge

A floating barge in the pond behind the tailings dam is a key feature of the main return water system. This barge carries six 400 horsepower vertical turbine pumping units each capable of delivering 3,000 USgpm when operating in parallel against a total head of 315 feet, when the barge is in its initial position. This head will decrease rapidly to less than 200 feet over the first few years of operation and one of the three impeller stages on each pump will be removed to suit the new operating conditions. As in the case of the fresh water system fully automatic control is provided, and this equipment, together with the main switchgear, is housed on the barge in an enclosure separated from the pump roon. A water bubbler system around the perimeter of the barge is designed to alleviate ice conditions.

Connection between the floating barge and the 36-inch diameter reclaim water line on shore is achieved with three 12-inch rubber hoses supported at their sag points on a pontoon, which also serves as a landing float for maintenance traffic. A fabricated pipe stirrup arrangement on the end of the reclaim pipeline is fitted with a rotatable barrel section to assist in hose alignment adjustment as the barge rises with the pond surface. Docks are constructed using log crib methods, and provide for a 25-foot rise in water surface at each location. Four docks were constructed on the moderately sloping valley side in anticipation of a pond rise of about 100 feet during the first two years. Each dock site is located alongside the reclaim pipeline and short lateral spurs provide for a future barge connection at each point.

Seepage Recovery Installation

Water escaping from the tailings dam area results from drainage out of the coarse fraction use for dam construction, seepage under the embankment, and local valley wall run-off. All of these flows are impounded behind a 30-feet high earth dam across a narrow valley site 2,800 feet downstream of the tailings dam on the east fork of Cuisson Creek. A pumping plant built against the valley wall behind this dam takes water from the pond for delivery to the sump of the reclaim booster station.

The dam embankment is constructed of locally borrowed glacial till and has a downstream drainage blanket three feet thick, and a centre cut-off trench into firm material below the creek bed. A 14-inch ductile iron pipe outlet culvert is provided for discharge of controlled releases and flood flows, and an 18-inch Dall tube measures and records all such releases from the impoundment in accordance with the terms of a Pollution Control Permit.

The pumping plant behind the dam has a reinforced concrete substructure which serves as an intake and pumping sump for three 14-inch 5 stage vertical turbine pumps. Each pump has a 200 horsepower vertical hollow shaft driver and the combined pumping capacity is 3,300 gallons per minute against a pumping head of 510 feet. An insulated prefabricated metal building houses the machinery and electrical equipment. Pump start/stop control is achieved by a float operated switching control mounted on the motor floor as in the case of all other plants on the water systems.

Provision for contingency spillage, should the seepage recovery pond level rise above the level established by freeboard requirements, takes the form of a fabricated steel pipe bellmouth located behind the intake screens. This spillway connects with the upstream end of the outlet conduit through the dam which is capable of discharging flows up to 18 c.f.s. A specially formed concrete outlet structure on the end of the through conduit permits free discharge whilst maintaining full pipe flow through the metering tube.

Reclaim Water Lines

The reclaim pipelines between the barge and the booster pumping plant is 36-inch O.D. welded steel pipe, 4,000 feet long. From the booster to the mill process water tank, 34-inch O.D. pipe is installed for the first 4,000 feet and this increases to 36-inch O.D. for the remaining 8,000 feet. Between the seepage recovery pumphouse and the booster station 8,500 feet of 14-inch O.D. welded steel pipe is installed to carry either 3,300 gpm when pumping from the recovery pond, or 4,000 gpm when dumping in the opposite direction to the pond from the booster station wet well.

TAILINGS DISPOSAL

Tailings are transported some 15,000 feet by gravity from the concentrator to an impoundment area located in a valley near the headwaters of the east fork of Cuisson Creek north east of the mill. This valley was selected as the best location in the vicinity and offers a satisfactory site from both topographical and hydrological standpoints. The impoundment created is sufficient to support storage of tailings for 20 years of operation at 30,000 T.P.D. mill production using a minimum of freshwater input.

The 36-inch O.D. welded steel tailings pipeline originates at the concentrator at elevation 3680 feet and after clearing the mill area falls through a series of drop structures to establish a contour route at 0.5% grade to the end of the ultimate tailings dam axis. From this point a second set of drop structures is used to lower the tailings line to the level of construction on the dam, where cyclones are used to process the transported material. A total of 17 fabricated steel drop structures, each 6 feet in diameter and 16 feet high, with rubber lined inlet and outlet nozzles is installed. A manifold pipe system terminating in a standpipe relieves air which might otherwise accumulate in the uppermost set of towers.

Tailings Dam

The downstream-type tailings dam is founded on dense glacial tills and has an ultimate height of about 300 feet to impound 78 million cubic yards of tailings production. Ultimate crest of the dam is at approximate elevation 3480 feet and at this height the dam will contain over 15 million cubic yards of fill. A starter dam 100 feet high constructed of glacial till borrow material is incorporated with the design together with a system of rock and gravel underdrains. The main body of the ultimate dam is constructed of free draining sand coarser than 50 microns separated by means of wet cyclones, and it is anticipated that 40% of the tailings will be coarser than this size. The downstream slope of 5 to 1 provides security against failure by liquification under adverse embankment conditions when subjected to earthquake loadings appropriate for zone 1 conditions.

The starter dam is of compacted homogeneous fill design, with a drainage blanket 5 feet thick covering the downstream third of the base area. Embankment slopes are 2 to 1 and the fill is compacted by sheeps' foot roller in thin lifts. Drainage facilities for the ultimate dam consist of selected rock fill finger drains 8 feet thick enclosed by sand and gravel filters and terminating against rock toes, together with the internal blanket within the starter dam.

Permits

Approvals required for the implementation of this project included a number of water licences, Pollution Control Branch Permits (both for liquid effluent and air emissions), and Mines Department approvals, together with Crown Land rights-of way and reserves; oil, gas, telephone, power, railway and highways crossings; and hydro easements.

All of these applications involved negotiation and discussion, and in many cases there was continuing need to provide additional data. Pollution Control Branch requirements were particularly demanding and in this respect considerable attention was given to ensure full conformity with the regulations.

Construction and Design

Commonwealth Construction was responsible as main contractor for all of the project items described, as well as the mill installation. Other contractors involved were: Pooley Construction, of Merritt, for preliminary site and access works; Dawson Construction, for work at the tailings dam; Pacific Water Wells, of Vancouver, for well drilling work on the Fraser River.

Placer Development Limited headed the design group for the entire project, and Ker, Priestman, Keenan & Associates Ltd. were prime consultants for the water supply, reclaim, and tailings disposal systems. Geotechnical services were supplied by Ripley, Klohn & Leonoff Ltd., and M.A. Thomas & Associates Ltd., were responsible for electrical design work.

HISTORY, GEOLOGY, EXPLORATION

The dedication ceremony on June 13, 1972, of Gibraltar Mines Ltd. marks the official commencement of production by another of British Columbia's big porphyry-copper mines. Tune-up operation during recent weeks has demonstrated that the concentrator is equipped to treat ore well above the design capacity of 30,000 tons daily. In mid-May throughput ranged from 34,000 to 36,000 tons.

The excess performance follows a pattern well established by other subsidiaries of Placer Development Limited in the highly-successful operations of Craigmont and Endako.

The Gibraltar mine is situated in the Cariboo Mining Division of central British Columbia, 38 miles north of the town of Williams Lake and 346 miles by road from Vancouver. It is in an area of good access with the British Columbia Railway (formerly P.G.E.) siding at Marguerite, Provincial Highway No. 97, and the Fraser River, all within eight miles of the property.

In an admirable paper presented at the 77th Annual Convention of the Northwest Mining Association in Spokane, Washington, last December and published in the February 1972 issue of Western Miner, the history, geology, exploration, and early development of Gibraltar have been recorded by three senior staff members of Canadian Aerial Exploration Ltd.: D. C. Rotherham, manager of exploration, Western Division; A. D. Drummond, research geologist; and S. J. Tennant, field supervisor. The following is reprinted from this work.

HISTORY

The first record of claims staked in the area goes back to 1917 when open cuts were made on quartz veins in what is known as the Pollyanna group. Little work was carried out in the area until an adit was driven in 1957 on what is now considered as an extension of the Gibraltar West zone. It should be pointed out that very little natural exposure of rock occurs in the areas of the Gibraltar ore zones. Of the four orebodies, one is completely covered; the smallest one, the Gibraltar West, has minor exposure; and the other two have minor exposures of leached capping. Rock exposure is confined to less than 5% in the area of mineralization.

The claims covering the adit zone were allowed to lapse and were restaked by Mr. J. Hilton in January 1962. He in turn optioned them to Gibraltar Mines in 1964. The claims covering the Pollyanna zone were staked by Mr. R. Glen in 1963. They were examined by Mr. Bill Kerns for Duval who recognized limonite that indicated a chalcocite zone at depth. On his recommendation, Duval optioned the Pollyanna property and did an I.P. survey which was followed by diamond drilling. This program indicated a sizeable body of low-grade mineralization. Canex was later invited by Duval to joint-venture the property with them. At this time, we would like to acknowledge the many contributions to the knowledge of the area made by Duval geologists, especially Dr. Bob Gale. Special credit should also be given to Mr. Pat Bowes, past-president of Gibraltar. Other early ground holders in the area were Keevil Mines, Gunn Mines and Coast Silver.

I.P. surveys and diamond drilling were carried out on the Gibraltar property from 1965 to 1968. This drilling was largely on the Gibraltar West zone which by itself is uneconomic. In early 1969, Gibraltar Mines drilled the discovery hole on the Gibraltar East zone. It differed from the previous Gibraltar holes in that it showed a leached capping to be followed by a chalcocite-enriched zone. The discovery hole was 500 feet from the Pollyanna border and suggested that the mineralization would extend into Pollyanna. The Gibraltar property was optioned by Canex-Duval with the provision that the Gibraltar and Pollyanna properties be commingled on the basis of ore reserves. The complex boundary picture with the orebodies occurring across property lines necessitated a legal survey which was carried out by McElhanney Surveying and Engineering Ltd.

