Proceedings of the 14th Annual British Columbia Mine Reclamation Symposium in Cranbrook, BC, 1990.
The Technical and Research Committee on Reclamation

QUEENSTAKE RESOURCES LTD.

MOYIE RIVER PROJECT - CRANBROOK, BC
Fort Steele Mining District

N. T. S. 82F/SE

Placer Leases #1902,1080,1775,1773, 2948,1081
Queenstake Resources Ltd.

by

Michael P. Henrick, Ph.D.

Covering work carried out during the period:

July, 1985 through May, 1990

May 29,1990

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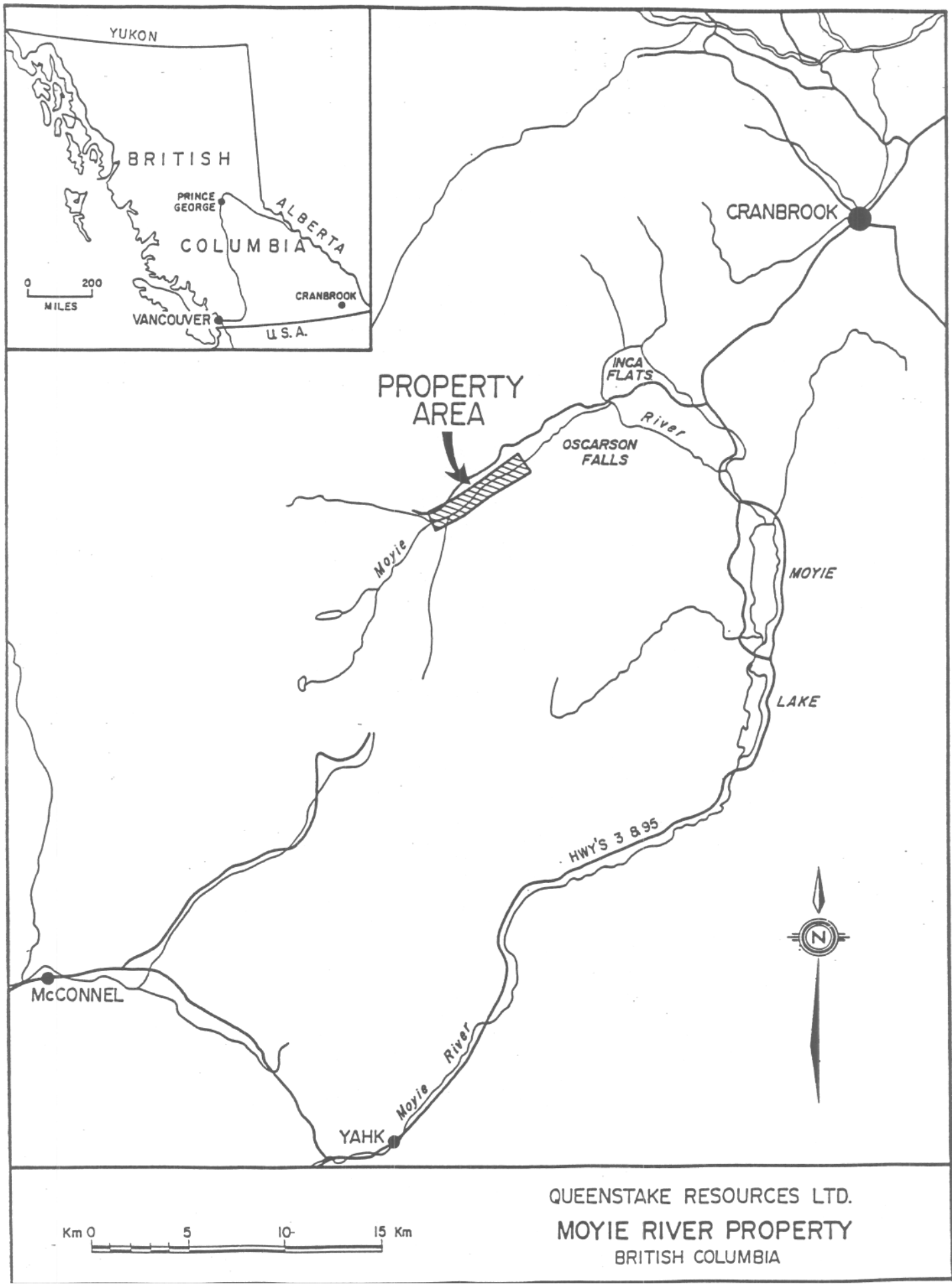
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BRITISH
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PROPERTY AREA
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HWY'S 3 & 95
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Moyie River
YAHK
Km 0 5 10 15 Km
QUEENSTAKE RESOURCES LTD.
MOYIE RIVER PROPERTY
BRITISH COLUMBIA

