

THE ECONOMIC IMPACT OF THE MINING INDUSTRY IN SOUTHEAST ALASKA



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Introduction

Southeast Alaska's mining industry has come to life after nearly 50 years of relative dormancy. Commencement of operations of the Greens Creek Mine in 1989 marked a turning point in the industry as the first large scale mining operation in the region since closure of the Alaska-Juneau Mine in 1944. The Greens Creek Mine is now the nation's largest silver producer. Other large scale mining projects are now on the drawing board, including development of the Kensington Mine and reopening the Alaska-Juneau Mine, which could become North America's largest underground gold mine.

The region's mining industry includes more than these large scale projects, however. For example, a significant level of mineral exploration occurs each summer in Southeast Alaska. In addition, mining operations in British Columbia and Yukon Territory are generating jobs and income in Southeast Alaska.

Today, the mining industry stands poised to rapidly expand into a major economic force in Southeast Alaska. The Greens Creek Mine already directly generates 265 jobs, and development of the Alaska-Juneau and Kensington mines could add another 800 jobs to the region's economy. Other projects have the potential to add hundreds more jobs. Of course, market conditions and, more frequently than in the past, environmental concerns will determine the future of the industry in Southeast Alaska.

As the mining industry expands, so does the industry's economic impact. This study, contracted by the U.S. Department of the Interior Bureau of Mines, is an effort to measure the economic impact of the mining industry in Southeast Alaska.

This study focuses on the region's metallic mineral mining industry. It is intended to serve two purposes: to measure, in detail, employment and payroll in the region generated by the mining industry, and to quantify spending by mining and exploration firms in Southeast. Coupling this spending information with sophisticated economic modeling techniques, government analysts and others can more accurately predict the economic impact of potential mine development projects in Southeast Alaska.

This study is generally limited to the basic industry portion of the Southeast Alaska mining sector. A basic industry is any industry or activity that exports a good or service to an outside market and draws money back into the region's economy. A support industry provides the goods and services required by the basic industry and its workforce. This analysis includes only a brief discussion of industrial mineral production, which typically meets local market demand and therefore is a support sector activity (and does not draw new money to the region).

The following report includes an executive summary and five chapters. Chapter I provides a profile of the mining industry in general, including a description of the industry from grassroots exploration to mine operations. In Chapter II, Southeast Alaska's mining industry is profiled, including discussions of current mining industry related activity in the region (including activity across the Canadian border) and potential future activity.

Employment and payroll impacts of the mining industry in Southeast are quantified in Chapter III. This analysis includes estimation of the indirect employment and payroll impacts of the industry. Chapter IV provides an assessment of the economic impact of mining industry expenditures in Southeast Alaska. Finally, the overall role of the mining industry (compared to other basic industries) in the Southeast Alaska economy is quantified in Chapter V. This discussion includes an analysis of the industry's future role in the regional economy.

Executive Summary

The purpose of this study was to measure the economic impact of Southeast Alaska's mining industry, one of the fastest growing components in the economy of the region. Six components of the mining industry affect the region's economy, including:

- Reconnaissance exploration
- Advanced exploration and pre-development (Alaska-Juneau and Kensington projects)
- Mine operations (Greens Creek Mine)
- Industrial materials production
- Exploration and mine operations in Canada
- Mining industry related government employment.

The mining industry affects the regional economy by creating jobs and by spending on goods and services with Southeast Alaska businesses. A summary of the mining industry's economic impacts in Southeast Alaska follows.

Employment and Payroll

The total employment and payroll impact of the mining industry in Southeast is estimated at 675 jobs and \$24 million in wages and salaries for 1991. This includes direct, indirect and mining-related government employment and payroll.

The Greens Creek Mine, accounting for about 265 year-round jobs, is the single largest participant in the region's mining industry. Total direct mining industry employment in Southeast during 1991, including all phases of mineral exploration and production, was an estimated 325 jobs (annual equivalent). Industrial materials production added another 25 jobs (annual equivalent), according to Bureau of Mines estimates. Government adds another 25 mining related jobs to the region's economy. Total direct payroll in the mining industry was an estimated \$16 million in 1991.

Spending by mining companies and their employees creates jobs in Southeast Alaska's service and supply sectors. This mining-related indirect and induced employment was an estimated total annual equivalent of 300 jobs in 1991. Indirect and induced payroll in 1991 was an estimated \$8 million.

Goods and Services Purchased

Exploration and mining companies active in Southeast spent a total of \$20 million in the region in 1991 on goods and services. Most of this spending is in support of

the Greens Creek Mine, but it also includes significant spending on exploration and pre-development activities, notably the Alaska-Juneau and Kensington mines.

Canadian exploration and mining projects (in BC and Yukon Territory) also purchase goods and services from businesses located in Southeast Alaska. Wrangell and Skagway are the beneficiaries of approximately \$2 million in Canadian mining industry spending in Southeast. Cominco's Snip Mine in B.C. and Curragh Resources Faro and Mt. Hundere mines are, in particular, impacting the economy of Southeast.

Direct spending on labor totaled an estimated \$18 million in 1991 including benefits and other personnel overhead (this excludes government labor costs).

Approximately 90% of the workers employed directly by mining companies in the region are year-round residents of Southeast Alaska. Contracted labor typically includes a higher level of non-resident participation.

In total, the mining industry spent \$40 million in Southeast Alaska during 1991, including spending on equipment, materials and supplies, services and personnel. This total does not include spending in support of industrial materials mining which may have totaled between \$1 million and \$2 million, though no specific data is available.

Role in the Economy and Future Outlook

While the mining industry plays an important role in the economies of Juneau Skagway, and to a lesser extent Wrangell, the industry's role region-wide is still comparatively small. The region's largest basic industries (in terms of employment) are the seafood industry, the forest products industry and the tourism industry.

However, mining is Southeast Alaska's fastest growing industry, expanding from only a few dozen jobs five years ago to over 300 jobs today. Further, the industry is poised for significant future growth. Development of the Alaska-Juneau and Kensington mines would add 800 jobs to the Southeast mining sector and approximately \$35 million in annual payroll.

Farther into the future, development of the Quartz Hill mine could bring another 800 jobs and \$35 million in payroll. In addition, Canadian mine development such as the Tulsequah Chief project could create additional jobs in Southeast. Therefore, it is possible that within ten years the mining industry could account for approximately 2,000 jobs in Southeast and over \$80 million in annual payroll.

It is important to temper this optimistic outlook with the reality of uncertain mineral market conditions. Further mine development in Southeast is not guaranteed. The environmental and socioeconomic impacts of mining are under increasing scrutiny, and these factors will play a greater role in mine development decisions in the future.

Chapter I. Profile of the Mining Industry

The mining industry is much more than extracting mineral resources from the earth. The mining industry is really a sequence of activities, or more accurately, a cycle of activities. Reconnaissance exploration, prospect assessment or advanced exploration, pre-development, mine construction, production and final reclamation and monitoring are all part of this cycle.

The foundation of the mining industry is exploration, or more specifically, "grassroots" or reconnaissance exploration, typically a regional program aimed at discovering previously unrecognized mineral deposits with economic potential.

With discovery comes a more specific exploration effort, sometimes termed target exploration or advanced exploration. This is a process of prospect assessment, where the deposit is sampled to determine grade and tonnage and the feasibility of profitable mining. It is this stage of mineral development that is the most complex and most dynamic. Literally dozens of constantly changing economic, financial and technical forces influence mine feasibility. Low grades, small tonnages, or high costs may mean that a deposit never advances beyond the assessment stage, or it may sit idle for decades until rising metal prices or technological advances help turn the uneconomic prospect into a profitable venture.

Many mineral prospects are drilled and sampled, but only one in a hundred ever becomes a mine. For those few prospects where detailed sampling indicates profit potential, the next step is mine development (construction). Here the orebody is prepared for mining, a mill is constructed and the support infrastructure developed. In large-scale mine development efforts, many millions of dollars are invested and hundreds of workers employed over a period of several years as the mine is readied for production.

Because mineral deposits are finite resources, the mining company is constantly active at all the different stages of the mineral cycle; performing reconnaissance exploration in one area, drilling and sampling a prospect in another area, maybe developing a new mine in yet another. When one deposit is depleted and the mine must close, to survive the mining company must be prepared to begin production at another deposit. This is the mineral cycle.

The following discussion is a more detailed description of mineral exploration, mine development and production.

A. Reconnaissance Exploration and Advanced Exploration

Mining companies invested approximately \$1.8 billion worldwide in mineral exploration in 1990.¹ In Alaska, exploration spending totaled \$63 million in 1990.²

The business of mineral exploration has become increasingly sophisticated in recent years. Reconnaissance exploration programs often begin with analysis of satellite or high altitude aerial photographs covering hundreds of square miles. Depending on the target minerals, airborne geophysical surveys may also be employed over large tracts of land. Geochemistry plays an important role in mineral exploration today. Chemical analysis of stream sediment and soil samples allows mining companies to preliminarily test mineral potential without actually sampling the underlying bedrock.

With discovery comes the sometimes lengthy and very costly process of determining if a prospect can or cannot be profitably mined. Prospect drilling, sampling and the whole process of property evaluation and mine feasibility analysis is, in the simplest of terms, an effort to determine if ore exists in sufficient quantity (tonnage) and quality (grade) to make profitable mining possible. This is a simple task in theory, but extraordinarily complex in practice. Unfortunately there is only one way to precisely determine the grade of ore in a deposit, which is to mine and mill the entire deposit. Short of this, geologists typically base ore reserve estimates on samples (usually diamond drill core samples) that they hope are statistically representative of the entire deposit.

With reliable ore reserve estimates in hand, the mining company is set to determine the feasibility of mining the deposit based on current market conditions, the cost of development, the cost of mining and milling, and many other factors. In reality, feasibility work is an ongoing part of prospect evaluation. A succession of preliminary feasibility studies may be performed, each based on more detailed and reliable information than the preceding (and presumably encouraging) study. Managers of the ongoing Alaska-Juneau Mine project, for example, have performed a series of preliminary feasibility studies, each showing positive results and indicating that further more detailed work is warranted. The last stage of this phase is the final feasibility study.