INDUCED POLARIZATION

The lack of outcrop caused geological frustrations in that it seemed impossible to come up with a geological model that would explain mineralization and the relationships between areas of mineralization. Geophysical I.P. surveys were carried out with varying success on the Gibraltar, Pollyanna, Keevil, and Gunn properties. The Pollyanna ore zone was completely covered and should be considered an I.P. discovery. I.P. had been done on Gibraltar, Keevil, and Gunn properties but follow-up drilling had produced little more than pyrite in abundance. In early 1969, Canex geophysical personnel combined all the known I.P. in the area into a one large-scale map (see Figure 1). It became apparent that if one took the regional foliation of the intrusive into account, one could come up with a pattern that resembled a distorted pyrite halo. The Gibraltar East zone fitted into the inner side of the halo and suggested that low to moderate I.P. response coincided with copper mineralization. A geological model was suggested which indicated that a drift-covered "core" existed in the center of the distorted halo. Further drilling on the Pollyanna zone strengthened the model picture in that it showed the Pollyanna zone to exist on the inner side of the halo. A decision was made to do step-out drilling on 800 ft. centers to the south of the Pollyanna. This resulted in the finding of a barren quartz porphyry "core" and on its south side, the Granite Lake zone of mineralization which became the second largest orebody in the area.


D. C. Rotherham


S. J. Tennant


Dr. A. D. Drummond

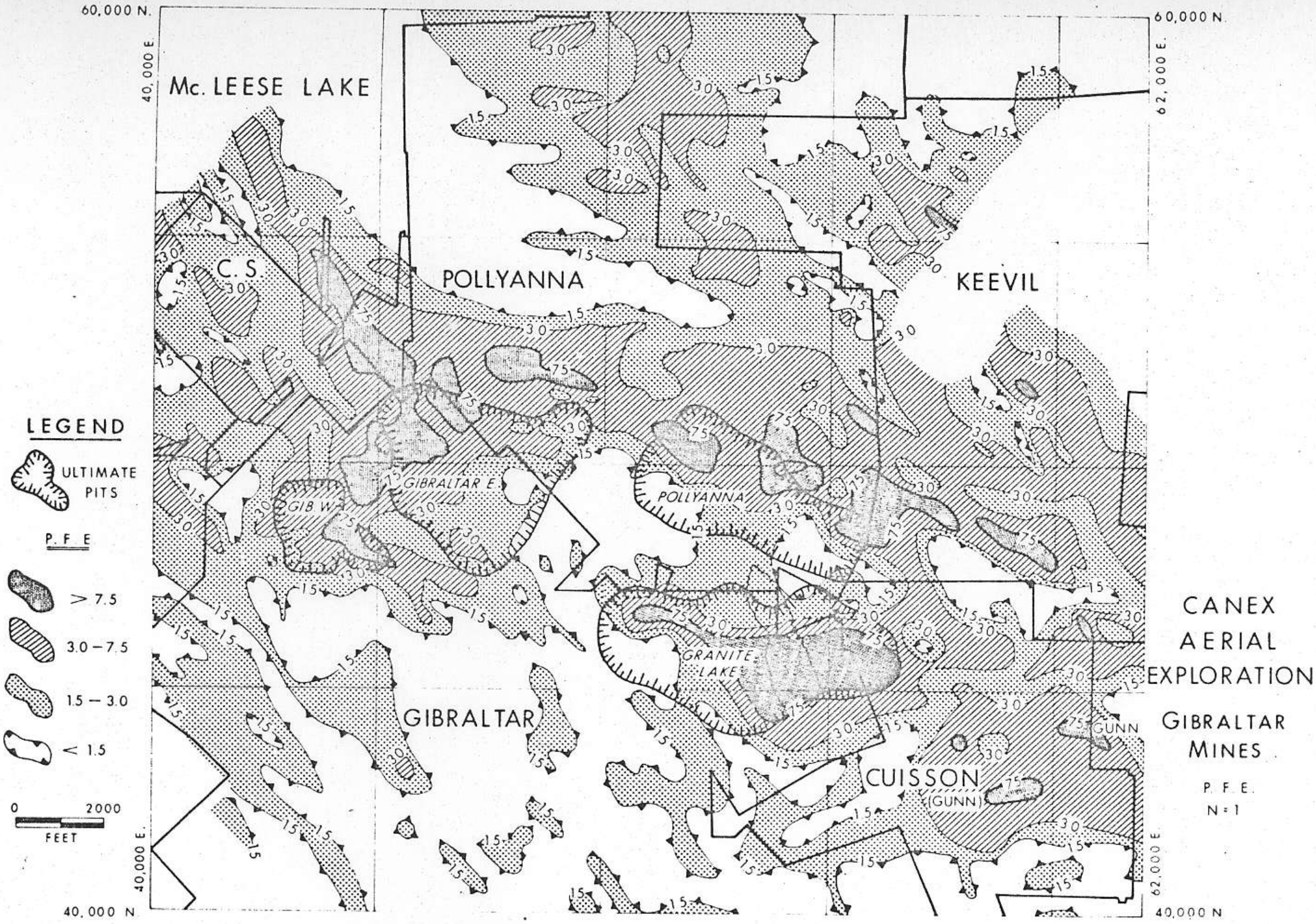


Figure 1 I.P. Compilation

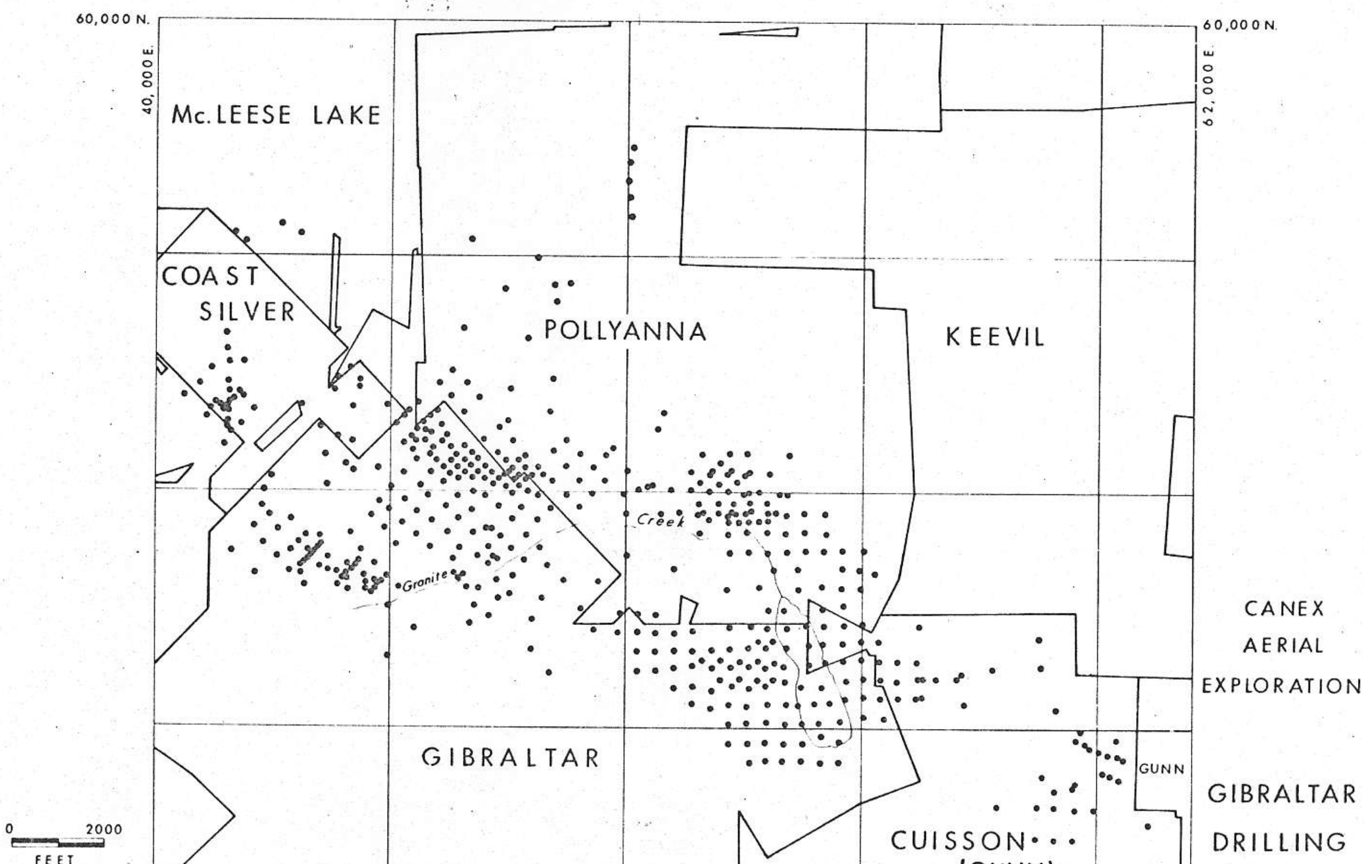
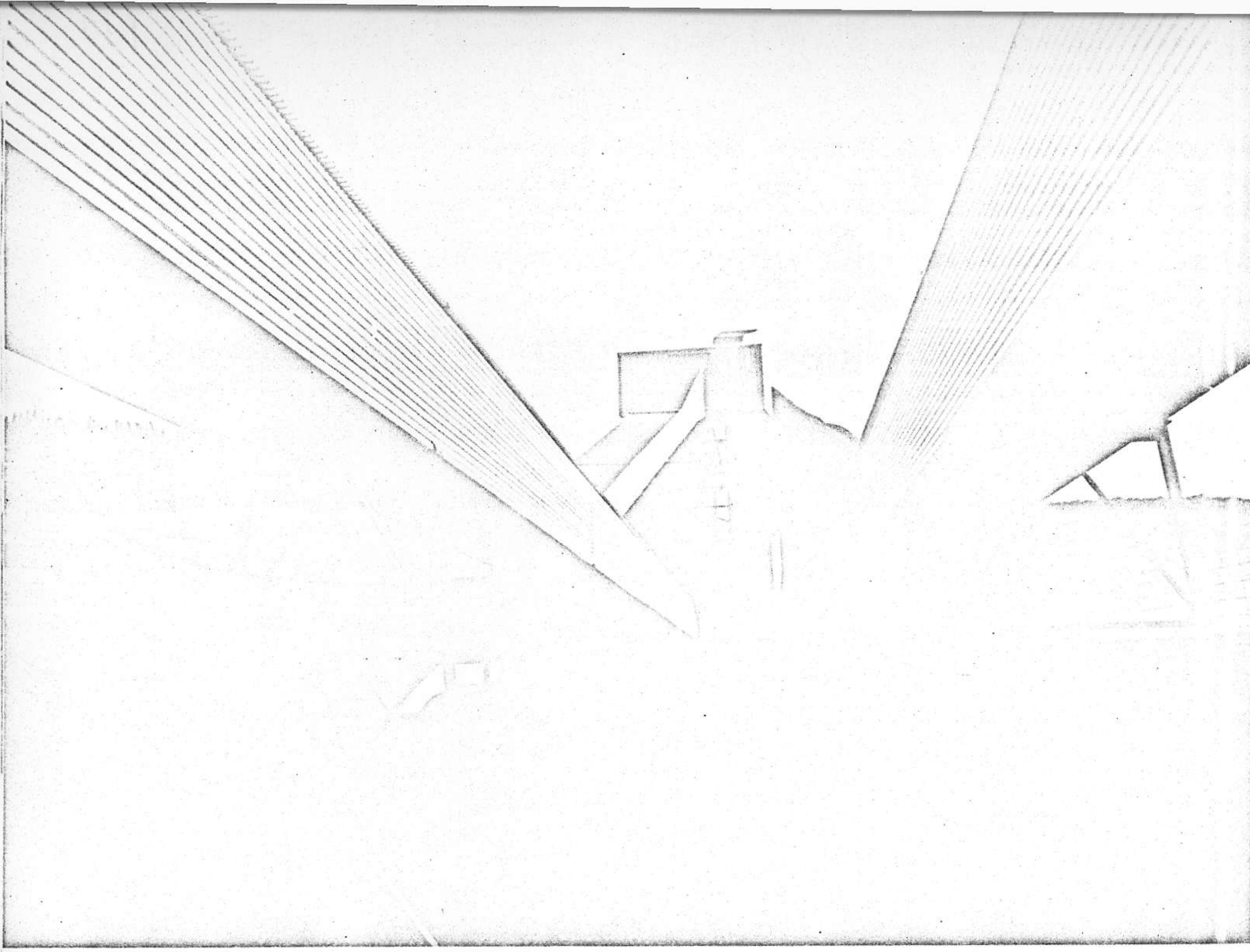