Location and Access

The property is located in the Fort Steele mining district of south central British Columbia, NTS 82F/8 Grassy Mountain, map sheet. Access to the property is via Highways 3 and 95 south from Cranbrook to the Lumberton turn-off, a distance of 16 kilometers, thence via the Moyie River road and the Semlim Creek road a distance of 16 kilometers to the lower end of the property. (Figure 1)

Claims and Ownership

The Queenstake Resources Ltd. Moyie River Placer Project consists of six contiguous placer leases (1902, 1080, 1775, 1773, 2948 and 1081) situated twelve kilometers below the headwaters of the Moyie River and extending downstream for a distance of six kilometers. All of the leases are owned outright by Queenstake Resources Ltd. and bear no contractual or royalty obligations (Figure 2).

Physiography

The property is located in the Moyie Range of the Purcell Mountains at an elevation from 4,100 to 4,300 feet A.S.L. The valley floor varies from 500 to 950 feet in width and is sparsely treed with second growth timber consisting mainly of large white poplar and minor small to medium sized pine and spruce. The climate is typical of the Rocky Mountains having temperature extremes of 30°C in summer to -40°C in winter. Winter snow accumulations are moderate to heavy. Summer precipitation occurs mainly as showers and low intensity rains predominantly during the month of June. The summer season starts in mid May and continues to mid October. During this period, the days are generally hot and the evenings are cool. Frost may occur at anytime during this period with the first snowfall usually occurring in late October.