Ore grade and tonnage are ultimately the determinant parameters in mine feasibility. But inseparable from the discussion of ore grade and tonnage are costs and revenues; the cost of preparing the ore body for mining, the cost of building a mill (concentrator), the cost of mining a ton of ore, and the cost of crushing, grinding, and refining a product from that ton of ore. Inherent in all these costs are labor costs, the cost of electric power, the cost of shipping supplies to the mine site, tax burdens, even the cost of acquiring the necessary permits to develop a mine.

Revenues are a function of production rates, product recovery rates, and prices. Forecasts of metal prices are undoubtedly the least reliable parameter in a mine feasibility study. The precious metals market, influenced more by speculators than by true supply and demand forces, are particularly difficult to forecast. Most mining companies, instead of focusing on price forecasting, concentrate instead on keeping operating costs at or below some predetermined level that still provides adequate margin for periods of declining metal prices.

B. Mine Development and Construction

Millions of dollars spent on regional exploration and millions more spent on assessing a handful of prospects may finally identify a mineral property that is worth mining. Five years may elapse between discovery and development, but 15 years is probably more the norm (Greens Creek was discovered in 1975, and went on-line in 1989). U.S. Borax spent \$100 million over 20 years on its Quartz Hill molybdenum deposit and mine construction and operation are still years away, if it occurs at all. Some prospects see 50 years of intermittent assessment work before final development occurs. New technology and changing market conditions often help turn once uneconomic deposits into successful mines.

The process of mine construction involves construction of a mill or concentrating plant – a facility to separate the valuable minerals from the ore. These facilities typically utilize a combination of mechanical (crushing and grinding) and chemical (floatation and/or cyanidation) processes to separate the valuable minerals from the worthless rock. In some cases only a concentrate is produced at the mine. The concentrate is then shipped to a smelter where final processing occurs and a metal product is generated. The Greens Creek Mine, for example, produces three types of concentrates containing silver, gold, zinc and lead. These concentrates are shipped to several smelters around the world for final processing.

The construction effort will also include support facilities, which may include transportation infrastructure (roads, docks, or airstrips depending on the location of the mine), tailings disposal facilities, power generating facilities if no outside power source is available, and office and lab facilities for the mine's managers, engineers and geologists. For remote mines, facilities are required to house and feed the mine's workforce.

Mine development is the process of preparing the orebody for mining: driving tunnels from the surface (adits), sinking shafts, driving access and ventilation raises, and accessing ore blocks with crosscuts and other tunnels. Mine development expenditures also include the purchase of mining equipment: drills, loaders, trucks, etc.

Major mine development in Alaska can be an extremely costly business. The final cost of Greens Creek Mine development is placed at \$114 million.³ It is expected that Alaska-Juneau Mine development would cost \$245 million initially, plus another \$76 million over the life of the mine for dam raising and other construction.⁴ The Kensington Mine could require \$167 million in capital expenditures⁵. It is these

extraordinarily high development expenditures that frequently lead mining companies to form joint ventures (JVs), which split the cost among several companies.

C. Mine Operations

With mine development and construction complete, production can begin. The production phase of the mineral cycle can last from a few years to several decades, depending on production rates, the size of the orebody and market conditions. For example, based on current market conditions, the Greens Creek Mine has a minimum life expectancy of about 15 years. The Alaska-Juneau and Kensington mines, if developed, would be in production for at least 13 and 12 years, respectively.

The life of a mine can be longer, or shorter than anticipated. Increasing metal prices, improved technology, lower prices on production factors such as fuel or electric power can all add years to the life of a mine. Conversely, technical difficulties (such as erroneous ore reserve estimates), falling metal prices, or increasing production costs can force temporary closure or prematurely end the life of a mine.

There are many different mining methods, though the two basic types of mines are open pit and underground mines. All Juneau area mines (Greens Creek, Alaska-Juneau and Kensington) are or would be underground mines. The Quartz Hill deposit near Ketchikan would be operated as an open pit mine. Open pit mining methods are usually employed when a mineral deposit is on or near the surface. Profitable mining of lower grade deposits often requires huge volumes of ore be processed. The world's largest open pit mines move over 100,000 tons of ore per day, far more than the typical underground mine.

The Greens Creek Mine is Southeast Alaska's only producing mine (excluding rock and gravel operations and a few very small scale placer mines). The underground mine operates 355 days a year, mining 1,050 tons of ore per day and producing nearly 70,000 tons of zinc, lead and bulk concentrates.⁶ The Greens Creek project is discussed in more detail in the following chapter.

¹Mining Engineering, May 1991, Society for Mining, Metallurgy, and Exploration (SME).

²Alaska's Mineral Industry 1990, Division of Geologic and Geophysical Surveys, Special Report 45.

³Alaska Miners Association 1991 Service Directory, pg. 143.

⁴A-I Mine Draft Socioeconomic Impact Assessment, City & Borough of Juneau, 1991, pg. 3.

⁵Final Socioeconomic Impact Assessment, Kensington Gold Project, City & Borough of Juneau, 1992, pg. 5.

⁶Alaska's Mineral Industry 1990, Division of Geologic and Geophysical Surveys, Special Report 45

Chapter II. An Overview of Mining Industry Activity in the Southeast Alaska Region

A. Greens Creek Mine

The Greens Creek Mine, located approximately 18 air miles southwest of Juneau, is the nation's largest silver producer. The mine produced approximately 7.6 million ounces of silver in 1990, along with 38,000 ounces of gold, 74 million pounds of zinc and 33 million pounds of lead. The underground mine produced just over 1,000 tons of ore daily.⁷

The polymetallic orebody is thought to be a volcanogenic massive sulfide deposit hosted in metasedimentary rock of Late Triassic age. The deposit contains 24 ounces per ton silver, 0.12 ounces per ton gold, 4% lead, and 10% zinc.

The Greens Creek ore deposit was discovered in 1975 by a joint venture of companies led by Noranda Exploration. Fourteen years of exploration and development work finally brought the mine into production in 1989. Controlling interest in the mine is now held by Kennecott Corporation. Minority interest holders include Hecla Mining, CSX Oil and Gas, and Exhalas Resources. These firms spent \$114 million developing the Greens Creek Mine.

Approximately 265 workers are employed by the Green Creek Mining Company. These workers earn an estimated \$12 million in annual payroll (with the highest annual salaries in Juneau), excluding benefits. Mine workers live in Juneau and commute to the mine on a daily basis. The mine is Juneau's largest private sector employer. Transportation to and from the mine is provided by a 100-foot, high-speed catamaran, linking Auke Bay and Young Bay on Admiralty Island. Mine workers are bused from the Young Bay dock to the mine site, a trip of about 15 miles.

Mine support infrastructure includes a deepwater port located on the shore of Hawk Inlet, approximately eight miles from the mine-mill site. Ocean-going freighters ship Greens Creek concentrates to European and Asian smelters.

The Greens Creek ore body contains sufficient reserves for at least ten years of operations. The extent of the deposit has not been fully outlined and mine operations beyond tens years are not unlikely.

B. Advanced Exploration and Pre-development in Southeast

Echo Bay Mines Ltd. of Edmonton, Alberta, and its partners are poised to begin construction of two major gold mining projects in the Juneau area. Echo Bay is prepared to reopen the Alaska-Juneau Mine, pending outcome of the environmental impact study and the permitting process. In addition, Echo Bay, along with co-owner Coeur D'Alene Mines are considering developing the Kensington Mine . That project is also in the permitting process.

Alaska-Juneau (AJ) Mine: The Alaska-Juneau Mine was at one time the world's largest low-grade gold mine, moving over 10,000 tons of rock per day with an average ore grade of only 0.045 ounces of gold per ton. Labor shortages and rising labor costs forced the Alaska-Juneau Mine to shut down in 1944, even though mine officials reported some 29 million tons of ore containing 1.2 million ounces of gold still in reserve.

Echo Bay Mines acquired development rights to the Alaska-Juneau Mine property in 1986 and since then has identified proven and probable reserves of approximately 100 million tons of ore with an average grade of just under 0.05 ounces per ton. Echo Bay's development plans call for a 22,500 ton per day mining operation. That rate of production would make the Alaska-Juneau Mine North America's largest underground gold mine.

Development of the Alaska-Juneau Mine would cost over \$245 million. Echo Bay's proposal for mine development includes installing crushing, grinding and concentrating equipment underground. A two-mile long adit would link the orebody with surface facilities located on the shore of Gastineau Channel near Sheep Creek. Surface facilities would include concentrate floatation and leaching equipment, tailings thickening and pumping equipment, power generating plant, warehouse facilities, an assay lab, and administration buildings. A tailings disposal facility would be constructed in Sheep Creek valley, including a roller compacted concrete dam that will double as a hydro-electric power generating facility.⁸ The design and operational parameters of the mine could change as the public review process progresses.

The Alaska-Juneau Mine would recover approximately 350,000 ounces of gold annually for a minimum projected mine life of 13 years. The Alaska-Juneau Mine property is owned by the City and Borough of Juneau and Alaska Electric Light and Power Company (AEL&P). The City and Borough would earn approximately \$3 million annually in royalties, depending on the price of gold.

A Final Environmental Impact Statement (FEIS) was released in the Spring of 1992. Upon completion of the FEIS Echo Bay will seek remaining necessary permits, including the City and Borough's Large Mine Permit.

Once in production, the Alaska-Juneau Mine would employ 450 workers, operating three shifts year-round. These workers would earn approximately \$20 million in annual payroll. Development of the Alaska-Juneau Mine would make the mining industry Juneau's top private sector basic industry in terms of employment, surpassing tourism and the seafood industries.⁹

Kensington Gold Project: The Kensington property has seen sporadic exploration and development activity since around 1900. Recent detailed assessment work was initiated by Placid Oil in 1980. Placid outlined ore reserves estimated at 2 million tons grading .239 ounces of gold per ton before selling the property to Coeur D'Alene and Echo Bay. The Kensington property is located approximately 50 miles northwest of Juneau, near Berners Bay.