Figure 2



An unusual view of conveyor housings at the Gibraltar mill complex. *All photos by Croton Studios Ltd., courtesy, Gibraltar Mines Ltd.*

It is apparent that a problem was present in the I.P. interpretation in that any single property only gave you part of the picture and was in many ways analogous to the old fable of the blind men describing the elephant.

GEOLOGY

The main feature of the regional geology is a north-south trending line of batholiths which occur along the eastern side of the Fraser River fault system. The Gibraltar deposits occur in one of these, the Granite Mountain pluton. This pluton intrudes volcanics and metasediments of the Cache Creek group. It has been regionally metamorphised and contains a uniform foliation at 110 degrees dipping 20-30 degrees south. It is predominantly a quartz-diorite which is extremely uniform in its mineral assemblage, quartz 25-30%, "plagioclase" now a mixture of albite-epidote-zoisite-muscovite, 50-55%, chlorite 20%. Grain size is generally 1-2 mm. The rock may best be described as a saussuritized quartz diorite with its present silicate assemblage comparable to the green schist facies of regional metamorphism. The area surrounding the pluton is in part underlain by late Tertiary basalts which allow limited knowledge of the earlier geology.

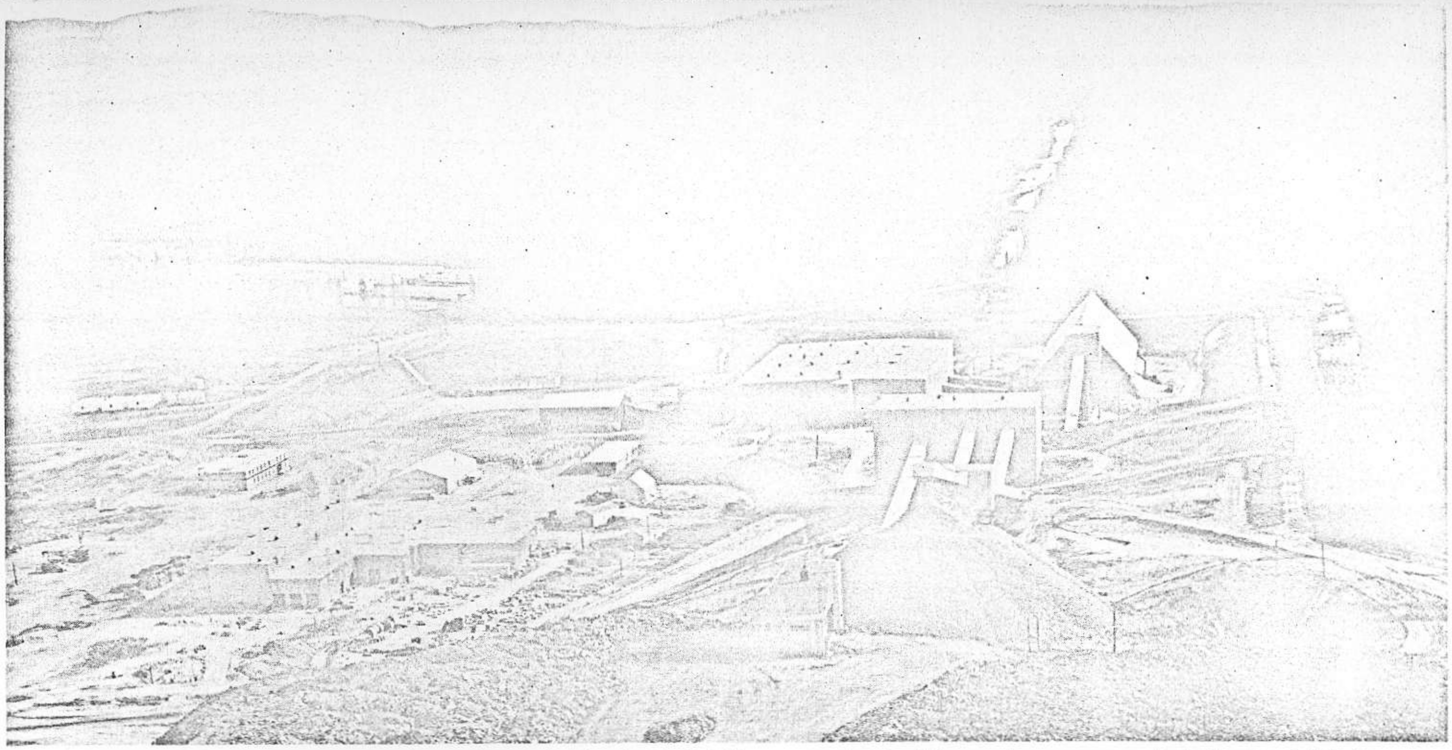
The main structural feature is the regional foliation. In the large picture, this foliation is uniform and through-going but locally is deformed and at times is extremely contorted. Often adjacent to shear zones it is completely obliterated. Observations suggest that the contorted areas are the most favourable for mineralization. Dikes of aplite and quartz feldspar porphyry cut the saussuritized quartz-diorite. The quartz feldspar porphyry is most common in the central core area.

The area of mineralization appears relatively undisturbed by faulting. However, strong zones of faulting occur to the East of Granite Lake.

MINERALIZATION

The Gibraltar East and the Pollyanna orebodies both have well-developed leached zones above a supergene zone. This supergene zone is irregular in development and thickness. The main supergene mineral is chalcocite with minor amounts of covellite. Chalcopyrite is the main primary-copper mineral with primary bornite being restricted to areas near the core porphyry. Present in minor amounts are cuprite, native copper, malachite, and zurite. The oxide mineralization is most prevalent near the interface of the leached and the supergene zones. Gibraltar will be the first of the British Columbia porphyries to have the majority of its initial production from a supergene zone. Other porphyries in British Columbia are known that have supergene zones. However, none are in production to date.

In the Pollyanna, Granite Lake, and to a lesser extent, the Gibraltar East zones, a definite relationship exists between structure, mineral zoning, and the I.P. response. The three main orebodies are situated along the inner side of an induced-polarization high. The mineral sequence outward from the



The Gibraltar concentrator complex as it appeared in March 1972. Primary crusher building and coarse-ore stockpile are visible in centre foreground. Secondary-crusher building is directly behind the coarse-ore stockpile. Fine-ore storage is covered by A-frame structure at right with main concentrator building to its left. Shop warehouse and garage are housed in the big building in left foreground.

quartz feldspar porphyry core is as follows:—

1. **minor bornite, minor chalcopyrite, pyrite often absent.**
2. **chalcopyrite-pyrite.**
3. **pyrite with minor chalcopyrite.**

Zone 3 is much thicker than zones 1 and 2. The pyrite zone is generally associated with numerous sericite envelopes so that at times in some areas, it may be equally well termed a pyrite-sericite zone. Molybdenite-bearing veins occur throughout but seem commonest with the better copper grades.

ORE RESERVES

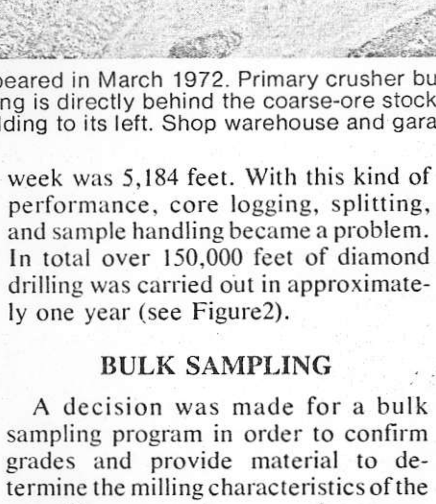
The total ore reserves using a 0.25% Cu cut-off are 358 million tons at 0.37% Cu and 0.016% MoS^2. This tonnage includes four separate pits. Profit optimization in pit planning is such that the first 55 million tons will grade 0.44% Cu and will be available for mining in the early years.

DRILLING

At that time of signing the Canex option, one diamond drill was working on Gibraltar and a second on Pollyanna. The number was rapidly increased to an average of 4. The majority of the drilling was done by Candian Longyear with a lesser part by Shepherd Enterprises and earlier drilling by Trollenberg. All drilling in the Canex program was NQ wireline. A drilling record was set for NQ by Canadian Longyear when one of their crews drilled 2,010 feet in a one-week period. Five moves were included that week. The total for the four drills for the same week was 5,184 feet. With this kind of performance, core logging, splitting, and sample handling became a problem. In total over 150,000 feet of diamond drilling was carried out in approximately one year (see Figure2).