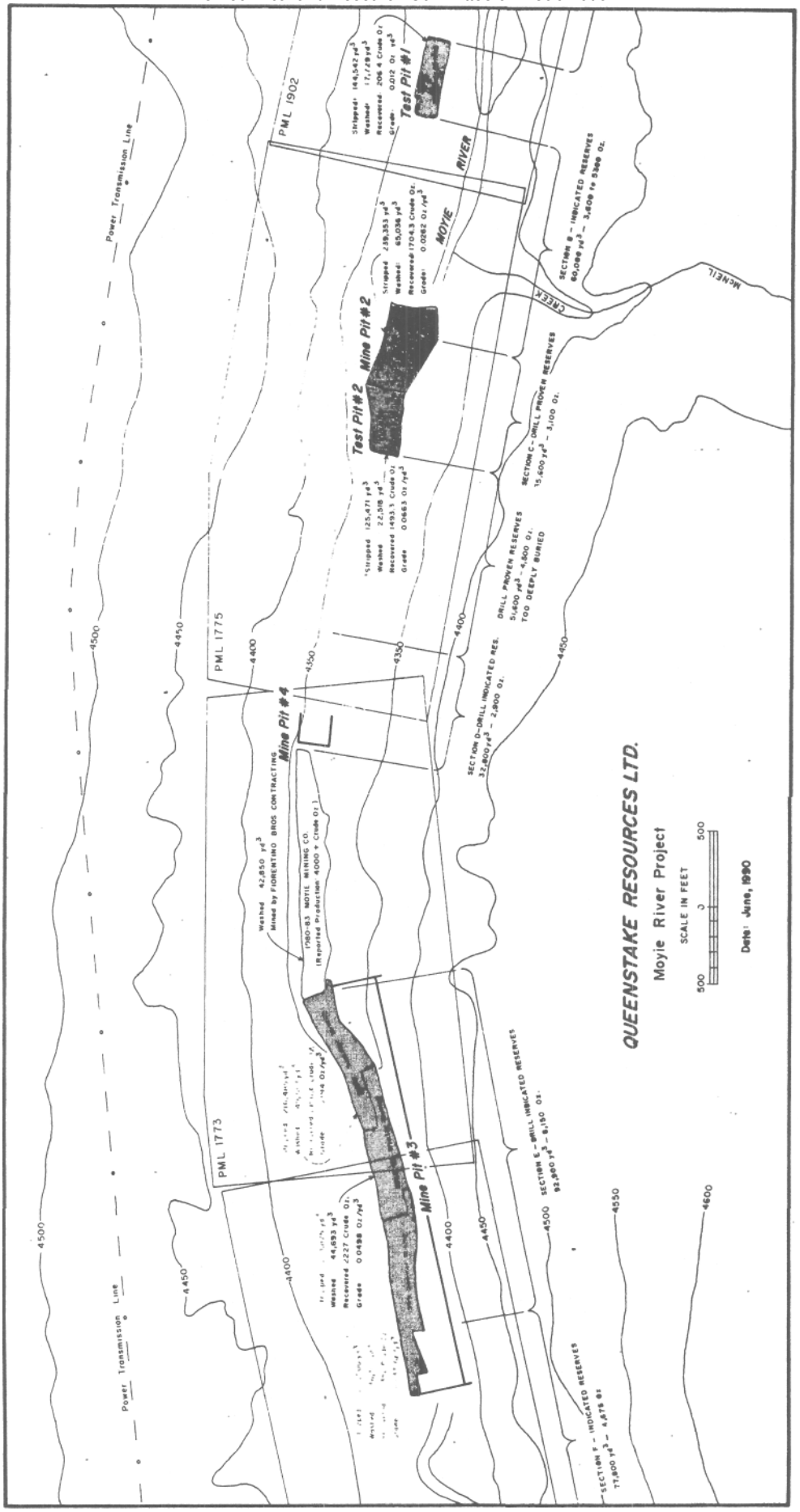
Geology

The entire property is underlain by Pre-Cambrian Aldridge Formation. The Aldridge Formation is a classic deep water turbidite sequence consisting of argillitic units strongly cleaved and metamorphosed to lower greenschist facies with conspicuous development of pyrite cubes and quartz veinlettes.

The Aldridge Formation is cut by numerous Moyie diorite sills and stocks consisting of 50% hornblende, 40 - 45% plagioclase and 5 - 10% quartz of probable Jurassic age. This Moyie diorite stock is most evident on the lower portion of the property and covers about two-thirds of the lower end of lease #1902.

The high ground between Moyie River and Perry Creek is underlain by the Creston Formation also of Pre-Cambrian age. Stratigraphically the Creston Formation lies above the deep water turbidites of the Aldridge Formation and below the shallow water calcareous Siyen-Kitchener Formation. The Creston Formation has a mixed lithology representing transition between these sedimentary facies. The area of economic interest lies entirely within the auriferous gravels deposited during the Tertiary age.

Gold mineralization associated with sulphide occurrences are common to the north and west of the Moyie River within both the Creston and Aldridge Formations. These occurrences are


QUEENSTAKE RESOURCES LTD.
Moyie River Project
SCALE IN FEET
500 0 500
Date: June, 1990
Power Transmission Line
PML 1902
PML 1775
PML 1773
MOYIE RIVER
McNEIL CREEK
Test Pit #1
Test Pit #2
Mine Pit #2
Mine Pit #4
Mine Pit #3
Stripped 144,542 yd³
Washed 17,789 yd³
Recovered 206.4 Crude Oz
Grade: 0.012 Oz yd³
Stripped 139,353 yd³
Washed 65,038 yd³
Recovered 1704.3 Crude Oz
Grade: 0.0262 Oz/yd³
Stripped 125,471 yd³
Washed 22,518 yd³
Recovered 1493.3 Crude Oz
Grade 0.0663 Oz/yd³
Washed 42,850 yd³
Mined by FIORENTINO BROS CONTRACTING
1980-83 NOTTL MINING CO.
(Reported Production 4000 + Crude Oz)
Washed 44,693 yd³
Recovered 2227 Crude Oz
Grade 0.0498 Oz/yd³
SECTION A - INDICATED RESERVES
60,000 yd³ - 3,400 to 5300 Oz.
SECTION C - DRILL PROVEN RESERVES
15,400 yd³ - 3,100 Oz.
DRILL PROVEN RESERVES
51,400 yd³ - 4,800 Oz.
TOO DEEPLY BURIED
SECTION D-DRILL INDICATED RES.
32,800 yd³ - 2,800 Oz.
SECTION E - DRILL INDICATED RESERVES
83,900 yd³ - 8,150 Oz.
SECTION F - INDICATED RESERVES
17,000 yd³ - 4,975 Oz
4500
4450
4400
4350
4550
4600

