

**APPENDIX 4**

**FISH AND WILDLIFE MONITORING**

**GREENS CREEK MINING COMPANY**

Revised: August, 1995

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# **1 BEAR MONITORING PROGRAM**

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## **1.1 Introduction**

As a requirement of the final Environmental Impact Statement in 1983, KGCMC began funding a Brown Bear Study in conjunction with the Alaska Department of Fish and Game (ADF&G), Division of Wildlife Conservation. KGCMC funding has continued through to the present time.

In 1990, KGCMC started to take a more active role in the Brown Bear Study. Kim Titus (ADF&G) conducted worker training on Bear Safety at the mine and a closer working partnership between KGCMC and ADF&G was established. In September, ADF&G conducted radio telemetry from the Greens Creek road system to determine the concentration of collared bears in proximity to the road. Further interaction continued with KGCMC representation on the telemetry flights and on bear tagging and collaring runs, until 1993, then the mine shut down production.

## **1.2 Monitoring**

Monitoring is currently performed by ADF&G by radio telemetry from the air and ground.

## **1.3 Results**

The paper entitled "Population and Habitat Ecology of Brown Bears on Admiralty and Chichagof Islands" December 1993, by Kimberly Titus and Lavern R. Beier, ADF&G, Division of Wildlife Conservation, concluded that the brown bear management program instituted by Greens Creek Mining Company was successful in maintaining bear populations over the study period.

## **2 EAGLE MONITORING PROGRAM**

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### **2.1 Introduction**

Bald Eagle monitoring was a requirement of the Final Environmental Impact Study. The study has been performed by the U.S. Fish and Wildlife Service with financial and manpower assistance by KGCMC. KGCMC has discontinued providing financial or manpower assistance for this study. The last survey was conducted in July 1992.

### **2.2 Monitoring**

Monitoring was conducted in late April or early May, and in July. Observations were made by flying the coastal regions of Young Bay and Hawk Inlet to observe birds and nests. Each nest was marked on a topographical map, eggs and young were also marked on the map.

### **2.3 Study Results**

The latest helicopter survey was conducted in May and July of 1992. No formal papers on the study results have been published at this writing. Mike Jacobson of the U.S. Fish & Wildlife Service in Juneau may be contacted for information concerning the latest results of these studies.

## 3 FISH MITIGATION

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Fish mitigation originally was proposed because fish spawning and rearing habitat would have been destroyed as a result of the original tailings dam. That dam was never built, because the Company installed a dry tailings system which reduced the tailing area and did not remove spawning or rearing habitat. During the 1988 EA which changed the tailings plan, the Company did not withdraw plans for fish mitigation. Because of this, fish mitigation at Greens Creek is still active.

### 3.1 History of the Mitigation Issue

Discussions regarding the obligation for mitigation of potential project development impacts on fisheries resources began in the middle of 1981. As discussion proceeded, the Forest Service generally felt that most of the fishery-related effects of mine development would be from tailings disposal, with some potential effects of water withdrawal from Greens Creek.

Discussions tended to focus heavily on coho salmon as the species of primary interest as far as mitigation was concerned. Fisheries resources in Greens Creek itself were previously identified as consisting of pink salmon, chum salmon and coho salmon. Dolly Varden char and cutthroat trout were known to inhabit waters of Greens Creek, but were not the objects of particular interest in the earlier environmental studies with the exception of the determination of body burdens for heavy metals.

It was suggested by the Forest Service that passage over Greens Creek Falls, opening about four miles of stream to anadromous access previously denied by the barrier (not counting lower extremities of tributaries or accessible reaches of Greens Creek above Big Sore Creek), would mitigate for any anticipated effects of the mining project. A fish ladder was installed during the summer of 1988 following the guidelines set out in

*Greens Creek Fishway, Guidelines for Fishway Construction Evaluation* (Ott Water Engineers, Inc., June 1988).

A memorandum to Jack Cottrell, Greens Creek Mining Company from J.W. Buell, Ph.D. dated March 13, 1991, summarizes the Greens Creek Mine, Anadromous Fish Mitigation in detail (Buell, March 1991).