BULK SAMPLING

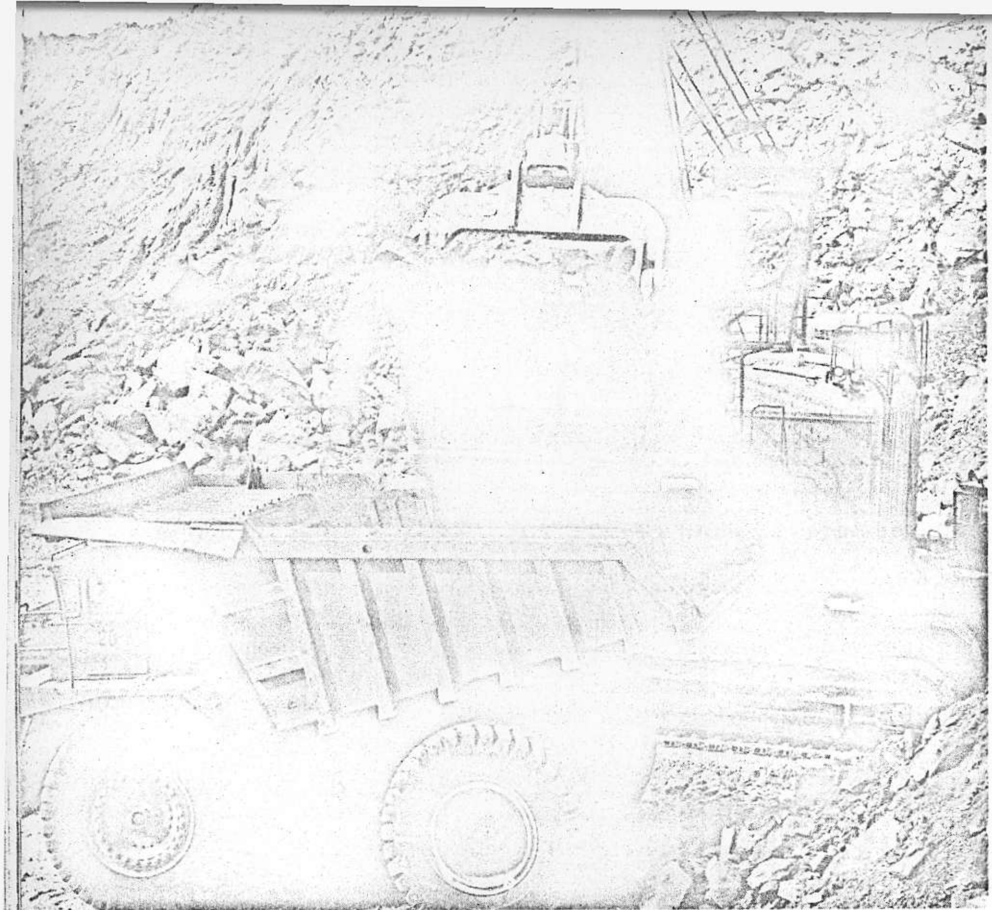
A decision was made for a bulk sampling program in order to confirm grades and provide material to determine the milling characteristics of the ore. Plans were drawn up for a conventional underground program with the sinking of shafts, cross-cutting, and raising on drill holes with all the material produced going through a sampling plant. Tenders were let and bids received. The bids were in the order of twice our estimated costs. In shock we decided to look at alternatives and were attracted to the idea of drilling large enough holes to give a check on grades and sufficient sample for metallurgical testing. Thirteen 5⅞-in. holes totalling 3,404 feet were drilled by Becker Drilling of Calgary using their reverse circulation equipment. In this system, all the cuttings are blown up the drill stem. The cuttings were then collected in a 45-gallon drum lined with a polyethylene bag. Each drum ideally represented 10 feet of hole. Considerable water was encountered in some holes and at times it was necessary to use up to 10 drums to collect 10 feet. In such cases, the drums were set aside to permit settling of the fines and then the water was decanted. The drums of cuttings were then shipped to Placer's research lab in Vancouver for assaying and testing. The assay samples were obtained by first augering the drums and secondly coning and quartering the dried samples. The use of the rotary drill saved over one million dollars and over six months in time when compared with the underground program.



One of Gibraltar's fleet of thirteen 100-ton diesel-electric trucks dumping in waste-disposal area

STAFF

Senior resident staff of Gibraltar Mines Ltd. includes J. M. Gibbs, mine manager; J. C. O'Rourke, mill superintendent; A. G. Stevenson, mine superintendent; W. A. Trythall, chief engineer; A. D. Croteau, plant superintendent; J. Sprotson, chief accountant; and G. G. Bell, employee relations superintendent.



Pit operation: 14-cu. yd. P.& H. shovel loads Lectra Haul truck

rock and a minor amount of low-grade ore. When the mill started production on March 8, 1972, several benches had been established in the ore zone and a broken reserve of ore was available.

Mine production, about 80,000 tons per day of ore, low-grade copper-bearing material, and waste, is carried out on a three-shifts-per-day, seven-days-per-week basis. Major items of equipment used in the pit, on a normal shift are two shovels, two drills, eleven trucks, four dozers, and one grader. A total pit complement of 109 men including supervisors is equally divided into four crews to provide coverage on the seven-day-per-week work schedule.

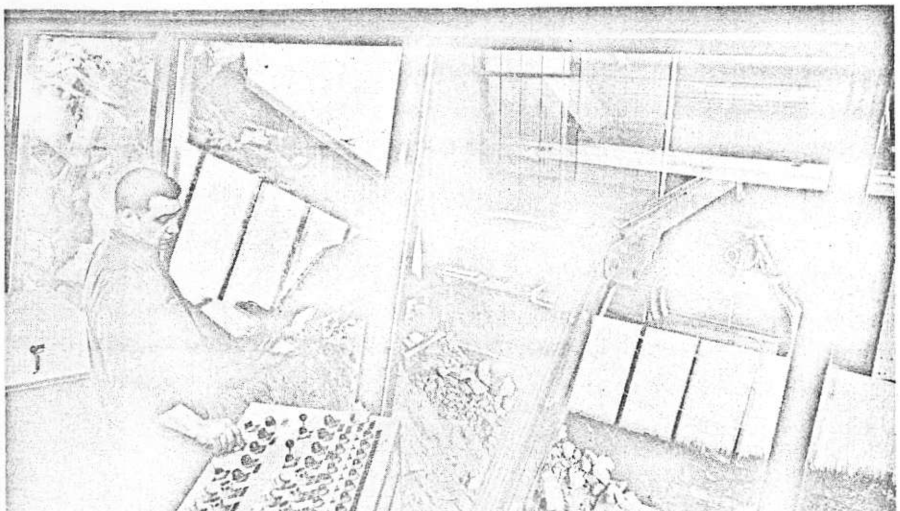
Pit design is based on a forty-five degree maximum wall slope and working benches forty-five feet high. In a typical sequence, the rotary drills first bore 9-⅞-inch blast holes to a depth of about 50 feet (5 feet below the floor of the next bench) on a grid averaging 23 ft. by 23 ft. Each hole will, therefore, break about 2,000 tons. The holes are loaded with about 800 pounds of explosives (0.4 pound per ton broken). Ammonium-nitrate fuel oil, (ANFO), is used in dry holes and slurry in wet holes. The explosives are prepared in a DuPont plant situated about two miles from the pit. The blast is initiated by primacord and electrical detonators.

Gibraltar Mines Ltd.

MINING PRACTICE AND EQUIPMENT

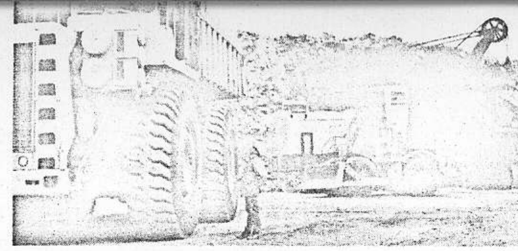
Ore reserves of the Gibraltar mine near Williams Lake in central British Columbia total 358,000,000 tons at an average grade of 0.373% copper and 0.016% molybdenite. Each of four separate zones will be mined in a predetermined sequence and in one or more stages. The sequence and stages of mining the zones have been determined by computer calculations and economic analyses to obtain maximum recovery of ore at the best possible grade and the least overall cost. In accordance with the sequence schedule, the first stage of the Gibraltar East ore zone has now been developed and is being mined at the full production rate.

Pit preparation commenced with the harvesting of commercial timber followed by clearing, grubbing, and stripping of overburden. This work was done by contractors during the first seven months of 1971. In late August 1971 Gibraltar started stripping the thin waste-rock cap from the orebody and by early March 1972 had removed approximately 9,000,000 tons of waste



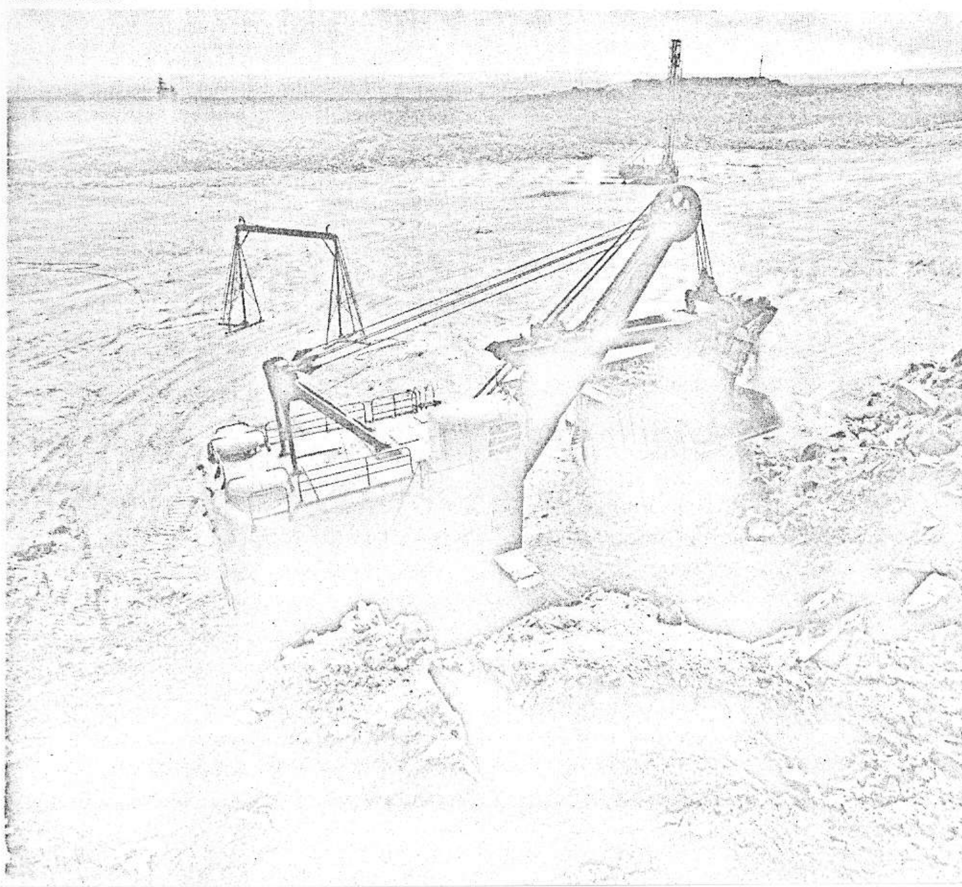
Operator controlling dumping at primary crusher

Mixture of ammonium-nitrate prills and fuel oil is pumped into blast holes



Pit operation: 14-cu. yd. P.& H. shovel loads Lectra Haul truck. Terex 150-ton truck in left foreground.