commonly associated with fault joints in close proximity to igneous intrusives. These hardrock deposits are the principal sources of the gold found in the Moyie River placer deposit.

A large diorite plug at the mouth of the Weaver Creek on the bottom end of the property acted as a natural dam and impeded the downward erosion of the original Moyie channel between Ridgeway and Weaver Creeks. This plug also injected numerous sills parallel to the bedding of the gently dipping sediments above Weaver Creek. These sills, varying in thickness from a few feet up to thirty feet, resisted erosion and created a network of natural riffles. Thus the original channel between Weaver and Ridgeway Creeks had a gentle bedrock gradient of from one to three percent and wandered from valley wall to valley wall trapping the gold behind the natural diorite riffles.

It is believed that the Moyie River eroded a narrow canyon drainage similar in configuration to the present valley during the late Cenozoic Era (Hopkins, 1971). It is a common practice to refer to the gold bearing placer channel as a "Tertiary Channel" as this age of alluvial deposition is so commonly associated with gold bearing placer deposits throughout the western Cordillera. The actual age of the Moyie "Channel" has not been determined but it is believed to be a mid-Quaternary deposit.

During the Pleiocene period, glaciation cut a very broad "U" shaped valley, generally following the early drainage. The bedrock walls bordering the original channel protected portions of the gold-bearing alluvial material from glacial scouring. Glacial till filled the valley and has only been partially removed to present levels by subsequent post glacial, high energy stream flows. The original preglacial gold bearing channel, (paleo channel), is from five to eight feet thick and lies in a bedrock trough somewhat paralleling the present drainage pattern. This channel is buried by forty to sixty feet of compact, silty, boulder till.

History

The property has been owned by several prospectors and companies since the turn of the century. Cominco has owned the property twice, once in 1939 and again in 1966. During 1939 -1940, Cominco drilled 48 cable tool holes for a total footage of 1,825 feet under the direction of a Mr. Marleau. This testing indicated 1,318,000 cubic yards valued at $0.503 per cubic yard at a gold price of $31.50 per ounce, giving an overall grade of 0.016 fine ounces per cubic yard over 1 1/2 lease lengths. Reported reserves based on incomplete drill lines gave 2,036,000 cubic yards valued at $0.4246 per cubic yard at $31.50 gold giving an overall grade of 0.014 fine ounces per cubic yard over 2 1/2 lease lengths.

During 1941 and 1942 G. Taylor, under agreement with Cominco, was allowed to mine by shaft and drifting method on the Helen placer lease which is Queenstake's current lease #P.M.L 1773. It is reported that he produced 28.6 crude ounces in 1941 and 18.6 crude ounces in 1942.

In 1973, Canadian Occidental Petroleum Ltd. acquired the area as a possible dredge property. The concentration of large boulders coupled with the stringent environmental requirements laid down by the government of the day made the property sub-economic at the time and the project was abandoned in 1974.

The Moyie Mining Company began mining operations in 1980 and mined through 1984. Total yardage and average grade for the entire four year project is not known. During 1982, however, 147,000 cubic yards of gravel was excavated and 19,000 cubic yards of gravel washed. The washed material consisted of seven feet of gravel and bedrock mined over a bedrock area of 77,000 square feet. The gravels consistently averaged 44 feet with a stripping ratio of 5.3 to 1.

