



# Pebble Mine Impacts

A view of the detrimental impacts the proposed Pebble Mine will have on the Bristol Bay region of Alaska

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## Abstract

The Bristol Bay watershed is one of the most productive marine ecosystems in the world. It is home to the largest run of Sockeye salmon as well as prolific runs of Kings, Chum, Silver, and Pink salmon. These runs of salmon as well as the many other aquatic species in the region are vital for this ecosystem as well as the many Bristol Bay communities. The commercial fisherman in the region as well as more than 30 sport fishing lodges rely on this precious resource. As many people in the region have stated, these salmon are “red gold” bringing in an estimated 4.1-5.4 billion dollars a year. However, the proposed pebble mine is threatening this precious and incredibly diverse region. Although it does present economic incentives, %80 of the region voted against the construction of the mine. Our objective is to examine the effects that this mine could have on the fish in this region by determining the amount of sediment that could be displaced into the rivers. We used GIS software to determine the affected areas.



Experimental drilling site for the Pebble Mine

## I. Introduction

The proposed pebble mine presents a wide variety of threats. We focused on the effects that increased sediment runoff from the construction of the mine will have on local rivers. Although aquatic ecosystems are incredibly dependent on suspended and bedded sediments (SADS) for nutrients and micro habitats such as sand bars, they can have negative effects on biota and the physical habitat of the of the river when excess is introduced to the system (What, 2003). Spawning salmon and other macroinvertebrates require a clean gravel river bottom for spawning and egg-rearing. This porous gravel river bottom allows for both protection of the eggs exchanges of gases and waste from the egg. Without this simple yet vital river feature, the salmon eggs would not be able to develop and eventually become smolts to migrate back to the ocean. The Bristol Bay region is entirely dependent on the yearly return of these salmon and therefore determining its potential effects on their spawning grounds and is very important. Our focus is on the a few of the many sport fishing lodges in the region to illustrate how devastating this mine could be.

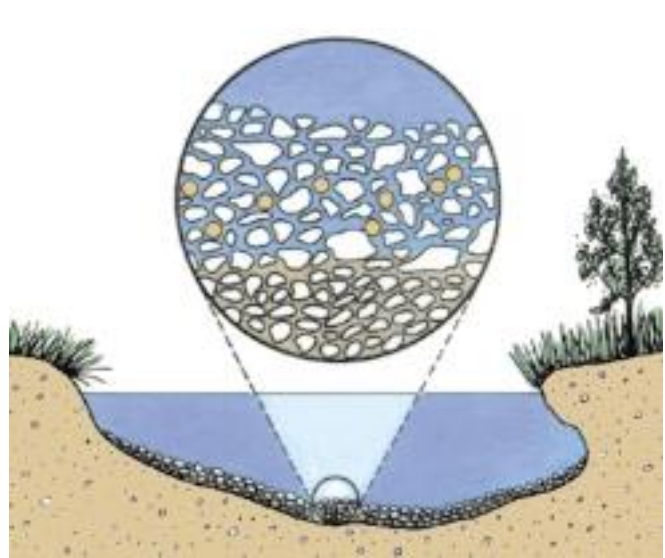


Figure 1: Illustrates how vital a porous, gravel bottom is for successful spawning and egg rearing.

