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Mr. Daniel S. Sullivan, Commissioner
Alaska Department of Natural Resources
550 W. 5th Avenue, Ste. 1400
Anchorage, Alaska 99501

Subject: Petition to Designate the Streambeds of Anadromous Water Bodies and Riparian Areas within the Chuitna River Watershed, Alaska as Unsuitable for Surface Coal Mining Pursuant to AS. 27.21.260

Dear Commissioner Sullivan:

I am a fisheries habitat consultant with 37 years of experience as a fisheries and habitat biologist and as a Habitat and Restoration Division Regional Supervisor with the Alaska Department of Fish and Game. I am writing in support of the petition to designate the streambeds of anadromous water bodies and riparian areas within the Chuitna River watershed, Alaska, as unsuitable for surface coal mining pursuant to As. 27.21.260. I support the petition for the following reasons:

1. **The Chuitna River is an important salmon producing system**: Unlike current coal producing areas of Alaska the Chuitna River is located in a productive coastal ecosystem which supports a diversity of fish and wildlife species. Chuitna River supports all five species of pacific salmon as well as Dolly Varden, rainbow trout and whitefish. Chuitna River salmon are harvested by an in river sport fishery, the Northern district commercial fishery, and the Tyonek subsistence fishery. On the west side of Cook Inlet the Chuitna River sport fishery for Chinook salmon is the second only in importance to the Deshka River. Because of its importance the Chuitna River Chinook stock was listed as a stock of management concern by the Alaska Board of Fisheries in 2010 (Helsinger 2010).

2. **Strip mining for coal will destroy the shallow aquifers and interrupt the flow of ground water to anadromous streams in and adjacent to the mined area:** Over the past several years I have conducted an extensive search of the scientific literature but have not found any examples of strip mine reclamation projects where phreatic ground water flow in streams has been restored to premine conditions by replacing mining tailings. However there is a large body of information documenting long term disruption of both surface and ground water flow as the result of recently permitted strip mining and reclamation (Bonta, 2007, Wilson 1978 and Schwartz and Crowe 1985). Bonta et al 2007 studied the effect of surface mining and reclamation on physical watershed conditions and ground water hydrology in three watersheds. This study found that mining disturbances in watersheds

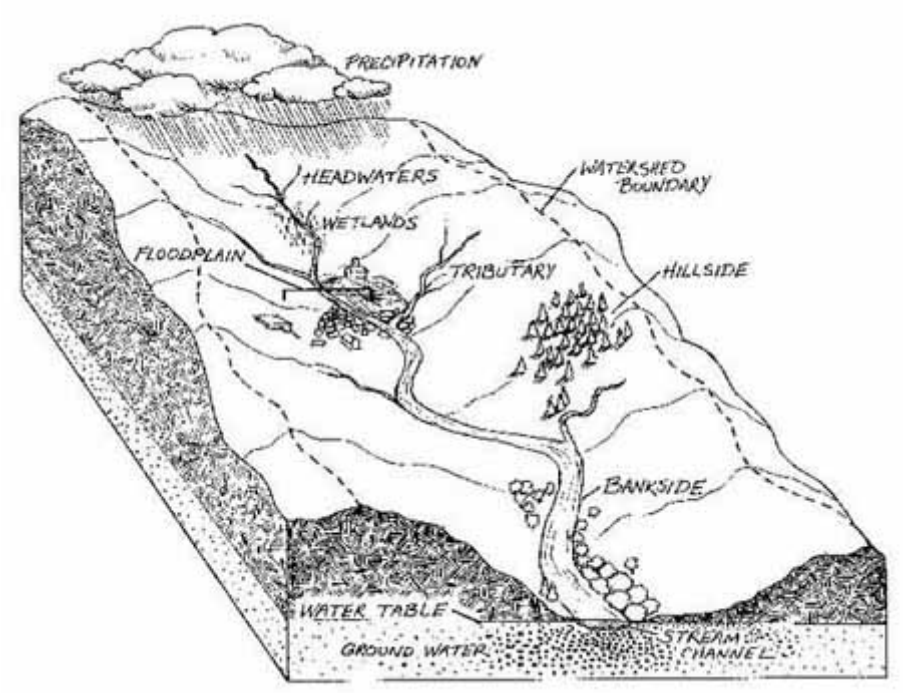

Figure 1: Cross Section of a Watershed (Source: USEPA)