The total gold reportedly collected from this operation was 1,141 ounces averaging 925 fine with 85% being nuggets greater than number four mesh. The overall grade for the material washed was 0.055 fine ounces per cubic yard. A total strike length of 1,240 feet was excavated during the four years of mining. The channel throughout this section averaged 175 feet in width with a constant 2% longitudinal gradient. Bedrock throughout this section consisted of shallow dipping middle Aldridge sediments, mainly argillites.

Work Completed

Property Acquisition, Grldding, Mapping and Seismic Survey

Queenstake Resources Ltd. acquired the property through outright purchase in August 1985 and immediately cut a grid on the property for survey control purposes. A total of 36,000 feet of base and picket lines were cut and chained over all six leases. All lines were mapped and surface elevations were measured at all 10O foot interval horizontal stations and at major breaks in topography. A total of fifteen picket lines were surveyed with an OYO McSeis 1500 seismic unit to outline and define the tertiary channel throughout the entire length of the property.

Drilling

Drilling on the Moyie Property is done to evaluate the following criteria:

1. delineate the channel width
2. determine overburden depth
3. sample and determine bedrock type and friability
4. determine longitudinal gradient
5. determine auriferous values

Through experimentation, it has been determined that the Barber Dual Overburden drill gives the best results. To date, 93 holes, for a total footage of 4,170 feet, have been drilled on the property. All but seven of these holes have been drilled by the Barber Dual Overburden drill.

During the winter of 1986, 20 holes, totalling 906 feet, were drilled to delineate the channel in the vicinity of Test Pit #1.

In 1987, a winter drill program was undertaken to delineate the channel in the vicinity of Test Pit #2 and Mine Pit #2. A total of 21 holes, seven of which were experimental top and bottom hammer holes, were drilled for a combined footage of 1,008 feet. This drilling outlined a section of tertiary channel over a strike length of 927 feet that proved economic.

In the winter of 1987 -1988,33 holes, totalling 1,418 feet, was drilled to delineate the channel in the vicinity of Mine Pit #3. This drilling outlined a section of tertiary channel over a strike length of 2,654 feet that was economic.

Nineteen holes, totalling 838 feet, were drilled during the winter of 1989 to extend Mine Pit #3 upstream. The channel was delineated over a strike length of 2,370 feet and was found to be mostly scoured with only minor isolated pockets of enrichment and thus sub-economic.

Mining

Mining on the Moyie River project is carried out under contract by Florentine Bros. Contracting of Cranbrook, BC. The project is managed and supervised by the author, Michael P. Henrick of Okanagan Falls, BC.

To date, 1,220,016 cubic yards of waste material have been stripped and 246,669 cubic yards of paydirt have been processed by gravity separation to produce 8,939.53 crude ounces of gold. Mining has been underway since the summer of 1986.

Mining continued on a year-round basis from the summer of 1987 through to the fall of 1989. The paydirt extracted during the winter mining period was stockpiled for processing the following spring.

During the winter of 1990,26,666 cubic yards was stripped in preparation for summer mining in the vicinity of Mine Pit #4.

River Diversions

Since 1987, a total of 5,793 feet of river diversions, at three separate locations, have been constructed to allow access to the tertiary channel below.

During the spring of 1987, a 1,680 foot river diversion was constructed. The Moyie River was diverted to the south to allow mining in Test Pit #*2* and Mine Pit #2.

As mining progressed upstream above the Moyie Mining Company's 1980 - 1983 mine area, preparations were made to divert the Moyie River to the north to allow mining in Mine Pit #*3.* A total of 3,120 feet of diversion was completed during the summer and fall of 1988.

A small 993 foot diversion has recently been constructed in May, 1990. This diversion moved the Moyie River to the south to allow mining within Mine Pit #4.

Reclamation

Reclamation has been an integral part of the operation from the initiation of mining in 1986. Mining has taken place at three separate pit locations over a total strike length of 4,057 feet.

Once the pit area has been outlined by drilling, a mine plan is drafted. Vertical sections throughout the pit area are drawn up and waste material dumps are laid out. These plans are personally submitted to the Mines Inspector, Ministry of Energy, Mines and Petroleum Resources. Personal consultation with the Department of Fish and Wildlife determine land shapes that will remain after reclamation is completed. To date, small ponds and wet areas have been left to encourage moose and water fowl habitat.