Echo Bay (the operating partner) has identified Kensington ore reserves totaling 17 million tons with an average grade of approximately 0.15 ounces of gold per ton. Mine plans call for a 4,000 ton per day operation over a projected mine life of 12 years. Development costs will total an estimated \$167 million.

A final environmental impact study of the Kensington Project was released in February 1992. With release of that document, Echo Bay and Coeur D'Alene are seeking the City and Borough's large mine permit (both the Alaska-Juneau and Kensington mines are located within the City and Borough of Juneau boundaries).

Once in full production the Kensington Mine would employ 340 workers. Mine employees would work two weeks on, one week off type shifts. A 250 person camp will be constructed at the mine site, and workers will be transported to and from Juneau by helicopter.¹⁰

Jualin Project: This Berners Bay gold project has identified 1.1 million tons of ore with an average grade of 0.35 ounces per ton. Past production at the Jualin includes 38,000 ounces of gold and 13,000 ounces of silver.¹¹ While no development decision is expected in the near future, if developed, the mine would probably operate at a rate of 500 tons of ore per day employing as many as 90 workers.

Quartz Hill: Between 1974 and 1983 U.S. Borax spent approximately \$100 million developing the Quartz Hill deposit, located about 45 miles east of Ketchikan. The Quartz Hill deposit contains an estimated 1.5 billion tons of mineable ore with an average grade of 0.136 percent molybdenite, based on approximately 250,000 feet of core drilling. Mine development plans called for an operation employing 850 workers, who would reside in Ketchikan. Construction costs were estimated at \$870 million in 1981 dollars. Construction of the mine has been delayed pending improvement in the world molybdenum market. In 1991 Cominco Ltd. (operators of the Red Dog Mine) purchased the Quartz Hill property from U.S. Borax. Cominco has made no announcements concerning their plans for the property, though no development activity is expected in the near term.

C. Other Mineral Exploration in Southeast

Over the last 100 years, most of Southeast Alaska has been the target of at least cursory mineral exploration efforts. These efforts have identified hundreds of prospects, dozens of mineable deposits, and at least one world class mineral deposit (the Quartz Hill molybdenum deposit). Exploration efforts in Southeast wax and wane with metal prices. The emphasis in the early years was on gold, and the rise of the Alaska-Juneau, Treadwell, and Chichagof mines, among others, was the result. Copper was also targeted around the turn of the century, resulting in development of several Prince of Wales Island mines, including the Jumbo, Coppermount and several small-scale mining operations.

After World War II, exploration efforts shift more toward base metals (copper, lead, and zinc). Uranium was the target of an exploration rush for a period in the 1950s. A barite deposit near Petersburg was developed in the 1960s. Barite is used as a drilling mud for petroleum exploration. The Alaska Barite Company mined the Castle Island deposit until 1981.¹²

The focus stayed on base metal exploration until the late 1970s when precious metals prices skyrocketed. During the 1980s Southeast's historic mining districts (notably the Juneau Gold Belt, but also the west Chichagof area) were once again the subject of intense exploration interest. Rising base metal prices in the latter 1980s, accompanied by relatively high gold prices, broadened exploration efforts in the region. Though base metal prices have been declining in recent months, firms active in Southeast continue to target both base and precious metal prospects.

In the last couple of years, a large number of mineral exploration firms have been active in Southeast Alaska performing reconnaissance exploration or prospect evaluation work. Areas that are the target of this exploration work have included the Prince of Wales Island area, the Chilkat Range, the Wrangell area and all along the Juneau Gold Belt (stretching from Windham Bay to Berners Bay). Chichagof Island has also seen exploration activity in recent years. Firms that have been active in Southeast (in addition to the major developers of the Alaska-Juneau, Kensington and Jualin) in 1990 or 1991 include: Placer Dome, Cominco, Kennecott Exploration, Hecla Mining Company, Battle Mountain Gold, International Curator, WGM, Salisbury & Associates, American Copper & Nickel, Pulsar Resources, Lac Minerals (USA) Inc., Hyak Mining Company, BPH-Utah, and Delta Minerals.¹³

Sealaska Corporation is Southeast Alaska's largest private land owner. After land conveyances are complete Sealaska will have approximately 630,000 acres of subsurface rights in Southeast Alaska. Sealaska has been aggressively seeking to enter Southeast Alaska's mineral industry and has established exploration agreements with several firms. Several promising mineral deposits have been discovered on Sealaska land and more detailed study has been initiated.

D. Mining Industry Activity in Canada Affecting Southeast

The impact on Southeast Alaska of Canadian mining activity has increased significantly in recent years. In fact, western British Columbia has been experiencing a major gold rush. For example, the Stewart - Iskut River area, known as British Columbia's Golden Triangle, was the target of \$60 million in exploration spending in 1990 involving 34 companies.¹⁴ There has also been an increasing level of exploration and mine development activity along the Canadian portion of the Taku River valley near Juneau. Of course, mining activity in the Yukon Territory continues to impact the community of Skagway. Following is a brief description of the Canadian mining and exploration projects that are (or may be) affecting the economy of Southeast Alaska.

Faro: The Faro Mine, operated by Curragh Resources, is a large (12,000 tonnes per day) open pit lead and zinc mine employing 500 workers. The Faro deposit contains approximately 12 million tons of ore with an average grade of 2.7% lead, 4.7% zinc and one ounce silver per ton. A second deposit, Vangorda, which added open pit production in 1990, is approximately 7 million tons grading 3.5% lead, 4.5% zinc, and one ounce silver. Open pit mining at a third deposit, the Grum, (25 million tons with 3% lead, 5% zinc, 1.7 ounces silver plus gold credits) is expected to begin in 1992.¹⁵

Faro is located approximately 300 miles by road northeast of Skagway. In 1990 Curragh shipped 605,000 tons of concentrates to overseas markets through the Port of Skagway.¹⁶ Curragh recently began production from its Mt. Hundere property near Watson Lake, which is funnelling additional concentrates through Skagway. Curragh owns and operates (dba Bowhead Equipment Company) the Skagway concentrate loading facility.

Windy Craggy: Geddes Resources Limited of Vancouver is attempting to develop a large-scale open pit copper mine in the northwestern-most corner of British Columbia. Geddes' mine operation plans call for mining 20,000 tons of ore initially and increasing to 30,000 tons per day after several years of operation. Concentrate production would start at an annual rate of 150,000 tons. The mine would also produce minor amounts of gold, silver and cobalt.

The mine site is approximately 80 miles northwest of Haines. Currently access to the property is by air only. If the mine is developed, a road would be constructed linking the mine with the Haines Highway. Concentrates would be trucked or slurry-piped to the Port of Haines for loading on ocean-going freighters. Geddes Resources is working through the Canadian mine permitting process at this time. Mine development is not likely to happen before 1994 or 1995. Mine development would cost approximately \$400 million. Once in full production, the mine would employ 600 to 650 workers.¹⁷

Tulsequah Chief: Cominco and Redfern Resources Limited are involved in the advanced exploration stage at the Tulsequah Chief property located in the Taku River drainage about 25 miles from Juneau. The Tulsequah Chief mine operated between 1951 and 1957 and closed with significant reserves still in place. Cominco and Redfern have identified at least 8.6 million tons of ore with an average grade of 1.6% copper 1.2% lead, 6.5% zinc, 0.08 ounces gold per ton, and 3.2 ounces of silver per ton.¹⁸

If the Tulsequah Chief is developed, it is likely that Juneau would act as the mine's service and supply center. The State of Alaska is studying the potential for constructing a road through the Taku River valley to Atlin. Such a road would significantly improve the economics of the Tulsequah Chief (which would produce a bulk concentrate) and other nearby mining ventures. In fact, without such a road, development of the Tulsequah is unlikely.

Polaris Taku: The Polaris Taku property, located near the Tulsequah Chief, is owned by Suntac Minerals Ltd. of Vancouver. Suntac spent \$570,000 (Canadian) in 1991 on a two-month drilling program. As of March 1990, proven and probable reserves totaled 900,000 tons averaging 0.47 ounces of gold per ton. Unlike the Tulsequah Chief, mining development may occur at the Polaris Taku even without road access to the property. Suntac is seeking permission from Canadian customs to expedite from Juneau. No development plans have been announced.

Snip: Cominco Ltd. and Prime Resources Group began mining operations in 1991 at this Bronson Creek gold property. The mine employs 140 workers and produces at an average rate of about 300 tons per day. Development costs totaled \$65 million. The deposit contains an estimated 1 million tons of ore with an average grade of 0.88 ounces of gold per ton. The mine is supported by air and Hovercraft from Wrangell. The mine has an estimated life of eight to ten years.¹⁹

Johnny Mountain: The Johnny Mountain Mine, located about 50 air miles east of Wrangell, operated between 1988 and 1990, producing 75,000 ounces of gold. Skyline Gold Corporation employed 75 workers and produced 350 tons of ore per day. The mine was supported by aircraft out of Wrangell. Exploratory work is continuing on the property.²⁰

Silbak Premier: In 1989 Westmin Resources Limited commenced gold mining operations on this property located about 15 miles from Hyder. The mill was designed to handle 2,000 tons per day but technical problems and lower than expected ore grades have hindered production. As of January 1991, Westmin estimated that reserves would sustain operations for two more years at a 1,650 ton per day rate.²¹

Eskay Creek: Drilling and underground exploration is underway at a gold-silver deposit in the Eskay Creek area. The Eskay Creek area is located approximately 80 air miles northeast of Hyder and 100 miles east of Wrangell. Prime Resources Group and Corona Corporation have the rich "21B Zone" discovery which has an indicated potential of three to five million ounces of gold.²²

E. Government's Role in the Region's Mining Industry

State and federal governments play a role in Southeast Alaska's mining industry. For example, the U.S. Bureau of Mines in Juneau employs 18 workers in the Juneau office. The USBM Juneau office performs mineral investigations throughout Southeast, studies the economics of mineral deposits in the region, maintains a library of minerals-related literature among a variety of other functions.

The U.S. Forest Service manages approximately 17 million acres in Southeast Alaska including areas with high mineral potential. The Forest Service employs a mining engineer in the regional office to oversee minerals-related issues on the Tongass National Forest. In addition, the Forest Service employs minerals management specialists at the district level plus a number employees of all disciplines who participate in studying the environmental impacts of mine development and operation in the national forest.