Below: Four to five dipper loads from one of the three P.& H. 14-cu. yd. shovels will fill 100-ton Lectra Haul



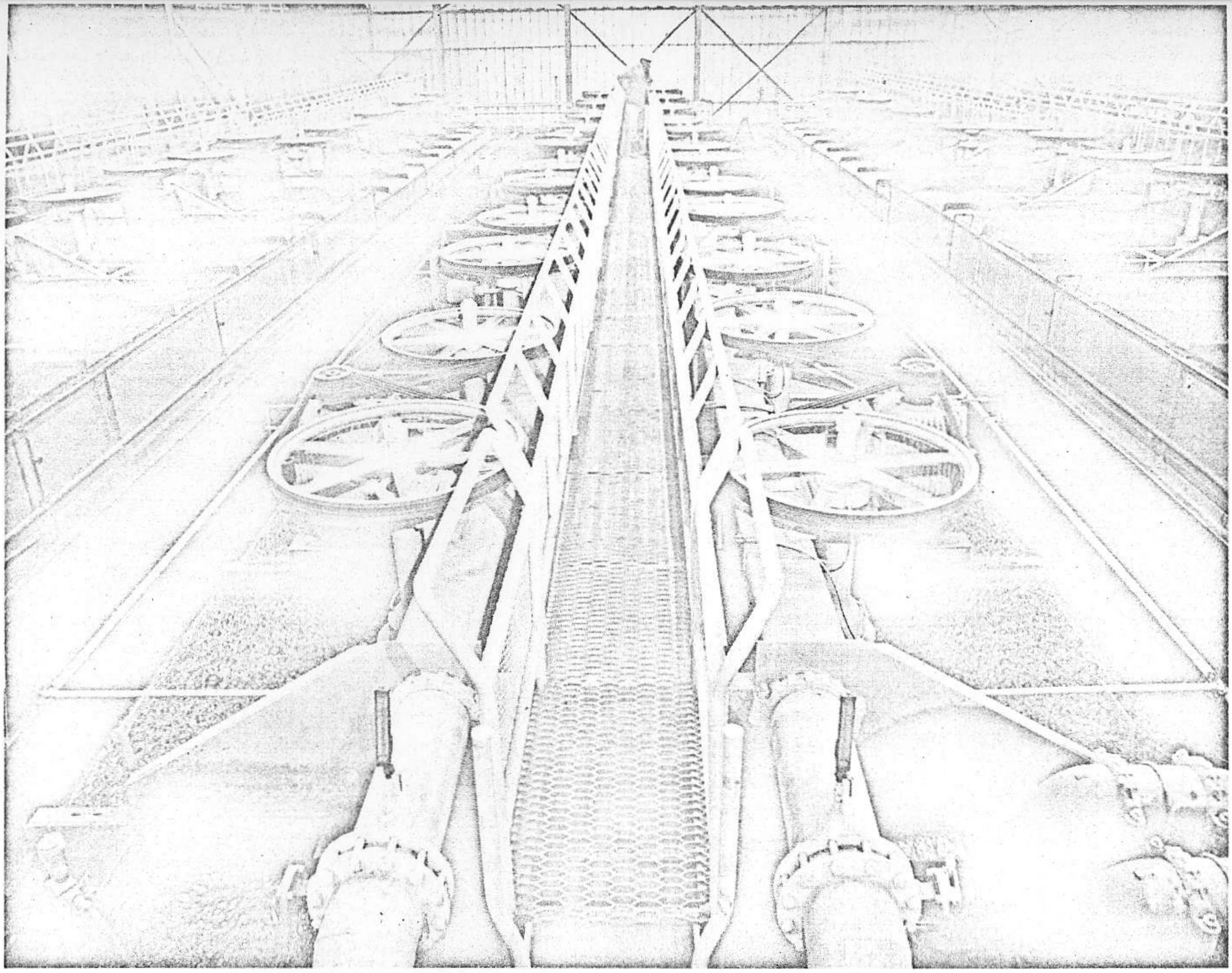
Hole locations are marked by a survey crew before the drill starts work and the exact location of the holes is recorded after drilling. Cuttings from the drill hole are sampled and assayed to determine the exact location of the ore and its grade. After a blast, the surveyors mark the broken material with coloured plastic ribbons and stakes to differentiate between ore, low grade, and waste.

After the blasted material has been appropriately marked, dozers and graders clean up the bench road and a shovel is moved in to commence loading. Five or six shovel buckets of material will fill a 100-ton truck in 2½ to 3 minutes. The shovel operator uses a horn signal to advise the truck driver when his vehicle is full and whether the load is ore, waste, or low grade. The truck then delivers its ore to the primary crusher, or other broken rock to stockpile or to the appropriate dump. Depending on haul distance, the truck makes a round trip every 12 to 16 minues.

A variety of service equipment is used in support of the mining operation. Constant attention to roads is essential, for which graders, dozers, sand trucks in winter, and water trucks in summer, are used. A rubber-tired dozer, for high mobility, is used to clean up around the shovels. A Napco self-contained, mobile, drill jumbo is used for secondary blasting, trimming, and bench-pioneering. A number of small trucks are used to service shovels, drills, dozers and trucks in the pit and to move personnel. Service and supervisors' trucks and the shovels are equipped with two-way radios for fast communication.

EQUIPMENT

1. **Three P & H electric shovels equipped with 14-cubic-yard dippers**
2. **Two Bucyrus-Erie 45R drills equipped to drill 9-⅞-inch holes**
3. **Thirteen Unit Rig 100-ton trucks**
4. **One Terex 150-ton truck.**
5. **Three Caterpillar D-8 bulldozers equipped with parallelogram rippers**
6. **Two Caterpillar Model 14 road graders**
7. **One Caterpillar Model 824 rubber-tired dozer**
8. **Miscellaneous support equipment and vehicles**



Part of Gibraltar flotation section

Gibraltar Mines Ltd.

THE CONCENTRATOR

When Gibraltar Mines Ltd. on June 13, 1972 officially opened its big copper-mining project near Williams Lake in central British Columbia, the crushing and concentrating facilities were treating between 34,000 and 36,000 tons of ore per day on a continuous basis after a short period of tune-up operation. The original design capacity was 30,000 tons per day.

PRIMARY CRUSHING

Ore is delivered from the open pit by a fleet of thirteen 100-ton Lectra Haul trucks and one 150-ton Terex truck with ten to eleven trucks normally in use on any one shift. The treatment process begins when ore is unloaded into one of two dump points directly into the 54-in. by 74-in. primary crusher. The crusher has a maximum capacity of approximately 3,000 tons per hour at a setting of 7 inches.

The primary crusher discharges directly into a 200-ton surge hopper from which the material is fed by a short 84-inch-wide, variable-speed conveyor onto a 72-inch-wide conveyor for transport to the primary screens in the secondary-crushing plant. Two double deck 8-ft. by 20-ft. primary screens split the material into two products — mill feed and oversize. Mill feed, about 30% of the primary-screen product, is the material which will pass through 1-½-in. square openings of the lower deck. The primary-screen mill feed joins with the products from the secondary-crushing plant on two systems of conveyors for transport to the 35,000-live-ton, fine-ore-storage facility. The oversize material goes to the 36,000-live-ton, coarse-ore pile from which it is drawn into the secondary crusher.

The primary crusher is controlled by an operator situated in a control room above and to the side of the dump pocket. The operator controls the dumping of the trucks through a system of traffic and signal lights. From his control panel he can start and stop the crusher and related conveyors and monitor the operation of the plant. Telephones and radios provide communications with the open pit and secondary crushing plant.

SECONDARY CRUSHING

Ore is drawn from the coarse-ore stockpile by six hydrostroke feeders and two conveyors running under the pile in concrete tunnels. This material is then crushed by four 13-in. by 84-in. hydrocone crushers, each of which discharges directly onto a single-deck 6-ft. by 14-ft. screen under the crusher. The screens remove finished mill feed and return the oversize to the coarse-ore pile. The screened products are transported to their respective destinations by the same conveyor systems which collect material from the primary screens. Each crusher is rated at 500 tons per hour of finished product. The crushing system is therefore capable of handling approximately 3,000 tons per hour, i.e. 1,000 tons per hour from the primary fines plus 2,000 tons per hour from the secondaries.

The secondary plant and all associated conveyors are controlled from a central control room in the secondary-crushing plant by an operator and helper. The helper's duties are essentially those of patrolling the system, clean-up, and lubrication. Both plants are manned three shifts per day, seven days per week. Routine maintenance is scheduled for day shift when additional men are available.

Both crushing plants are equipped with dust-collection systems which discharge dust into tanks to be mixed with water and pumped to the concentrator. Wherever possible, dust is further controlled by hooding or enclosing all points where it is produced. Central vacuum-cleaning ducts are placed throughout both plants for speedy clean-up of spills and any accumulated dust.