Waste material is placed in pre-determined areas, depending on boulder size and clay content. The coarse material is used to line and arm river diversions and dikes. The finer gravels are located within the tailings and waste areas. The finer clay materials are hauled by scrapers and dumped on top of the tailings. Organic muck and top soil that was originally stripped from the pit area is hauled and spread by scrapers over the clays. Only minor grooming with a D8 Caterpillar is required prior to seeding. The tailings dump areas are draped and sculptured into the toe of the existing valley in areas previously mined.

The dump areas are immediately seeded. In wet areas, a mixture of Timothy, Clover and Brome grasses are used. The percentage of each varies and usually is determined by what is currently available. Dry areas are seeded with a mixture of Creeping Red Fescue, Kentucky Blue Grass, Fiesta Perennial Dry Grass, Clover and Alfalfa. The percentages of each grass are again dictated by what is currently available. Once seeded, the entire area is fertilized using a 4600 Nitrogen fertilizer. To date, excellent growth has been achieved and each year the grasses come back noticeably stronger.

A test area was planted with poplar and spruce seedlings in the spring of 1989. To date, 90% of the spruce are thriving. The poplar seedlings were completely destroyed by local horses shortly after being planted.

Prior to 1988, reclamation consisted of material distribution, grooming, seeding and fertilizing. During the initial years, costs of the reclamation ran at 0.98% (1986) and 1.07% (1987) of the total operating costs.

After 1988, flocculation was required to relieve the overloaded washing pond during periods of excessive runoff. The initial equipment and chemical costs increased the overall reclamation costs for 1988 to 2.42% of total operating costs.

The initial costs of flocculation which ran as high as $272.00 per day have been cut by implementing the following measures:

1. Creating filtering berms at the discharge end of the wash water pond. These berms and baffles are created by dozing the washed coarse material, (+3/4" to 2 feet in diameter), across the pond. The silt laden wash water is forced to percolate through the baffles and much of the silt is filtered out.

2. A floating skimmer was designed and built. This allows the floe pump suction line to skim the top 1 1/2 " of water with the least amount of silt off the pond. The skimmer is located at the opposite end of the wash water pond -- the greatest possible distance from the wash water discharge.

3. Flocculation is now carried on during periods when the washing plant is not being used, e.g. weekends or night time. This allows the pond to settle naturally without added agitation from washing before the flocculation process begins.

4. Planning is a crucial part of the operation. The pond is now lowered during the dry periods in anticipation that it will fill during periods of excessive runoff. This relieves the pressure during the wet periods so that the floe plant does not have to be run continually as previously had been the case. The floe plant is only run as required and may be shut down for days during dry periods.

Flocculation costs are currently running at $26.70 per day. This is approximately one tenth of original costs. In addition, the number of days that the floe plant is operated is approximately 50% less now, thereby reducing the overall costs again by one half.

All work on the Moyie River project has been conducted under the guidance and with the assistance and co-operation of all government agencies. (Ministry of Energy, Mines and Petroleum Resources, Fish and Wildlife, Waste Management, Water Resources, and Forestry).

Mining Potential

The six contiguous placer leases owned by Queenstake Resources Ltd. on the Moyie River have a combined mineable length of 18,686 feet.

To date:

1980 -1983	Moyie Mining Company mined	1,240 feet
1986	Test Pit #1 mined	476 feet
1987 -1988	Test Pit #2 & Production pit mined	927 feet
1988 -1989	Pit #3 mined	2.654 feet
Total length currently mined		5,297 feet

The 1989 drilling located above Pit #3 delineated a section of tertiary channel over a length of 2,370 feet. This section proved to be scoured by glaciers and will not be mined.

To date, a total length of 7,667 feet has been either mined or proven sub-economic through exploration. This represents 41% of the total channel length on the property.

Additional drilling will have to be done to evaluate the remaining 59% of the property. Given results consistent with past results, there is potential for reserves to be proven that could extend the mine life an additional 3 to 4 years.