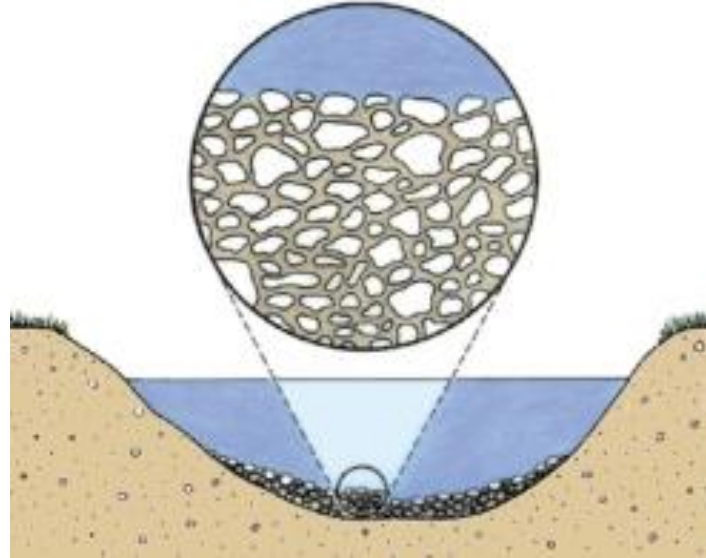


Figure 2: Illustrates how the bedded sediments destroy spawning grounds

## II. Literature Review

The debate of the construction of the Pebble Mine just north of Lake Iliamna has received a lot of national attention. Overall, the consensus is that the installment of such a mine would be devastating to the surrounding environment, especially the local water systems in the short term. This collection of opposition has resulted in the successful delay of the construction of the mine, but not the termination. The most prevalent and obvious argument made has been the environmental detriment that will result from the mine, although the general public have failed to realize the hydrological and economic devastation as well. One article cites that pollutants like copper, which is what 95% of the metal that the mine will produce; will without a doubt leach into local streams and watersheds. Even slightly elevated levels of copper are enough to kill entire rivers of fish, including salmon, and once leached into the environment will reach distances far beyond that of the source (Parker, 2008). As well as the leaching of dissolved copper into the river system, the most immediate effect would be the destruction of spawning grounds due to an increase in SADS. Many fishing lodges rely on healthy salmon in the streams, and the loss of them would quickly put them out of business and therefore cripple the backbone of the local and state economy. Every year, Alaska charges thousands of anglers who visit the region for weekly fishing permits, and the loss of this industry would greatly decrease if not eradicate this number (Hauser, 2007). Legislative representatives for the Alaskan population have taken note of the rising opposition to the mine and as a result have cleared a quarter of a million dollars to put towards the further research of Pebble Mine (Ess, 2010). Similar mines have been constructed like this in the past and have had poor effects on the environment and economy, such as the series of mines built in Butte, Montana in the 1950's. In 1982, it was found that the mine was leaching highly acidic water with toxic heavy metals into the ground and so the open mine was classified as a Superfund because of the environmental hazard it posed (Jenkins, 2002).



## III. Methodology

In order to create our map, we received shape files from the Alaska State government. These files included detailed layouts of rivers, lakes, elevations lines, and mining claim ownerships. We immediately realized the overload of information we had, and so clipped and deleted unnecessary information and data where we could. To realize where the source of the issue was coming from, we looked to the mining claims attribute table and highlighted the land owned by Pebble Mine Co. We also wanted to locate the fishing lodges in the path of destruction from toxic runoff. To do this we researched all the lodges in the region and located them on Google Earth. We were then able to find the latitude in longitude in decimal degrees of the lodges, which we charted in an Excel sheet and plotted them on the map. To determine the downstream watershed boundaries, we looked at a topographic map of the region and using that were able to conclude where runoff water would go, and indicated the area with orange lines and black and white stripes. All of this information indicates where would be effected from the inevitable toxic mine runoff.

## IV. Conclusion

It is inevitable for sediment from the construction and operation of the mine to reach the local watershed. The areas within the orange watershed boundaries are areas downstream that will contain toxic levels of copper and sediment. When salmon spawn, they swim upstream from the ocean to the far depths of small rivers and streams into the mainland of Alaska, but because of the toxic waters they must pass through they will not make it. Therefore, the map in the lower left corner (Figure 4) shows the entire watershed for the area, which contains all the rivers and streams that will no longer be able to produce salmon. The lodges located within the watershed of the pebble mine will experience an immediate decrease in fish population and health once the mine begins construction. Although other lodges in the region such as Alaska Adventures Lodge and Tikchik Narrows Lodge will not see immediate effects in their local fisheries, salmon runs provide vital food to other freshwater fish. Without these salmon eggs and smolts to help prepare for the winter, an immediately decline in size and population will be seen. The increase in bedded sediments will smother the once porous and gravel filled spawning beds, making successful spawning nearly impossible. With less fish in the rivers and lakes, lodges will experience a drastic decrease in anglers and commercial fishing will quickly cease to bring income to the region.