Other government agencies with mining industry-related employment in the Southeast region include the Department of Commerce and Economic Development, the Department of Natural Resources, the U.S. Geological Survey, and the U.S. Department of Labor (Mine Safety and Health Administration).

⁷Alaska's Mineral Industry 1990, Division of Geologic and Geophysical Surveys, Special Report 45.

⁸Alaska Juneau Mine Project Description, Prepared by Echo Bay Exploration Inc, May 1990.

⁹The Socioeconomic Impacts of the Alaska Juneau Mine, prepared by the McDowell Group, updated report August 1990.

¹⁰The Socioeconomic Impacts of the Kensington Mine, prepared by the McDowell Group, February 1990.

¹¹Mineral Investigations in the Juneau Mining District, Alaska, 1984-1988. U.S. Department of the Interior Bureau of Mines.

¹²Fortunes from the Earth. An History of the Base and Industrial Minerals of Southeast Alaska, Roppel, Patricia, Sunflower University Press, 1991.

¹³Alaska's Mineral Industry 1990, Division of Geologic and Geophysical Surveys, Special Report 45.

¹⁴Exploration in British Columbia 1990. Ministry of Energy, Mines and Petroleum Resources, Victoria, British Columbia, Canada.

¹⁵Canadian Mines Handbook 1990-91. Published by Northern Miner Press, Toronto, Ontario, 1990.

¹⁶Curragh Resources Inc. 1990 Annual Report.

¹⁷The Socioeconomic Impacts of the Windy Craggy Project on Haines Alaska, prepared for Geddes Resources Limited by the McDowell Group, November, 1990.

¹⁸Draft Environmental Impact Statement, Kensington Gold Project, USDA Forest Service, 1991.

¹⁹Canadian Mines Handbook, 1990-91. Published by Northern Miner Press Inc. Toronto, Ontario, 1990.

²⁰U.S. Bureau of Mines, personal communication, 1992.

²¹Ibid.

²²California Mining Journal, July 1990.

Chapter III. Mining Industry Employment and Payroll in Southeast Alaska

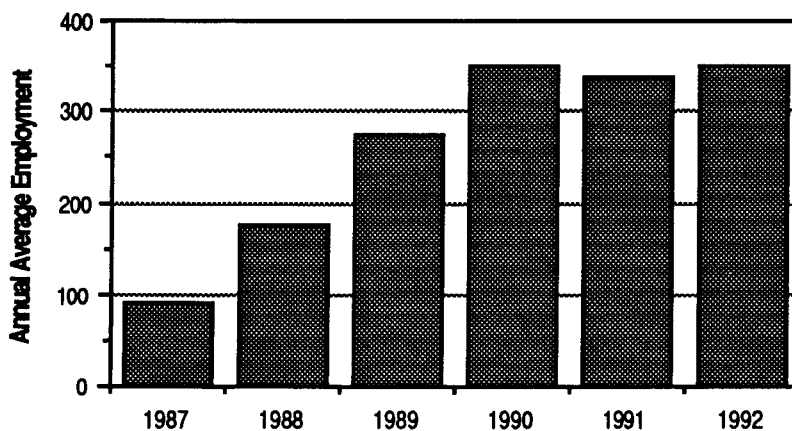
Employment in Southeast Alaska's mining industry has increased significantly over the last five years, thanks largely to the development of the Greens Creek Mine. In 1985, mining generated less than 50 jobs (on an annual average basis) in Southeast. Most of that employment was seasonal and largely non-resident. Today, as a result of the Greens Creek development, Southeast Alaska's mining industry is largely a resident and year-round industry.

Neither state or federal government reports detailed mining employment data for Southeast Alaska. The Alaska Department of Labor (ADOL) is unable to provide detailed employment numbers for the mining industry because only a few firms reported mining related employment in Southeast and therefore the data is non-discloseable (for reasons of confidentiality).

The ADOL does report an estimate of all mining employment in Southeast, including industrial materials mining, in its *Alaska Economic Trends* publication. ADOL has been reporting mining employment in the *Trends* publication since 1987, when employment was reported at about 50 jobs. Since then mining employment has climbed to about 350 jobs (as of April 1992).²³

Graph III-A

**Average Annual Employment in Southeast's Mining Industry
1987 to 1992 ***



Source: Compiled by the McDowell Group from Alaska Department of Labor data published in the *Alaska Economic Trends* series.

*1992 estimate is based on the first four months of the year only.

It is important to identify and evaluate separately the different components of the mining industry. Each component or phase of the industry (exploration, development, construction and operations) has different objectives, different labor needs, different service and supply needs. In this chapter, employment and payroll related information is presented for Southeast's mining industry, including exploration, development and operations. Employment in government agencies involved in mining issues is also quantified.

A. Exploration Employment in Southeast

There are two basic phases of exploration programs: grassroots or reconnaissance exploration and advanced exploration. Reconnaissance exploration is, in Alaska, a seasonal effort, typically lasting less than four months. Many programs operate from remote locations and are camp supported. The relatively small crews involved in reconnaissance exploration can have a high component of non-resident workers.

Advanced exploration can also be a seasonal effort with only modest labor needs. However, advanced exploration can also be a year-round program requiring dozens of workers. Echo Bay Mines' assessment of the Alaska-Juneau deposit has employed over sixty workers during peak levels of activity. Further, because considerable underground development has already occurred at the Alaska-Juneau, the assessment (drilling and other sampling) can take place year-round.

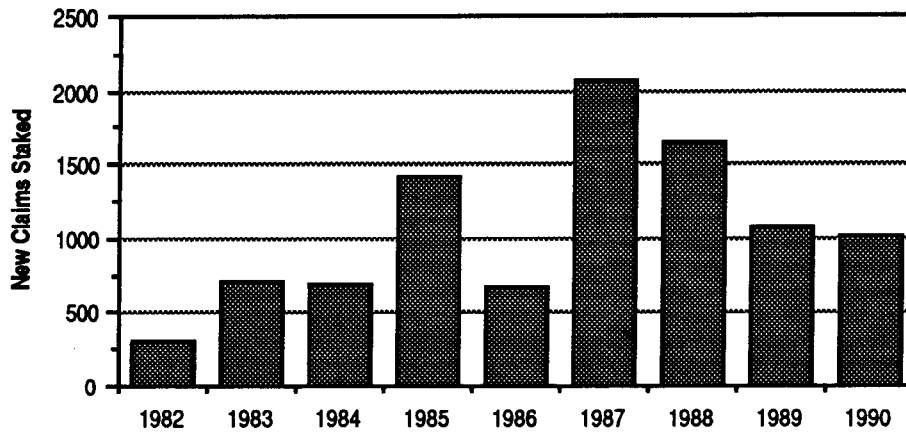
Exploration labor needs include, depending on the scale of the exploration effort, geologists, drillers, helicopter pilots, cooks and others. In addition, larger scale operations will include construction workers, miners, and engineers. Small projects may include only a couple of geologists.

Part of the assessment effort may include performing environmental and socioeconomic impact analyses necessary to acquire permits from local, state and federal government agencies. These activities have very specialized employment needs including biologists, hydrologists, and other scientists.

One indicator of exploration activity is the number of claims staked in Southeast each year. During years when more exploration crews are in the field more claims are likely to be staked, so this information represents broad trends in employment and spending. However, it is not possible to define a quantitative relationship between employment and the number of claims staked. Some exploration may be on private land and the number of claims staked on public land during an exploration program can range from one or two claims (20 acres each) to several hundred claims.

Graph III-B

New Mining Claims Staked in Southeast Alaska 1982 to 1990

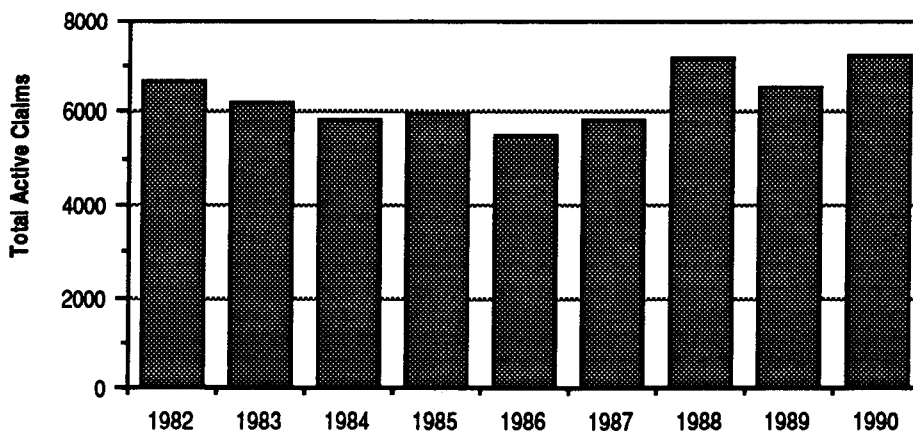


Source: Alaska's Mineral Industry, various issues. Division of Geological and Geophysical Surveys, State of Alaska.

Another general indicator of exploration activity and therefore exploration employment is the number of active mining claims. In order to maintain possession of an unpatented federal mining claim, the holder must perform at least \$100 worth of assessment work on each claim. For example, to hold a 20 claim block, the holder must spend at least \$2,000 annually in assessing the mineral discovery. Again, this data only suggests the level of exploration employment. It is not possible to define a quantitative relationship between the number of active claims and exploration employment.