QUEENSTAKE RESOURCES MOYIE RIVER DRILLING STATISTICS

APPENDIX 1

	Holes	Total Footage
1986 Winter Drilling		
(Barber Dual Overburden Drill)	20	906
- defined test pit area #1		
1987 Winter Drilling		
(Barber Dual Overburden Drill)	14	690
(Top and Bottom Hammer Holes - experimental)	7	318
- defined test pit area #2, 1987 summer production and 1987 - 1988 winter production		
1987 - 1988 Winter Drilling		
(Barber Dual Overburden Drill)	33	1,418
- defined Mining Pit #3, 1988 summer production 1988 - 1989 winter production and 1989 summer production		
1989 Winter Drilling		
(Barber Dual Overburden Drill)	19	838
- tested and area of tertiary channel above mining pit #3 over a length of 2,370 feet. Results were disappointing showing the channel was mostly scoured leaving only small isolated pockets of enrichment.		
Totals	93	4,170

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QUEENSTAKE RESOURCES MOYIE RIVER MINING STATISTICS

APPENDIX 2

Test Pit #1 **Summer 1986**

Cubic yards stripped		144,542	
Cubic yards processed			17,729
Crude ounces recovered	206.43		
Average crude grade = .012 oz/cu. yd.			
Stripping ratio - 8.15/ 1			

Test Pit #2 **Summer Mining 1987**

Cubic yards stripped		239,353	
Cubic yards processed			65,036
Crude ounces recovered	1,704.33		
Average crude grade = .0262 oz/cu. yd.			
Stripping ratio - 3.68/ 1			

Winter Mining 1987 - 1988

Cubic yards stripped		125,471	
Cubic yards processed			22,518
Crude ounces recovered	1,493.32		
Average crude grade = .0663 oz/cu. yd.			
Stripping ratio - 5.5/ 1			

Test Pit #3 **Summer Mining 1988**

Cubic yards stripped		216,485	
Cubic yards processed			49,553
Crude ounces recovered	1,956.6		
Average crude grade = .0394 oz/cu. yd.			
Stripping ratio - 4.36/ 1			

Winter Mining 1988 - 1989

Cubic yards stripped		210,875	
Cubic yards processed			44,693
Crude ounces recovered	2,227.0		
Average crude grade = .0498 oz/cu. yd.			
Stripping ratio - 4.7/ 1			

Summer Mining 1989

Cubic yards stripped		256,624	
Cubic yards processed			47,140
Crude ounces recovered	1,352.45		
Average crude grade = .02869 oz/cu. yd.			
Stripping ratio - 5.44/ 1			

Pit #4 **Winter Stripping 1990**
(in preparation for Summer Mining 1990)

Cubic yards stripped		26,666	
Totals to Date	**8939.53**	**1,220,016**	**246,669**

Average crude grade overall	0.03624 oz/cu. yd.
Average stripping ratio overall	4.837 : 1

QUEENSTAKE RESOURCES MOYIE RIVER DIVERSION STATISTICS

APPENDIX 3

	Length
Diversion #1 1987 Spring - diverted to allow mining in pit area #2	1,680 feet
Diversion #2 1988 Fall - diverted to allow mining in pit area #3	3,120 feet
Diversion #3 1990 Spring - diverted to allow mining in pit area #4	993 feet
Totals	5,793 feet

QUEENSTAKE RESOURCES IMOYIE RIVER RECLAMATION STATISTICS
APPENDIX 4

Prior to 1988, reclamation consisted of material distribution, grooming, seeding and fertilizing.

1986 reclamation costs ran at 0.98% of total operating costs.

1987 reclamation costs ran at 1.07% of total operating costs.

After 1988, reclamation costs were broken into two categories as follows:

#1	Material distribution (grooming, seeding and fertilizing)	$15,112.91
#2	Flocculation (chemical costs only)	6,723.00

Based on the total operating costs for 1989 of $1,049,221.29, the material distribution accounted for 1.44% and the flocculation costs accounted for 0.64% of the total costs. The combined reclamation costs = $21,835.91 or 2.08% of the total operating costs. The 1989 flocculation costs represented 31% of the reclamation costs.