## V. Results and Discussion

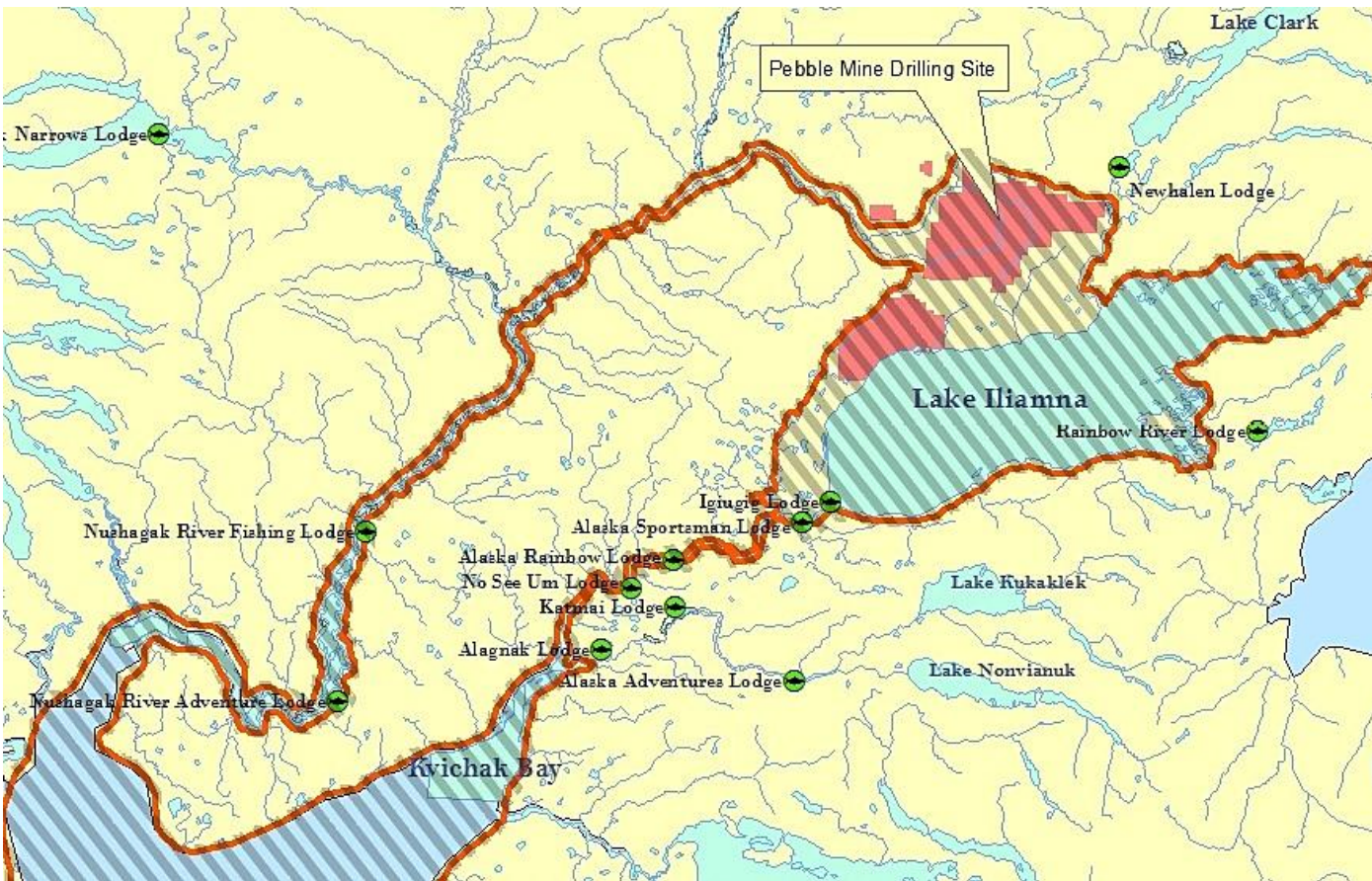


Figure 3: This map illustrates the extent of the watershed that will see and immediate decline in fish population due to SADS.