Graph III-C

Active Mining Claims in Southeast Alaska 1982 to 1990



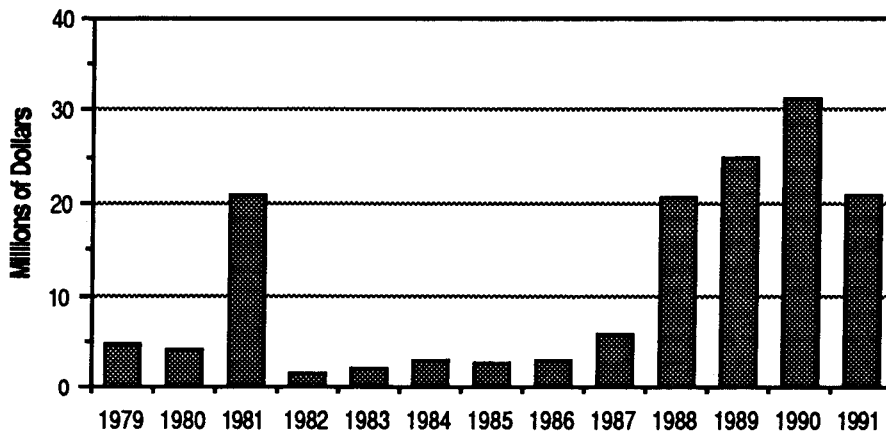
Source: Alaska's Mineral Industry, various issues. Division of Geological and Geophysical Surveys, State of Alaska.

Probably the best indicator of exploration employment is exploration expenditures. The following graph presents a twelve year summary of exploration expenditures in Southeast Alaska. These figures include all expenditures in support of exploration

programs, including materials and supplies, transportation, contract work and labor. The sharp increase in 1981 is primarily related to exploration and pre-development work at the Quartz Hill and Greens Creek projects. Exploration expenditures began increasing again in 1988 as Echo Bay Mines' work on the Alaska-Juneau and Kensington projects intensified. The decline in 1991 is the result of Echo Bay Mines shifting its focus from exploration and pre-development work to the permit acquisition process.

Graph III-D

Mineral Exploration Expenditures on Southeast Alaska Projects 1979 to 1991



Source: Alaska's Mineral Industry, various issues. Division of Geological and Geophysical Surveys, State of Alaska.

Exploration employment probably followed a trend similar to expenditures, peaking in 1990 at an estimated 160 annual equivalent jobs.²⁴ Seasonal employment was significantly higher, probably between 250 and 300 jobs (this total excludes Greens Creek, which was in full production in 1990). Though no data is available, this level of employment suggests a total exploration-related payroll of \$6 million to \$7 million in 1990.

Interviews and correspondence with firms involved in exploration activities in Southeast suggests that direct 1991 employment averaged 55 for the year. Payroll totaled an estimated \$2.3 million (these estimates are not directly comparable with the 1990 numbers because the estimates for that year included certain contracted labor). Echo Bay Mines (which is involved in advanced exploration and pre-development activities) accounted for most of this employment and payroll.

It is important to recognize that the employment and payroll estimates for 1991 do not include contracted labor. Drilling, construction, mining and transportation services are often contracted. Interviews with mining related firms suggests that the total number of people working in Southeast that generated earnings in 1991 from contracts with exploration and mining companies was approximately 200. This is a

peak-season estimate and is comprised mostly of drilling and mining contractors. It also includes environmental researchers and consultants, pilots and many others.

B. Mine Construction Employment

Currently there is no mine construction occurring in Southeast Alaska. However, it is important to consider because a large mine construction project recently occurred (Greens Creek) and further large mine construction is likely in the future (Alaska-Juneau and Kensington). The construction efforts can have significant impacts on nearby communities.

The Greens Creek construction program included a peak employment level of approximately 300 workers. The Alaska-Juneau and Kensington projects would have similar construction labor force requirements. In the typical construction program, employment levels vary over the two to three year construction effort, peaking during the summer, often as weather permits.

Mine construction programs have specialized labor requirements. Heavy equipment operators are required to build roads, establish building sites, construct tailings dams and other facilities. General and specialized construction workers, plumbers and electricians are also needed to develop surface facilities. The Construction phase also usually includes pre-mining underground development. Skilled underground miners are required for this type of effort, in addition to the engineers, geologists and other involved in planning the development.

Because the mine construction phase is short term, there is typically a greater proportion of non-residents in the workforce than in the long term operations phase. Most mining companies have local hire policies, but it is often necessary to use non-local contractors who bring in their own employees.

C. Production Employment

Development of the Greens Creek Mine in 1989 added a stable, year-round component to the region's mining industry. The Greens Creek Mine employs 265 workers year-round. With the day-to-day activity of mine production comes a level of socioeconomic stability usually not seen during the exploration and construction phases. The production workforce is a permanent workforce that is more likely to bring with it families, buy homes, and establish itself in the community.

Mine production workers earn the highest average salaries in Juneau. High average salaries, along with a high proportion of residents in the labor force, results in a high level of impact in the service and supply sector. This secondary impact creates jobs and income in the local support sector. Indirect or "multiplier" effects are discussed in more detail elsewhere in this report.

The Greens Creek Mine accounts for about 75% of mining-related employment in Southeast. The mine is Juneau's largest private sector employer, both in terms of number of workers and total annual payroll.

Not including mining of industrial materials (such as sand, gravel, crushed rock and other construction materials), the only other mineral production employment in Southeast occurs in the Porcupine placer mining district near Haines. The area has a long history of small scale placer mining. Placer mining is the process of recovering gold concentrated in sand and gravel deposits. Sluice boxes or some other gravity concentrating equipment are used to separate the gold from the sand and gravel. Today, only a handful of people (probably around five or six) are employed placer mining in Southeast .

Most Southeast communities have sand, gravel and rock quarries that provide materials for road construction and maintenance, site preparation for residential, commercial and industrial construction and for a variety of other construction purposes. It is difficult to measure employment in this component of the mining industry because many of these jobs are typically credited to the construction industry. Alaska Department of Labor data indicates that during the summer of 1991 there was a total of approximately 80 jobs in the industrial minerals category for all of Alaska, including 40 jobs in crushed rock, sand and gravel mining.²⁵

Actual employment in the industry is probably significantly above this number. For example, the State Division of Geological and Geophysical Surveys reported that 850 people were employed in mining of building stone, sand and gravel in Alaska during 1991.²⁶ No regional data is currently available but probably 10% of that employment was in Southeast Alaska. For purposes of this study, a U.S. Bureau of Mines estimate of 50 seasonal jobs (25 annual equivalent jobs) in Southeast's industrial materials sector will be used.²⁷ This estimate includes employment in quarries where material is sorted and/or crushed. It excludes employment in the mining and handling of non-crushed material used in logging road construction, for example.

D. Indirect Employment and Payroll Impacts

In addition to the 350 jobs created directly by the mining industry in Southeast Alaska, a number of other jobs are created in the region's support sector as a result of mining industry spending. These support sector jobs fall into two general categories: indirect jobs and induced jobs.

Indirect jobs result from spending by mining companies on goods and services. Fuel purchases, for example, create jobs with fuel suppliers. Similarly, spending on helicopter charters generates employment opportunities for pilots, mechanics and others. Drilling, exploratory mining, construction and camp services are also common forms of indirect mining-related employment.

In some cases there is no distinction between direct and indirect employment. A firm initiating an exploration program may have only two or three employees on the project along with dozens of contracted workers. There is little difference in terms of economic impact between these direct and indirect workers.

Induced jobs are the result of the demand for goods and services by mining company employees. These induced jobs are created in the service sector (hotels, personal services, health care, auto repair, etc.), the retail sector, elsewhere in the private sector and in the public sector (local government administrators, teachers and others).

On the local level, induced employment impacts are a function of residency and earnings. Mining projects with a relatively high degree of non-resident labor will generate relatively low induced employment. Non-residents are less likely to spend their earnings locally than residents. The greater the local spending, the greater the induced employment. Of course, in general, a worker with high wages will have greater local spending than a worker with low wages.

Employment Multiplier: Indirect and induced economic impacts are often quantified together by an employment multiplier. For example, an employment multiplier of 1.5 tells us that for every direct or basic job, half a job is created indirectly in the support sector. In other words, for every two basic industry jobs, another job is created in the support sector. Alaska's employment multiplier (all industry average) has been estimated at approximately 1.5.

Employment multipliers vary from industry to industry. As previously mentioned, non-resident labor participation and average salaries are determining factors. The service and supply needs of the industry also determine secondary impacts. If Alaska's support sector is capable of competitively meeting the supply needs of an industry, a higher employment multiplier will result. If not, industry will buy from out-of-state and there will be reduced economic benefit in-state.

Estimating an employment multiplier requires modeling of the region's entire economy and detailed analysis of all its industries. The data that is provided in this report can be used to refine existing models of the region's economy and more accurately measure the economic impact of the mining industry.

Past economic modeling work suggests that Alaska's mining industry employment multiplier is about between 1.7 and 2.0. The Bureau of Economic Analysis estimated an Alaska mining industry multiplier of 2.01. This estimate is based on very limited data. The U.S. Forest Service uses a multiplier of 1.74, developed from their Interactive Policy Simulation System (IPASS) for the mining industry in Southeast. A statewide model developed by Alaskan economist John Weddleton also suggests that the employment multiplier for the nonferrous metal mining industry in Alaska is 1.74. Specifically, this multiplier includes an indirect impact of 0.26 jobs and an induced impact of 0.48 jobs (in other words, 1 direct job plus 0.26 indirect jobs plus 0.48 induced jobs equals 1.74).²⁸

In fact, the full economic impact of the mining industry would best be described by two or three different multipliers. The indirect and induced economic impacts differ significantly from one phase of the mining industry to the other. For example, the indirect and induced impacts of the exploration component of the industry are less than the operations component. The indirect and induced impacts of the construction phase are also unique. Unfortunately, short of a comprehensive assessment of the entire economy, it is not possible to quantify three different multipliers for the mining industry.

For purposes of this analysis, an overall multiplier of 1.74 is considered reasonable for measuring the indirect and induced impacts of the mining industry in Southeast. Using a multiplier of 1.74 suggests that the private sector portion of the industry indirectly accounts for nearly 260 jobs in the support sector. Therefore, total private sector mining industry employment in Southeast Alaska, including direct and indirect employment, totals about 610 jobs (350 direct jobs \times 1.74 = 610 total jobs).

The 350 direct private sector mining industry jobs in Southeast Alaska accounted for \$15 million in annual payroll in 1991 (excluding benefits). Further, based on the average salary in Alaska's support sector (approximately \$25,000), the mining industry indirectly is responsible for another \$6.5 million in support sector wages (260 \times \$25,000). Therefore, the mining industry is the source of direct and indirect payroll totaling nearly \$22 million, excluding benefits.