## **3.2 Mitigation Efforts**

Following the plan outlined in the 1988 EA by Buell and Associates, KGCMC initiated studies in the fall of 1988 to determine the effectiveness of the fish ladder by migrating salmon.

Initially, studies concluded that adult Coho salmon did not migrate to the fish ladder area and spawn above or below that particular reach of Greens Creek.

In order to meet mitigation requirements, a trap and haul plan was initiated in 1991. However, after the plan had been approved, salmon fry were discovered above the fish pass and the trap and haul plan was tabled until population studies could be implemented.

By early 1992, two surveys found fry and yearlings above the pass, but, due to high stream flows, finite populous numbers were not established. A third attempt was scheduled for August 1992 when stream flows are historically lower. Coho, chinook, pink and chum were found above the waterfall, almost to the portal. Pink and chum salmon access was established by visual observation of adults. Coho and chinook access above the waterfall was established by the capture of juveniles of those species (Buell, 1995).

## **3.3 Fish Ladder Maintenance**

The fish mitigation program was implemented to open spawning and raising habitat primarily for coho salmon, although other species including chinook, pink, and chum salmon also use this new spawning and rearing habitat.

An annual survey of the fish ladder site is conducted to assure that the fish ladder is clear of rocks and other debris and is determined to be passable by fish. A maintenance program will assure that the mitigation program continues.

## **3.4 Fish Pass Silver Salmon Smolt Monitoring Program**

In 1995, KGCMC and the USFS initiated the Greens Creek Fish Pass Silver (Coho) Salmon Smolt Monitoring Program. The goal of the program is to determine whether KGCMC has attained 1:1 mitigation for loss of habitat as a result of the tailings

impoundment. A habitat survey will be conducted to obtain habitat information above the fish pass. Coho smolt will be estimated by conducting a mark-recapture experiment. Smolt densities will be estimated for different pool habitats within a reach.

To validate smolt identification during the mark-recapture experiment a fyke net will be used to catch out-migrating smolt. The fyke net will be placed above the falls and monitored. All fish will be counted, measured and examined for marks. A comparison of length frequencies will determine if the out-migrating smolt are from the same population identified as smolt during the mark-recapture experiment.

The mitigation target will be attained when a population of 200 coho smolt have been estimated to be above the fish pass. The lower limit of the 95 percent confidence interval will need to exceed or equal 200 smolt.



## 4 SPAWNING GRAVEL

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The major thrust of the Spawning Gravel Monitoring Program was to determine whether mining and related activities have resulted in deposition of excess sediment in anadromous fish streams to the extent that salmon spawning and incubation would be adversely affected.

The major inspiration for the design and execution of this monitoring program was the then-ongoing work of Sheridan, et al., reported in 1984. The authors compared the results of analysis of over 2,000 stream bed samples from disturbed and undisturbed watersheds. The percent fines (<0.83 mm), which Sheridan et al. found to be strongly correlated with the "fredle index" of spawning substrate quality (Lotspeich and Everest, 1981), was used by the authors to make their comparisons.

Gravel samples taken as part of Greens Creek Mining Company's monitoring requirements were gathered from pre-determined sites representative of spawning habitat in Zinc Creek, "Tributary Creek", and Greens Creek.

### 4.1 Findings

The gravel monitoring data did not suggest any adverse impact (increased fines or decreased spawning habitat quality) due to mining or related activities in the Greens Creek or Zinc Creek watersheds. On the contrary, the data showed consistency among samples within sites and, to a somewhat lesser degree, among sites, before and after commencement of mining activities. The only significant difference in fines content of samples was associated with a natural channel change event. This was a significant finding, since potential fine sediment sources, such as runoff from the haul road and the mill site and small slides have been greatly reduced in number and potential output since startup. A May 9, 1991 memorandum to Jack Cottrell of Greens Creek Mining Company, from J.W. Buell, Ph.D. summarizes the Spawning Gravel Monitoring Program in detail. On the recommendation of the Forest Service, the spawning gravel study has been concluded. In a letter from the U.S. Forest Service to KGCMC dated May 2, 1994, the Forest Service stated that the monitoring program has provided the information required in the EIS and associated study plan, and that continued limited monitoring would not be necessary.

## 5 REFERENCES

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