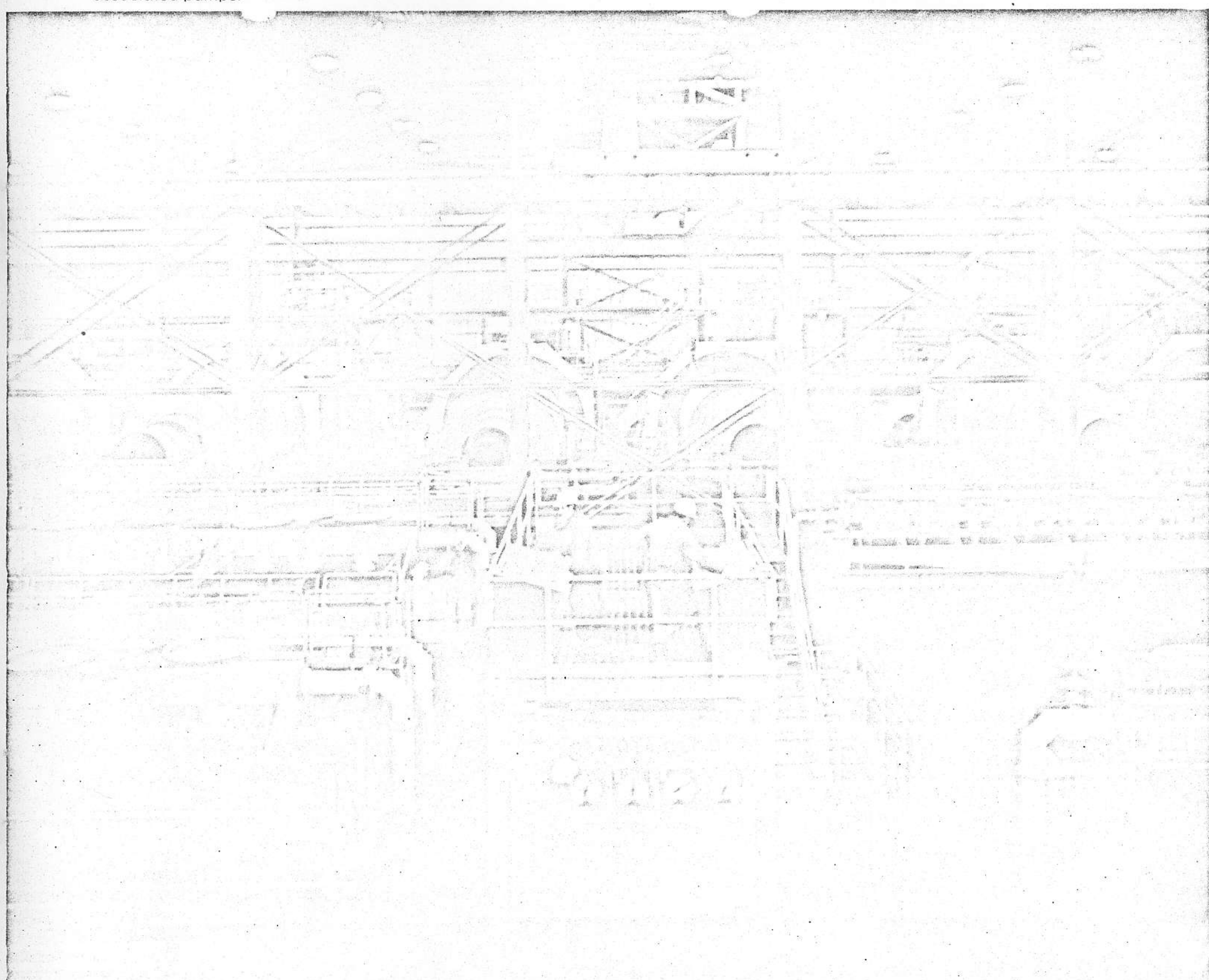
Metal detectors on the belts feeding the secondary crushers stop the belts whenever a metallic object of sufficient size to damage a crusher passes through. The operator must then remove the metal and restart the belt. A weightometer on the fine-ore belt leaving the secondary crusher indicates both rate and total tons delivered to the fine-ore stockpile.

MILLING

Each of the three rod mills in the concentrator is supplied from the fine-ore stockpile by a system of nine tube-type feeders, three variable-speed collector conveyors, and a feed conveyor. Feed rate is set by the mill operator and is then automatically maintained by a weightometer on each feed conveyor which adjusts the speed of the collector conveyors. Primary grinding is done in two stages by three 13-½-ft. by 20-ft. rod mills, each followed by a 13-½-ft. by 20-ft. ball mill operating in closed circuit with cyclones. Power consumption is 1900 and 2300 h.p. respectively. The final grind, approximately 70% to 80% minus 100 mesh, is varied to best suit ore characteristics and mill performance. Cyclone overflow at 36% to 40% solids runs by gravity to rougher flotation.

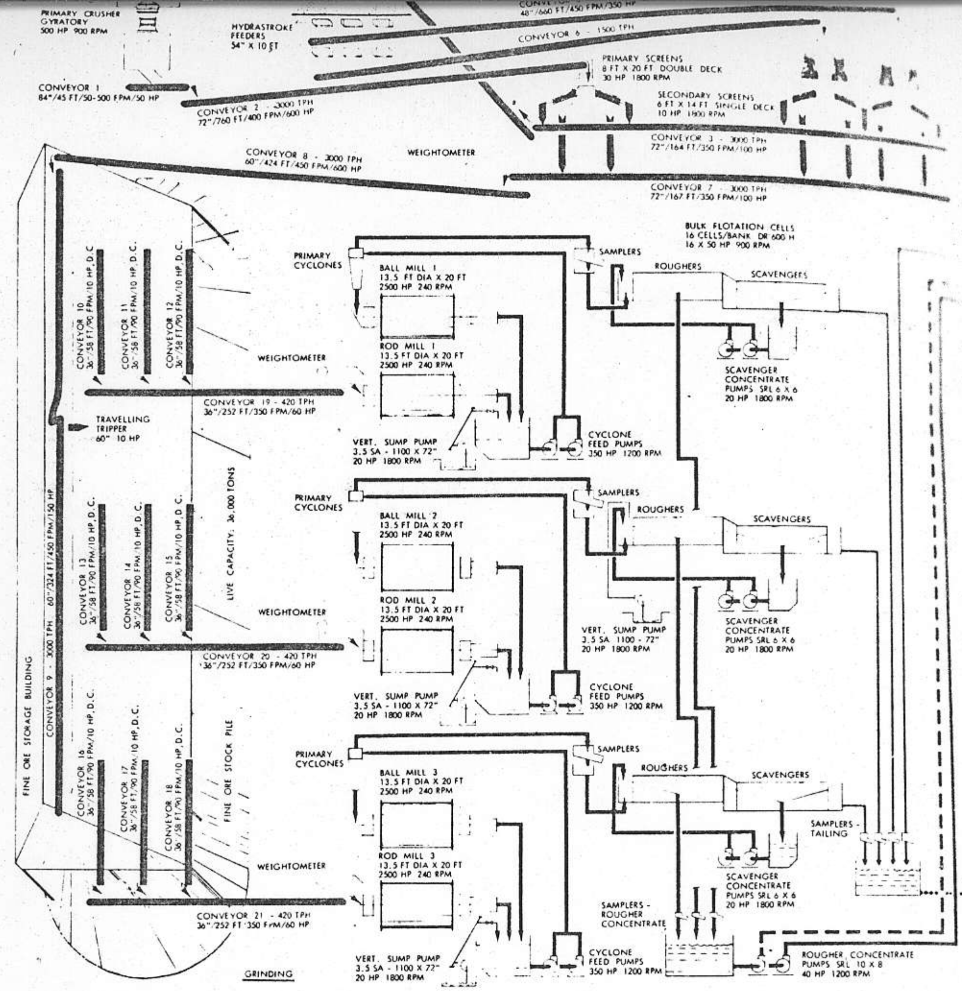
Below:

A view of the grinding bay at the Gibraltar Mines concentrator. Three rod mills and three ball mills, each 13.5 ft. by 20 ft., were supplied by Canadian Allis-Chalmers. The panel in centre foreground consists of pH automatic controllers; upper panels control cells and associated pumps.



Each grinding circuit is followed by a single bank of sixteen 600H Denver flotation cells. The first eight cells produce the rougher concentrate and the last eight, a scavenger concentrate which is recycled to the head of the roughers. All material which does not report to the rougher concentrate is discharged to the tailing pond as waste.

Rougher concentrate is pumped to 9-ft. 6-in. by 14-ft., 600-h.p. ball mill where it is reground in closed circuit with cyclones. Cyclone overflow at 10% to 15% solids and approximately 75% minus 325 mesh is then fed to the cleaner circuit. The first cleaner stage is a bank of sixteen DR300 V Denver cells. The first eight cells produce the first cleaner concentrate. Concentrate from the last eight cells along with the tailing from the second and third cleaners is returned to the regrind circuit. The tailing from the first cleaner stage is combined with the rougher tailing and is discarded. Second and third stages of cleaning follow, each being done in a a single bank of sixteen 600H Denver cells. The final copper or "bulk" concentrate is either sent to the dewatering circuit or to the molybdenum circuit for removal of a "moly" concentrate. The moly circuit will be used wherever there is an economic quantity of moly present and markets for the product have been developed.



METALLURGY

Ore to be treated during the early stages of operation contains chalcocite, pyrite, some chalcopyrite, and minor amounts of azurite, malachite, and cuprite. The moly content is quite variable but in material treated to date is well below average grade. As the pit reaches a greater depth the copper will be mainly in the form of chalcopyrite and the secondary copper minerals will essentially disappear.

Rougher flotation is done at a pH of about 10.0 and cleaning stages at about pH 11.5. Lime, used for pH control, is added where required by an automated system controlled by monitors at appropriate points in the circuit. Proper pH control is essential to both good copper recovery and pyrite suppression. Test work and early mill performance indicates that Z-200 is an effective and selective collector. Only very minor quantities of frother are required.

DEWATERING

Copper concentrate from the third cleaners or from the moly circuit is thickened in an 80-foot diameter thickener prior to filtering. Thickener underflow at approximately 55% solids is pumped to a 16-ft.-diameter by 16-ft.-high stock tank and then to one or both of two 8-ft. 6-in. diameter by 10-leaf disc filters. Filtered concentrate is conveyed to either the concentrate-storage building if under 8% to 9% moisture or to the dryer if moisture levels are too high. Drying, when required, is done in a 6-ft. by 40-ft., Lockhead-Haggerty, rotary-kiln dryer fired by natural gas. The dryer reduces the moisture content to 5% to 7% only, in order to minimize dusting losses during subsequent handling and shipping. After drying, the concentrate rejoins the conveyor to the concentrate-storage building which has a capacity of about 3,000 tons.