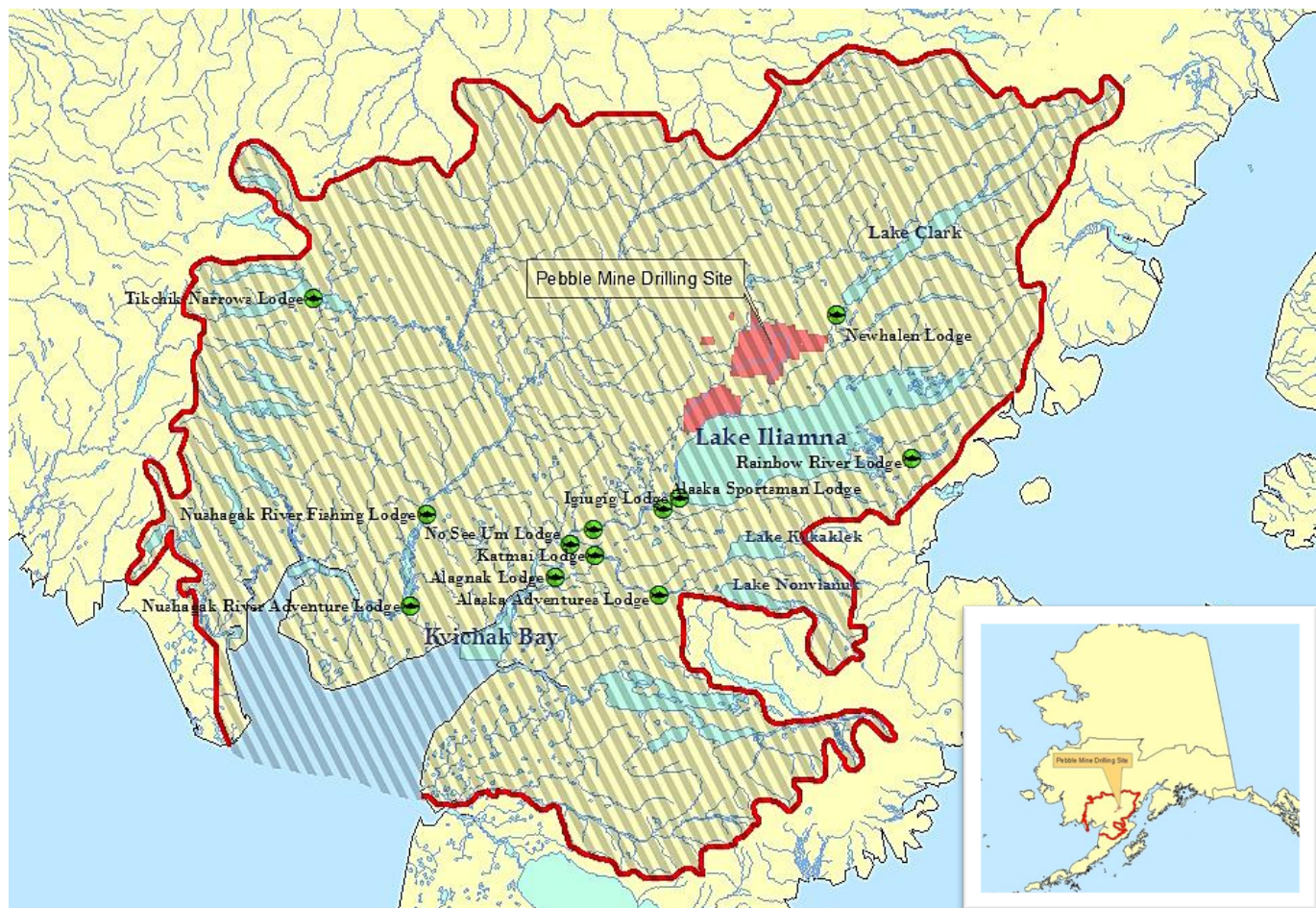


Figure 4: This illustrates the entire watershed that could be effected from the mine runoff

## V.I. Future Research

Research should continue in the region to quantify the effects of ground water contamination from the mine on the surrounding rivers. A ground water flow model of the region could show where and how long it would take the potential contaminants to enter the river. Since fish are extremely sensitive to copper and that is the main mineral that will be mined, determining the full effects of ground water contamination of the rivers will be vital in determining the overall impact of the mine on the marine ecosystem. This data could be compiled with ours to further define what effects the pebble mine could have on the regions rivers and communities.



## VIII. Acknowledgements

Thanks to Mike Winiski and Suresh Muthukrishnan assisted with putting the above maps together. The Alaskan Government provided the shape files and other data necessary to complete our map.

## VII. References

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