This total does not include all mining related jobs in Southeast, however. Mining activity in British Columbia and Yukon Territory is also creating support sector jobs in Southeast Alaska. An informal survey of several Southeast Alaska businesses suggest that approximately 20 jobs result from spending by Canadian exploration and mining operations, notably Curragh Resources mines in the Yukon and Cominco's Snip mine in British Columbia (see Chapter II). Payroll for these jobs was approximately \$500,000 in 1991.

E. Other Mining-Related Employment in Southeast

Mineral Industry-Related Government Employment

The U.S. Department of Interior, Bureau of Mines is the largest public sector entity involved in Southeast Alaska's mineral industry. The Bureau of Mines employs 18 workers in Juneau. Bureau payroll totals approximately \$700,000.

State and federal agencies employ several other mining industry-related people in Southeast, including the United States Geological Survey, U.S. Forest Service, the Alaska Department of Natural Resources, and the Alaska Department of Commerce and Economic Development. Some of this employment is seasonal and non-resident (such as the USGS, excluding their Water Resources Division), but most is permanent, resident employment.

Total minerals management-related government employment in Southeast is estimated at 25 jobs accounting for approximately \$1 million in annual payroll. This employment and payroll also generates indirect and induced economic benefits for the region. Approximately 20 jobs and \$500,000 in payroll are created in Southeast's support sector as a result of this government activity.

F. Non-Residents in the Mining Labor Force in Southeast

Most of the workers in Southeast Alaska's mining industry are year-round residents of the region. Overall, approximately 90% of employees in the region's industry live in Southeast, and almost all are in Juneau (working for the Greens Creek Mine).²⁹ This percentage varies within the industry, with the highest level of non-resident participation in the reconnaissance exploration phase and the lowest level in the operations phase.

Basic industry in Alaska in general has a high non-resident labor component. In the seafood processing industry for example, 50% of the workers are from out-of-state.³⁰ In commercial fishing, approximately 25% of the participants are non-residents. These statistics reflect the seasonal nature of the seafood industry and, in the case of seafood processing, the low wages paid (wages paid by the industry are not high enough to attract local residents, who can work in other industries for higher wages). As another example of non-resident participation, the logging industry includes 40% non-resident labor. Tourism also has a non-resident component higher than the mining industry.³¹ In fact, among Alaska's basic industries, mining has the lowest non-resident labor component.

In terms of economic impact, the important factor in the resident/non-resident issue is where workers establish permanent residency. People spend most of their earnings where they live, not where they work. In the case of the Greens Creek Mine, employees must live in Juneau. Therefore, Juneau is where they spend most of their earnings and where they have the greatest economic impact. Non-resident seasonal workers may spend three or four months working in Southeast, but at the end of the summer they go home taking their earnings with them. The economic impact of resident versus non-resident labor in the mining industry is discussed further in Chapter IV of this report.

G. Summary of Mining Related Employment in Southeast

In 1991 the mining industry directly generated the annual equivalent of approximately 375 jobs in Southeast Alaska. This includes jobs in exploration and production and includes only employees on mining company payrolls. The Greens Creek Mine accounts for three-quarters of this employment. Exploration and development activities at the Alaska-Juneau and Kensington mines account for most of the remainder. Mining of industrial minerals accounts for the annual

equivalent of approximately 25 jobs. In addition, government also employs approximately 25 workers in Southeast who participate in mining industry activity in the region.

The mining industry in Southeast Alaska also indirectly generates approximately 280 jobs (annual equivalent) in the region's service and supply sectors. This includes both indirect employment (drilling, mining, and other contracted labor) and induced employment (as a result of spending by the mining industry-related population). Mining activity in Canada also generates jobs in Southeast Alaska's service and supply sectors.

Including all direct and indirect employment, the mining industry accounts for approximately 675 annual equivalent jobs in Southeast Alaska. In 1991, workers filling these jobs earned an estimated \$24 million in payroll (excluding benefits and other labor overhead).

Table III-A

**Mining Industry-Related Employment in Southeast, 1991
(Annual Average)**

Direct		375
	Reconnaissance. Exploration	15
	Advanced Exploration	40
	Production	295
	Metallic Minerals	270
	Industrial Materials	25
	Federal and State Government	25
Indirect and Induced		300
	From U.S. Operations*	280
	From Canadian Operations	20
Grand Total		675

*Includes indirect and induced effects of federal and state government activity in Southeast Alaska related to the mining industry.

²³Alaska Economic Trends, July 1992, Alaska Department of Labor.

²⁴Alaska's Mineral Industry 1990, Division of Geologic and Geophysical Surveys, Special Report 45, pg. 9

²⁵Alaska Department of Labor, unpublished quarterly employment and earnings report data for third quarter of 1991.

²⁶Alaska's Mineral Industry 1991 Summary, Division of Geologic and Geophysical Surveys, Information Circular 35.

²⁷U.S. Bureau of Mines, Alaska Field Operations Center, Juneau Branch. Personal communication.

²⁸Population Projections and Fiscal Impact Analysis for the AJ Gold Mine, Technical Memorandum. Prepared by Northern Economics, December 1991.

²⁹Residency information provided by Greens Creek Mining Company and other mining and exploration firms operating in Southeast Alaska.

³⁰Non-Residents Working in Alaska, 1988. Alaska Department of Labor.

³¹Alaska's Visitor Industry: An Economic Profile. Prepared for the Alaska Division of Tourism by the McDowell Group, July 1991.

Chapter IV. Mining Industry Expenditures in Southeast Alaska

A. Spending on Goods and Services in Support of Metallic Mining Industry Operations

The mining industry has a wide variety of service and supply requirements. Some are highly specialized, others are very basic. In this chapter, spending in Southeast Alaska by the mining industry is quantified, including an assessment of service and supply needs by the various phases of the industry (exploration, construction, operations). This type of analysis is important because it helps us understand (and quantify) the indirect economic impacts of the industry in Southeast Alaska.

In 1991, the mining industry spent approximately \$40 million in Southeast Alaska, including payroll and benefits. Most of this spending is in support of operations at the Greens Creek Mine. Advanced exploration projects account for about one-quarter of the total. This total does not include spending in support of industrial minerals mining operations which may have totaled between \$1 million and \$2 million, though no specific data is available.

The detailed spending data collected from exploration and mining firms during the course of this study is confidential and therefore only industry totals can be presented. The following table presents spending totals by type of expenditure. These totals include only spending with businesses based in Southeast Alaska.

Table IV-A

**Mining Industry Spending with Southeast Alaska Businesses
During 1991 (thousands of dollars)***

Transportation		\$3,700
Freight	\$1,100	
Personnel	2,600	
Fuel		2,700
Supplies/Equipment		5,300
Drill Supplies/Machinery	4,300	
Explosives	900	
Chemicals	-	
Food	100	
Lodging		300
Contract Services		5,900
Drilling	200	
Construction	1,200	
Mining	-	
Other	4,500	
Professional Services		1,600
Legal	400	
Engineering	1,100	
Accounting	-	
Other	100	
Other Miscellaneous		600
Total Spending in Southeast**		\$20,100

*Excludes an estimated \$2 million in spending by mining companies operating in Canada but purchasing supplies and services in Southeast Alaska.

**Excluding direct personnel costs.

In addition to this \$20.1 million in spending in Southeast Alaska, mining companies also funnel money into the region's economy through wages, salaries and benefits. The industry paid \$15 million in total payroll in Southeast during 1991 (see Chapter III) plus another \$3 million to \$4 million in benefits. Added to this spending is approximately \$2 million spent by Canadian projects purchasing goods and services in Southeast Alaska. Therefore, the total direct impact of the metallic mining industry on the region's economy was approximately \$40 million in 1991. Spending in support of industrial materials mining may have accounted for another \$1 million to \$2 million, according to McDowell Group estimates.

B. Effect of Mining Industry Spending in Southeast

Mining industry spending affects nearly all segments of the Southeast Alaska economy. In Chapter III of this report the indirect employment effects of mining industry spending were estimated, based on an employment multiplier. In this section, a more detailed discussion of the mining industries indirect impacts on the Southeast Alaska region is provided.

It is important to recognize that spending patterns differ among the various stages of exploration, advanced exploration and mine operations. Therefore, the economic impact of the various stages differs. To reflect this, spending pattern data from actual exploration or mining projects is presented in the following graphs. These graphs represent spending in Southeast only and do not represent total spending in support of an exploration or mining program (a portion of total spending occurs out of state).

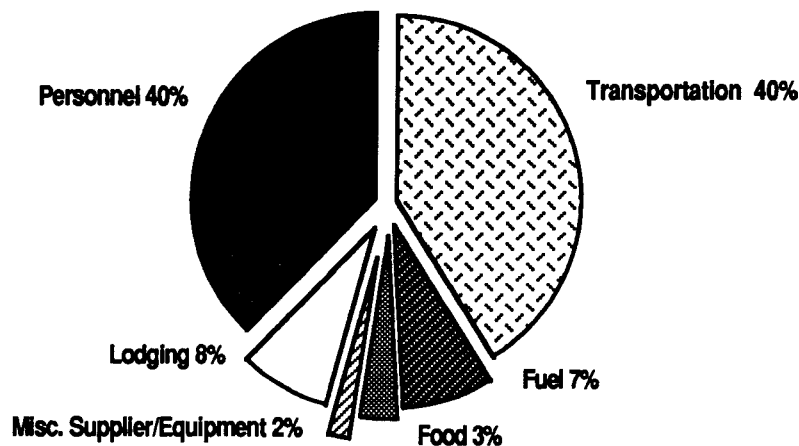
Based on interview results, Southeast spending patterns for a typical exploration program are presented in Graph IV-A. Spending patterns differ widely among exploration programs, as does the proportion of in-state versus out-of state spending. In-region spending, as presented in Graph IV-A, is dominated by personnel and transportation costs. A portion of personnel expenditures have relatively little impact on the Southeast economy because employees are non-residents who are in the region only for the three to four month field season and who often live in remote field camps. Non-resident participation among exploration firms surveyed ranged from 50% to 90% of total employment (this excludes Echo Bay Mines employment).