TAILING DISPOSAL

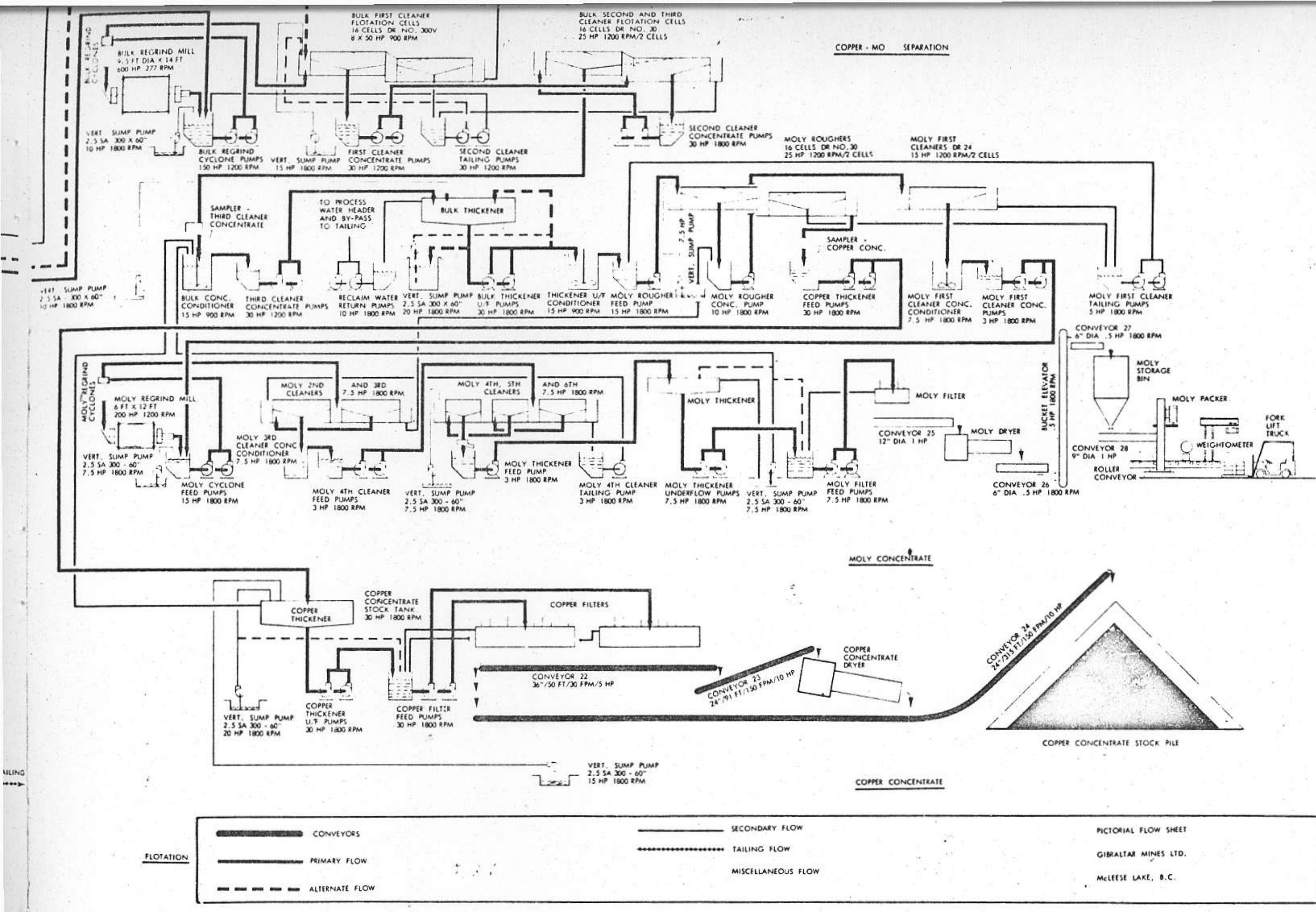
Rougher and first cleaner tailing is discharged into a common sump in the floor of the concentrator. From this sump, the material flows by gravity through a 36-in.-diameter welded-steel pipeline laid at a 0.5% decline for approximately 20,000 feet to the impoundment area. The additional vertical drop between the concentrator and the impoundment area is handled in 17 vertical drop tanks, each from 16 ft. to 20 ft. high.

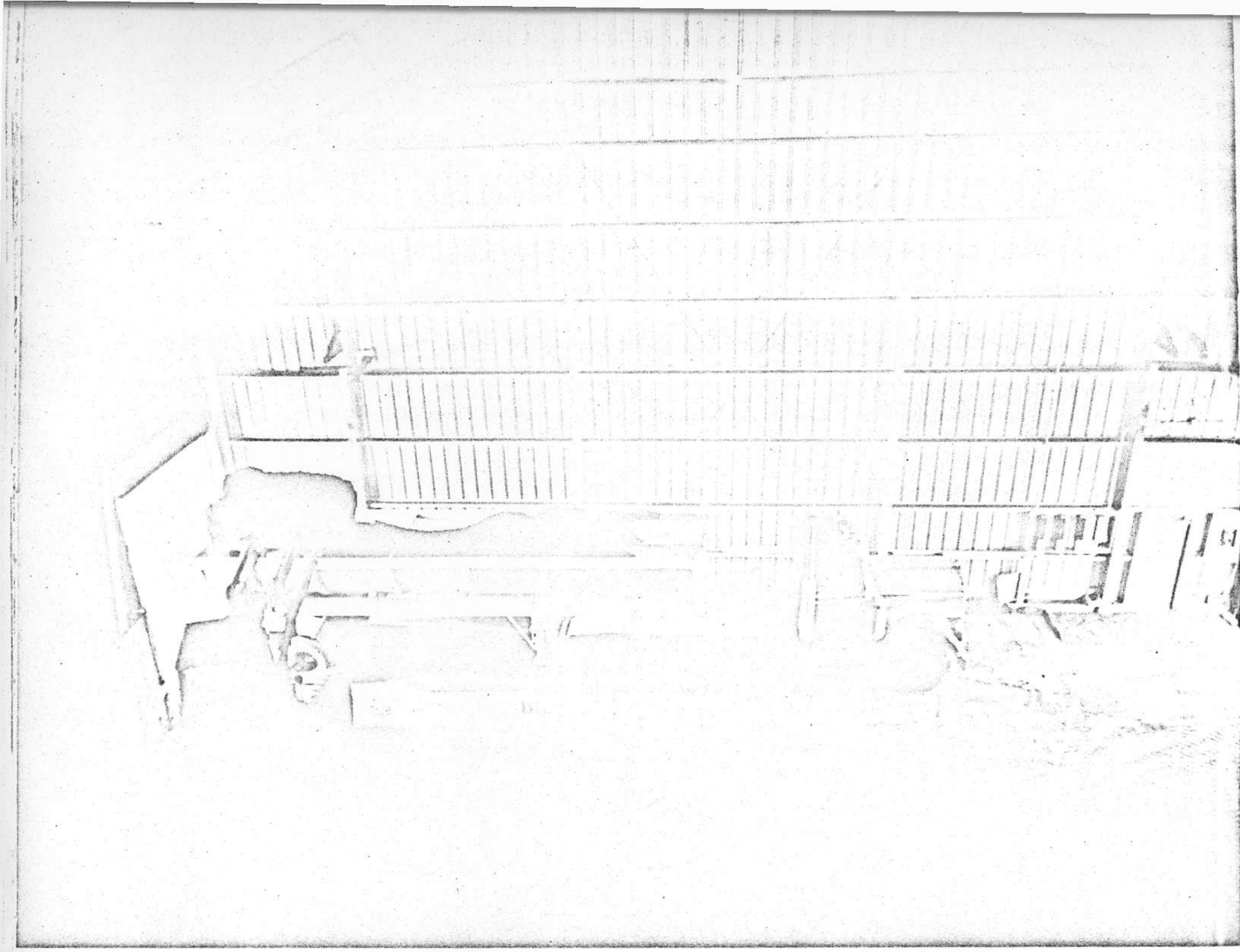
The tailing impoundment area was created in a flat, broad, valley-like basin. The area, approximately 1,000 acres, was cleared and grubbed and a glacial-till starter dam was built across a narrow neck at the lower end of the basin. Tailing sand, extracted from the mill tailing by twenty 30-inch cyclones spaced across the crest of the dam, will be used to increase the height of the dam as the level of impounded material rises.

PROCESS WATER

Most of the water used in the milling process is reclaimed by a pumping system from the tailing-impoundment basin. The only fresh water, pumped from wells on the bank of the Fraser River, is that required to replace water permanently trapped in the voids between particles of the tailing material. Excess water entering the area from natural run-off is either diverted around the basin or discharged at a controlled rate. Seepage water passing through or under the dam and water from the cyclone production of sand is collected in a small seepage dam below the main tailing dam and is pumped back into the water-reclaim system.

The reclaim water system consists of twelve 400-h.p. vertical-turbine pumps, six mounted on a barge in the tailing pond and six in a booster station just above the maximum anticipated level of the tailing impoundment. These pumps, the seepage pumps, and fresh-water-system pumps are automatically controlled by level controllers in the fresh and process water tanks.


COPPER - MO SEPARATION
BULK THICKENER
MOLY THICKENER
MOLY FILTER
MOLY DRYER
MOLY STORAGE BIN
MOLY PACKER
WEIGHTOMETER
FORK LIFT TRUCK
MOLY CONCENTRATE
COPPER THICKENER
COPPER FILTERS
COPPER CONCENTRATE DRYER
COPPER CONCENTRATE STOCK PILE
COPPER CONCENTRATE
CONVEYORS
PRIMARY FLOW
ALTERNATE FLOW
SECONDARY FLOW
TAILING FLOW
MISCELLANEOUS FLOW
FLOTATION
PICTORIAL FLOW SHEET
GIBRALTAR MINES LTD.
McLEESE LAKE, B.C.



Concentrate is hauled from the Gibraltar mill to the British Columbia Railway siding at Margurite under contract by Vancouver-Merritt Freight Lines Ltd. Trailer box with 25-ton capacity is filled by front-end loader.

Gibraltar Mines Ltd.

RECLAMATION AND ENVIRONMENTAL CONTROL

In the September sky over Gibraltar Mines, one of British Columbia's newest copper properties near Williams Lake, a small plane circled, then swooped low over the cleared areas. Behind it trailed a long plume of fine particles which settled along recently-contoured banks and clearings.

The plane was seeding cleared areas of the mining property with a mixture of grass, fertilizer, and legumes. A few weeks later the bare earth began to show a trace of green and before the first snows fell a healthy growth had taken root.

Gibraltar's major shareholder, Placer Development Limited, is also the developer and operator of the mine. Placer has wasted no time in beginning reclamation and rehabilitation of land disturbed by the construction program.

Seeding operations have also been introduced at three other mines which Placer operates in the province. These were started in the summer of 1969 and were among the first such projects undertaken by a public company. Gibraltar is significant for the fact that new grass was growing long before construction work was finished.

Aerial seeding has been carried out on waste rock areas, clearings, and tailing ponds at the Craigmont copper mine near Merritt, the Endako molybdenum mine near Fraser Lake, and at former tailing areas of the now-closed Canex lead-zinc operation in southeastern B.C. At each, a slightly different mix of plant seed and fertilizer, chosen for its suitability to local soil conditions, was distributed by the aircraft.

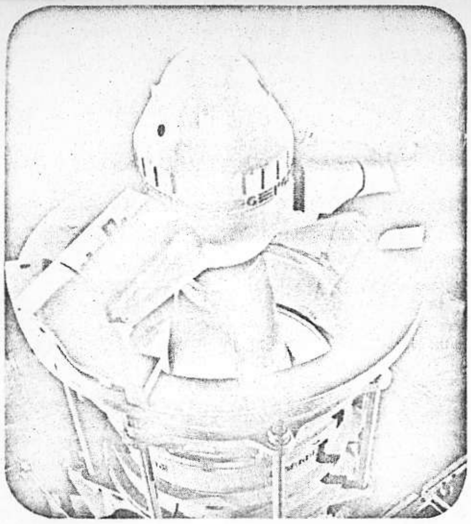
In one case, previous attempts to grow grass had failed. Rich, black earth — the kind that should grow almost anything — had been trucked in to provide a three-inch cover on the surface of an unused tailing pond. Grass did grow and a matted-root system extended down to the sandy tailing, but did not penetrate it. In less than a year rain and wind eroded the top layer, gradually exposing the tailing with the result that most of the growth died.

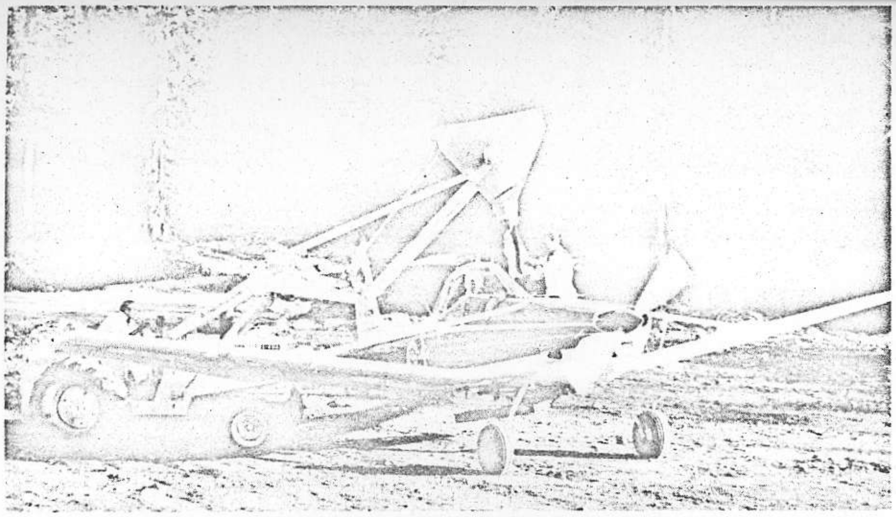
The solution turned up in the form of Stan Weston, an agronomist with different ideas about the right way to handle mother nature. His plan was to forget the loam and seed the tailing. It seemed improbable that this sandy material could support plant life since a tailing pond is composed of finely-ground rock and is, like all land a few inches below surface, almost totally sterile.

Yet, Weston's ideas are based on a sound understanding of plant growth. Placer's programme calls for introduction of the basic links required to create a self-generating system of grasses. It includes follow-up applications of fertilizer to support nature as she forges the links into a cycle of growth, reproduction, degeneration, and conversion to nutrient. Soon, the grasses become self sufficient, thriving in sand that had always defied growth.

This is not because tailing contains harmful ingredients, but rather the opposite. It does not contain enough of anything. About the worst that can be said of tailing is that it is sterile. The nutrients necessary to support plant life are not — and never were — in it. Yet, under Placer's programme, introduced on its own initiative, nature is provided with the building blocks. The simple test of turning over a shovel-full of tailing to reveal healthy root systems

Each application of seed is the result of careful soil analysis by agronomist Stan Weston, shown here checking a special mix before it is loaded on aircraft. With the seed is fertilizer, legumes, and natural bacteria.





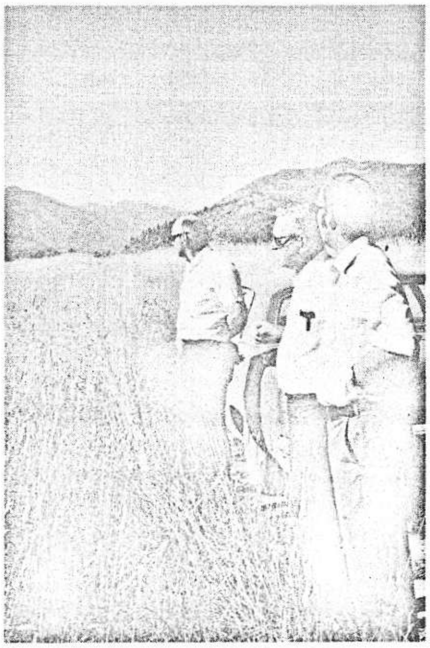
Aerial seeding is being carried out by various industries around British Columbia. Small planes typically land on makeshift runways to replenish their load of seed. Placer Development Limited has carried out such programmes at four different mines in the province.

penetrating deeply into the sand, is encouraging proof that the plan works. What could take nature two decades to achieve, is accomplished in less than five years.

To date, Placer's efforts have been directed toward areas no longer in use around the mines. Other sites will be seeded as soon as mining operations are completed.

Weston's first step, when considering the problems of growing grass around mines, is the evaluation of soil conditions together with the area's climate, elevation, precipitation, etc. Next is the application of selected grasses and legumes often through aerial seeding. One other important commodity, nitrogen-producing bacteria, must be present to make the others work. These natural bacteria are the catalytic agents which effect the breakdown of complex organics into food for growing plants. Impregnatng the leguminous seed with a culture of live bacteria insures that a mix of grass strains, fertilizer, and legumes will work together to create a life cycle for the plants.

At first glance, it's a strange combination — agronomists, grass seed, bacteria, and mining. But a second look shows that it makes sense. Mines do have to be profitable, but "good housekeeping" reflects good management which usually goes with profitability.



Healthy grass grows in abundance from the tailing of a former mine operated by Placer near Salmo, B.C. After initial planting, follow-up applications of fertilizer are required until a complete cycle of growth and decomposition is established.

WHAT GIBRALTAR MEANS TO WILLIAMS LAKE

The community of Williams Lake, located in the heart of the Cariboo District of central British Columbia, has been shaped by those who followed the fur trade, the early gold rushes, and the lure of the open range and cattle.

Today, the town and area are progressing rapidly as people come from many parts of the world — to take advantage of a pleasant way of life and ample business and employment opportunities. Hunting, fishing, and recreational areas exist within a few minutes' drive of the town.

The economic base of Williams Lake was established on the forest industries, cattle ranching, and a supply centre for the vast Chilcotin Valley extending to Bella Coola on the Pacific Ocean. Large numbers of tourists, fishermen, and hunters are attracted to the Williams Lake area each summer and fall contributing a significant income to the community.

The annual population growth since 1960 has more than doubled the provincial average. The forest industry has seen a transition from large numbers of small bush mill operations to large, integrated forest projects providing year-round employment. Last year the five lumber mills based in Williams Lake contributed an estimated $6,545,000 in direct wages; $8,527,000 to log-haul contractors; and $2,010,000 to suppliers.

GIBRALTAR MINES

The development of Gibraltar Mines — the largest single economic development in the area — brings further growth and progress to Williams Lake.

The impact of Gibraltar has already had a pronounced effect on the town. With an annual payroll of $3.5 million and the creation of 350 new jobs at the mine, the town is entering a new era of development.

Using the national figure of three new service jobs created for each one in a primary industry, Williams Lake and District Chamber of Commerce forecasts an additional 1,050 jobs in its area.

To provide housing for Gibraltar employees and their families (estimated at a total of 850 persons), the company purchased 90 lots in three Williams Lake subdivisions. An employee may obtain a home on a fully-serviced lot under an attractive first- and second-mortgage arrangement. In addition, a 75-unit garden-apartment complex is available for those who wish to rent.

The effect of population and economic growth on Williams Lake, to date, can best be illustrated by comparing various economic indicators from previous years to the present.

Building permits, (town of Williams Lake)	**1969**	**1970**	**1971**
Home Starts, (units	**36**	**30**	**121**
Home Starts, (dollar value)	**$487,000**	**$663,000**	**$2,631,745**
Apartments, (units	**-**	**59**	**85**
Apartments, (dollar value)	**-**	**$400,000**	**$770,000**
Commercial, (dollar value)	**-**	**$383,062**	**$761,640**

In addition to the above, approximately 200 mobile homes worth an estimated $2,000,000 were located in Williams Lake and surrounding areas during 1971.

For the first quarter of 1972, the dollar value of building permits in Williams Lake is more than double that for the same quarter of 1971.

COMMERCE

Retail trade cannot be accurately gauged but the increase can be reasonably estimated at 40 to 50 percent above 1970. Food outlets alone indicate increases from 1970 to 1971 of 50 to 75 percent.

Overwaitea will soon build a new store of 20,000 square feet — almost triple that of the existing store — to become the largest in the British Columbia chain.

Carloadings reported by the British Columbia Railway office in Williams Lake are as follows:

1969 — 11,375
1970 — 12,217
1971 — 13,761

SCHOOLS AND HOSPITAL

To meet the needs of the expanding school population, a $1,700,000 money by-law was approved this March. It will provide additions to existing schools as well as another elementary school and a second Junior Secondary School.

Last December, Williams Lake residents approved a $730,938 money bylaw for additions to Cariboo Memorial Hospital. This money will be used to complete a portion of the fourth floor; add an intensive care unit; double the emergency and X-ray facilities; and improve other needed hospital facilities.

During 1971 a total of 783 cars were unloaded for the development phase of Gibraltar. The mine expects to ship an average of five carloads of copper concentrate daily.

Pacific Western Airlines carried 50 percent more passengers to this region in 1971 than in 1970 and for the first quarter of 1972 has almost doubled the number of passengers carried in the same quarter of 1971. Total aircraft movements in and out of Williams Lake Airport increased 25 percent in 1971 over 1970.

The Canada Manpower Centre at Williams Lake placed more than 2,000 people in employment in 1971 — an increase of 106 percent over the previous year. The Post Office handled over 5,500,000 pieces of mail and parcels compared to 4,800,000 in 1970.

SPORT

Williams Lake has long been noted for its famous 'Stampede' held yearly in July. Contestants and visitors come from far and near to enjoy one of the last of the old 'Wild West' rodeos featuring such events as wild bronco riding, calf roping, and Brahma bull riding along with many other cowboy feats.

Horseback riding is popular in the Cariboo. The Trail Riders Club offers facilities for stabling horses and an indoor arena for western events.

For golfers there is a fine nine hole golf course.

Winter sports include curling, ice skating — on the lake or in the arena — and snowmobiling in the surrounding country. The Town has a regulation hockey rink and takes pride in the 'Stampeders', their local hockey team. Skiing at Little Squaw Valley, 14 miles north of Williams Lake, attracts a large number of people.

The Williams Lake Recreation Commission is studying ways and means to obtain an indoor swimming pool, a new community art centre, and an expanded library.

The citizens of Williams Lake have welcomed Gibraltar's employees into the community and look forward to their contribution in building an even stronger and better place in which to live.

For further information contact: R. L. Diether, P.O. Box 1510, Williams Lake, British Columbia.