Noticeably absent from this data are contract services, particularly drilling services. While there are drilling contractors based in Southeast, interview results suggest that most exploration programs utilize outside drilling contractors. Drilling costs can account for as much as one-third (or more) of an exploration program budget.

Overall, two-thirds to three-quarters of all exploration spending was with Southeast businesses. Southeast's business community is well equipped to provide most of the service and supply needs (notably helicopter services, fuel, lodging, etc.) of the typical exploration program. Total 1991 exploration budgets for firms surveyed ranged from \$150,000 to \$900,000 (excluding work on the Alaska-Juneau and Kensington projects).

Graph IV-A

Mining Industry Spending Patterns in Southeast Alaska Exploration Program

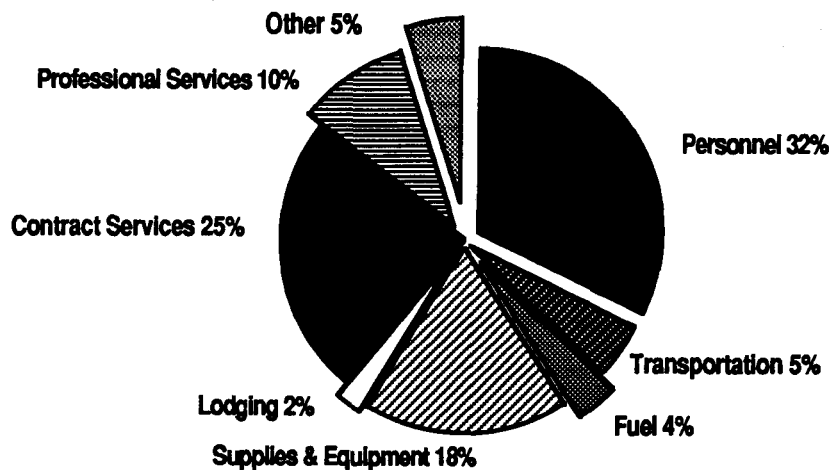


In the advanced exploration/pre-development phase total spending usually increases dramatically and spending patterns shift from the personnel and transportation dominated pattern of broader exploration programs. Personnel spending is still an important component of in-region spending (about one-third of the total) in this phase. Importantly, employment in this phase shifts to a largely resident workforce. In this phase contract and professional services together are the largest component of in-region spending. Contracted services might include drilling, mining, and construction plus environmental and engineering services. In some cases contract services can account for the nearly all of the advanced exploration/pre-development budget.

A relatively higher proportion of total spending during this phase occurs out-of-state. Service needs are highly specialized and often not available in Southeast. For example, there are no businesses in Southeast that specialize in underground development; there are many such firms located outside Alaska. Other examples of specialized services not available in Southeast include metallurgical testing (for testing ore processing techniques) and mine feasibility analyses. These types of services can be very expensive and can consume a large portion of the total budget.

Graph IV-B

Mining Industry Spending Patterns in Southeast Alaska Advanced Exploration/Pre-Development Program



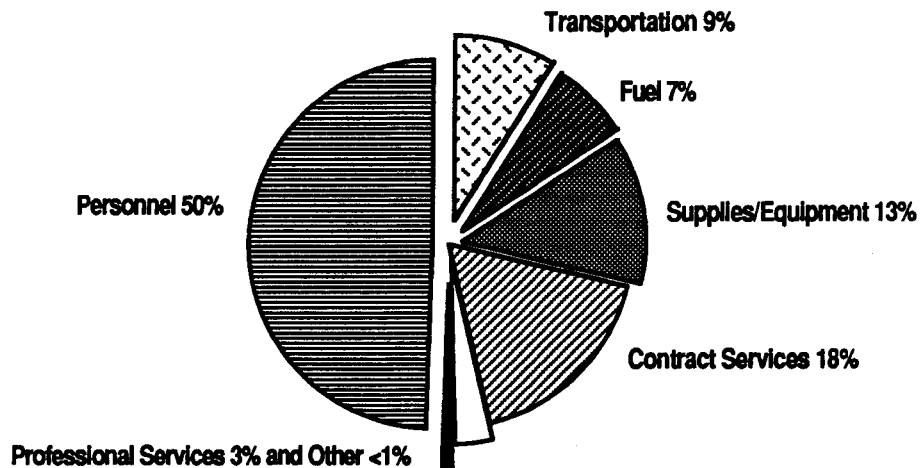
NOTE: Percentages may not total 100% due to rounding.

Mine development and construction follows the advanced exploration/pre-development phase. No spending data is available for mine construction in Southeast, however, it is clear that the largest component of spending is contract construction services. Typically all construction is contracted, including access development, mill construction and construction of ancillary facilities. Both local and non-resident contractors would be used, with the more specialized jobs going to outside firms.

Graph IV-C depicts in-region spending by an operational mine. By far the largest component of operation spending within the region is for personnel. This is particularly significant because, unlike many exploration programs, most mine personnel are year-round residents who typically establish households in the area and are responsible for a high level of spending in the support sector.

Graph IV-C

Mining Industry Spending Patterns in Southeast Alaska Operational Mine



No out-of-state spending data was collected as part of this study. Of course the ratio of in-state and out-of-state spending could differ significantly from one mine to the next. It is estimated that at Southeast's only operating mine, approximately one third of all operational spending occurs out-of-state. This out-of state spending is necessary because specialized materials are not available from local businesses. Further, the mine is remote and therefore it is more cost effective to ship large volumes of materials directly from outside suppliers to the mine site than to ship through nearby communities where additional handling would be required.

C. Spending by the Mine-Related Population

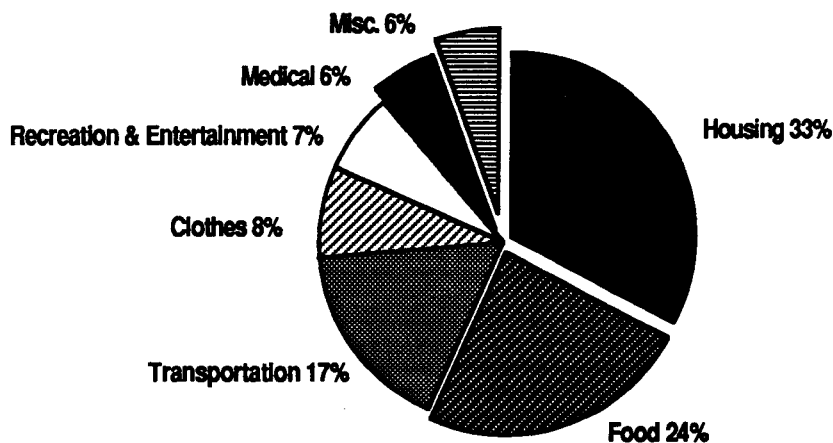
Dollars spent by mining companies and their employees circulate through the local and regional economies several times before finally flowing out of Alaska. Eventually most of these dollars leave the region because very few goods are manufactured in Southeast Alaska. Spending by a mining company or an employee at a grocery store demonstrates this point. About two-thirds of a \$100 purchase, for example, immediately flows to non-local wholesalers. Most of the remaining \$33 will circulate through the local economy once again as payroll for store employees, profits for owners, taxes paid to local government, payments for utilities, etc. As these monies are spent, another two-thirds exits the local economy (\$22 of the \$33).

This process of re-circulation continues until all of the original \$100 has exited or "leaked" from the local economy.

Of course this is a very simplified model and this spending leakage varies from one sector of the economy to another. All components of the support sector are affected by mining industry-related spending, including spending by employees. The following profile of a typical Juneau household provides a description of how mining company employee wages circulate through the local economy.³²

Graph IV-D

Typical Juneau Household Budget Disposable Income Spending Patterns



NOTE: Percentages may not total 100% due to rounding.

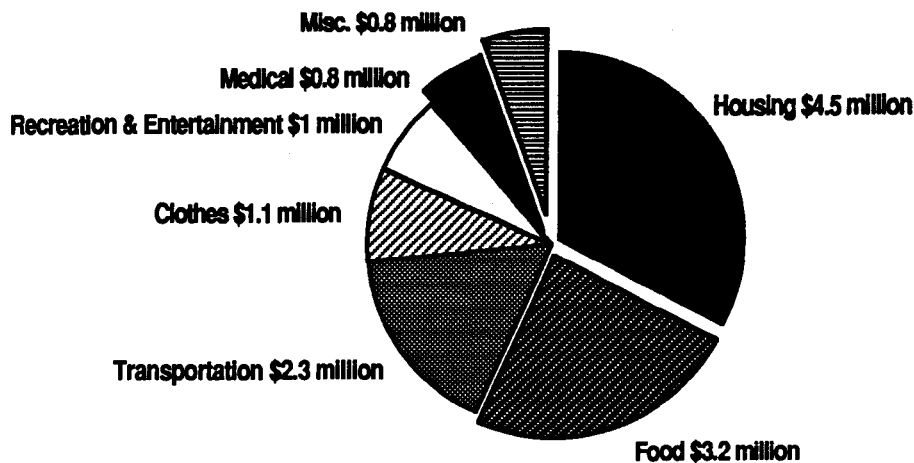
This graph represents how the typical Juneau household spends their after-tax income. Not all household spending is local spending, of course, but this information does provide a good indication of how the local service and support sector is affected by new payroll dollars flowing into the economy.

Combining this data with the payroll data presented in Chapter III, it is possible to quantify how much the various sectors of the region's economy benefit from spending by the mining-related population. Assuming that 90% of total payroll is paid to residents (people living in Southeast) and subtracting from total payroll an estimate of taxes paid (assumed to be 15% of income), an estimate of disposable income is derived. Assuming a direct mining industry payroll of \$15 million, including \$13.5 million to residents, total disposable income is estimated at \$11.5 million (in 1991). In fact total disposable income is higher than this amount because certain sources of income, such as the Permanent Fund Dividend, are excluded.

Based on this estimate of disposable income, the following graph quantifies spending by household expenditure category. These spending totals include out-of-state spending, though certain categories of spending, such as food, almost entirely local.

Graph IV-E

Southeast Mining Household Spending Totals (includes out-of-state spending)



From this data it is also possible to estimate the amount of taxes paid to local governments via sales taxes. For example, the assumption can be made that all purchases on food are taxable. In Juneau, where 90% of the Southeast mining population resides, the sales tax is 4%. This suggests that in Juneau the mining related population directly pays \$150,000 annually in sales taxes on food alone.

Other portions of the household budget are also taxable. In the housing category, fuels and utilities payments (9% of the household budget) are taxable. These expenditures probably generate another \$50,000 in tax revenues for the City and Borough of Juneau. It is not possible to predict how much household spending is non-local (mail order, trips to Seattle, etc.), but if the assumption is made that half of all household spending is local and taxable (food, utilities, and a portion of spending on clothing, recreation & entertainment), then sales tax payments total approximately \$300,000. This total does not include taxes paid on local purchases made directly by the mine.

It is important to recognize that spending is not the only factor that determines indirect impacts. For example, the mining industry's impact on local government services is largely a function of population. The number of administrators, planners, police officers, teachers, hospital workers and others in local government is dependent on population demands, not on spending. Based on annual equivalent employment of approximately 300, it is estimated that the mining industry accounts for a population in Juneau of approximately 1,000 residents. That is the equivalent of about 4% of Juneau's population. Based on a strictly proportional relationship, that suggests that approximately 50 of Juneau's 1,400 local government jobs (including school teachers and hospital employees) exist to serve the mining-related population.

³²Alaska Geographic Differential Study. Prepared for the State of Alaska Department of Administration by the McDowell Group, April 1985.

Chapter V. The Role of the Mining Industry in Southeast Alaska's Local and Regional Economies

A. The Southeast Alaska Economy

The Southeast Alaska economy is a diversified mix of private industry and government. State government is the largest employer in the region, accounting for 5,000 jobs and drawing in \$150 million in payroll and millions of dollars more in grants and funding for local governments. Juneau is the primary beneficiary of state government employment and spending. State government accounts for over two-thirds of Juneau's economy.

Federal government is also an important player in the Southeast economy. Federal government employs approximately 2,000 civilian workers in Southeast and 700 uniformed military personnel (almost all Coast Guard). These workers draw over \$80 million in wages and salaries into the Southeast economy.

The leading private sector industries in Southeast are the seafood industry and the forest products industry. Approximately 4,000 jobs (annual equivalent) are generated in commercial fishing and seafood processing in Southeast. The seafood industry plays a relatively minor role in Juneau's government dominated economy, but is very important in the economies of all the region's other communities.

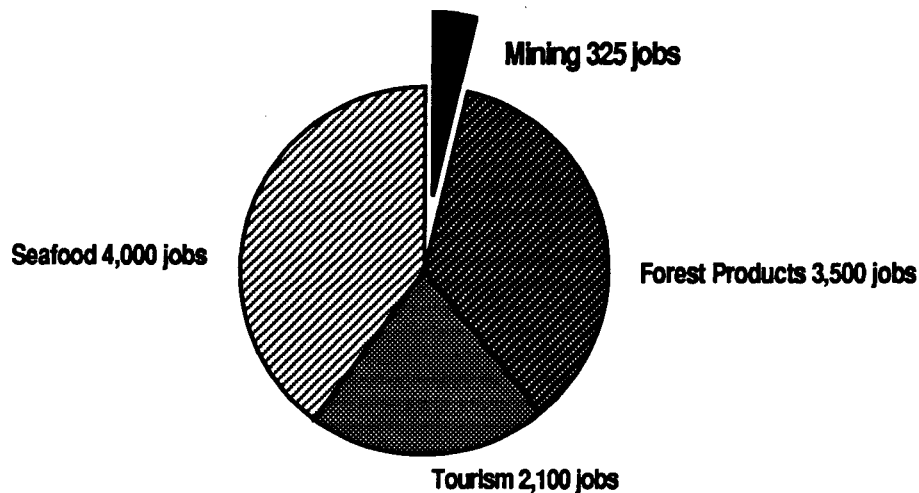
The forest products industry generates about 3,500 logging, sawmill and pulpmill jobs in Southeast, plus approximately 500 hundred more jobs in road construction, stevedoring, towing and related fields. The industry accounts for over \$160 million in annual payroll.

Tourism is a growing industry in Southeast Alaska. Employment in the industry is estimated at approximately 2,100 jobs. This is annual equivalent figure; seasonal employment in the industry is significantly higher. These are jobs generated as a result non-resident visitor travel to the region. Annual payroll in the industry is estimated at \$37 million.

Today, the mining industry plays a relatively minor role in the economy of Southeast Alaska. Mining directly accounts for 325 basic industry jobs (annual equivalent) in the region, or about 2% of all basic industry (including government). Mining accounts for approximately 3% of private sector basic industry employment.

Graph V-A

Private Sector Basic Industry Employment in Southeast Alaska



NOTE: Employment estimates include resident and non-resident labor.

It is important to recognize that mining of industrial materials in Southeast is not a basic industry activity. Currently, industrial materials are mined to meet the needs of the local construction market only and no new money is drawn into the region's economy as a result of this mining activity. Therefore, industrial materials mining now serves a support sector function only.

B. Mining's Role in the Local Economies of Southeast Alaska

While mining is not a leading player in the regional economy, the industry plays a relatively more important role in several local economies in the region. Juneau, Skagway and Wrangell all benefit economically from nearby mining activity.

Skagway is the site of a marine terminal and ore concentrate loading facility. Lead and zinc concentrates from Curragh Resources' Faro and Mt. Hundere mines in the Yukon Territory are trucked to Skagway at a rate of about one truck every 30 minutes. Ten Skagway residents work at the terminal, an important employer for the community of 700 residents. Truck drivers are residents of Canada, but their presence in Skagway does benefit the local economy (restaurant sales, etc.). The terminal is also an important source of property tax revenues for the City of Skagway.

In Wrangell, Canadian exploration and mining activity is having an important impact on the local economy. Over the last several years Wrangell has been the expediting center for what was a gold rush into western British Columbia. While Canadian exploration activity in the area is now declining, operation of Cominco's Snip mine continues to benefit the local economy. The Snip mine is supported by Hovercraft and aircraft from Wrangell. An informal survey of businesses in Wrangell identified as many as ten local jobs that would probably not exist without this Canadian mining activity. Local economic impact also includes approximately \$1 million in local purchases (mostly fuel) made by Canadian mining companies (this is highly variable from year to year).

The mining industry's economic impact is currently greatest in Juneau. The Greens Creek Mine accounts for 265 local jobs and approximately \$12 million in annual payroll. Including indirect and induced employment, the Greens Creek project accounts for an estimated 460 local jobs (assuming a multiplier of 1.74). Echo Bay Mines employs approximately 40 workers in Juneau in their Alaska-Juneau and Kensington mine development efforts. Both Greens Creek and Echo Bay Mines purchase millions of dollars worth of goods and services from Juneau area businesses.

C. Outlook for the Mining Industry in Southeast Alaska

Juneau and Southeast Alaska can probably look forward to increasing economic impact from the mining industry. Development of the Alaska-Juneau and Kensington mines would add 800 jobs to the Southeast mining sector and approximately \$35 million in annual payroll.

Farther into the future, development of the Quartz Hill mine could bring another 800 jobs and \$35 million in payroll. Therefore, it is possible that within ten years, the mining industry could directly account for approximately 1,900 jobs in Southeast and over \$80 million in annual payroll. In comparison, Southeast Alaska's tourism industry now directly accounts for about 2,100 jobs (annual equivalent) and \$37 million in annual payroll.³³ Including indirect impacts, in ten years mining could account for 3,200 jobs in Southeast Alaska.

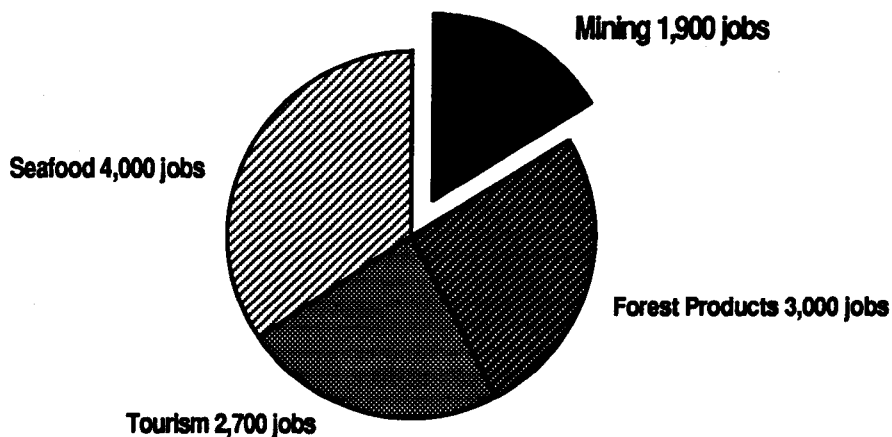
Additional Canadian mine development could also impact Southeast's economy. Road construction in the Taku River Valley could prompt development of the Tulsequah Chief Mine. Construction of a deepwater port and concentrate handling facility to service the Tulsequah (and other mines in Canada) would mean jobs for Alaskans. As the mine's service and supply center, Juneau's business community would benefit significantly.

The following diagram illustrates the potential role of the mining industry in Southeast Alaska's economy in ten years. This assumes that the Alaska-Juneau, Kensington and Quartz Hill mines are all developed within the next ten years. For purposes of this presentation, it is assumed that tourism employment will grow at

an annual rate of 2.5%, seafood industry employment will not change (actually there is some chance that employment in this industry will decline over the next ten years) and that forest products employment will decline by about 500 jobs (as a result of declining Native corporation timber harvests).

Graph V-B

**Private Sector Basic Industry Employment
in Southeast Alaska, Ten Year Forecast**



³³Alaska's Visitor Industry; An Economic Profile. Prepared for the Alaska Division of Tourism by the McDowell Group, July 1991.

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