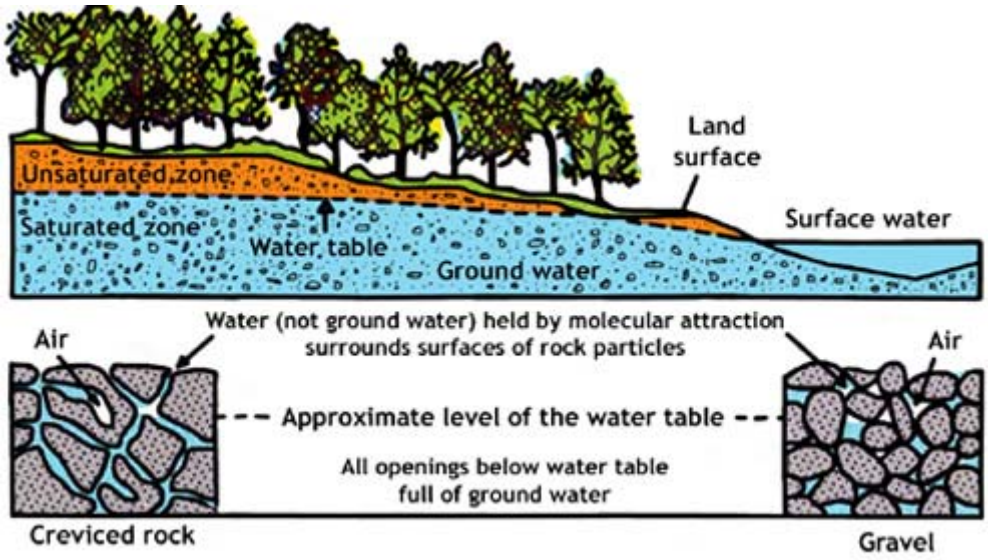

Figure 2: Cross Section of an Aquifer (Source: USGS)

Ground water is critical because it maintains stream base flow and moderates water level fluctuations, particularly in the winter when there is no precipitation. It provides stable temperatures and thermal refugia for fish. It provides water for riparian vegetation which controls bank strength and the rate of erosion (Douglas 2006). It also creates the hyporheic zone (Figure 3).

processes in the hyporheic zone play a central role in the functioning of stream ecosystems (Malcolm et al 2003).

To restore fish habitat in these streams after mining it, it would be necessary to restore the same quality and quantity of ground water. To successfully reconstruct a new stream that is as productive as mined streams, it would be necessary to reconstruct a new shallow aquifer to provide the same amount of phreatic and hyporheic flow, the same seasonal flow patterns and same quality (temperature, pH, dissolved elements, dissolved solids etc.) of ground water present prior to mining. I conducted an extensive search of the scientific literature to find examples of restoration of salmon streams after the type of strip mining proposed for the Chuitna River drainage. I also consulted with experts who have been involved in salmon habitat and strip mine restoration in Alaska and the continental United States. The search found many examples of how strip mining has dramatically altered local and regional ground water flow during and after mining, but no references to any scientific studies of mines where the aquifer's supplying phreatic ground water to the hyporheic zone of a salmon spawning and rearing stream has been successfully restored to premining productivity after strip mining. Most experts do not believe that it is possible to reconstruct a functioning shallow aquifer for an anadromous streams system in a deep mined system with any degree of confidence that it would work. Attempts to restore ground water flow to mined stream would be further hampered by the fact that the very complex geology of the Chuitna River drainage and how these shallow aquifers function is poorly understood except that ground water from these aquifers up well's at certain points in these streams and currently supports salmon spawning, rearing and overwintering.

3. **Strip mining will result in the long loss of marine derived nutrients and organic carbon essential to stream productivity:** Even if mined anadromous stream channel's in the Chuitna River drainage could be successfully reconstructed to full physical function, it is unlikely these streams could be restored to their former level of biological productivity because of the loss of marine derived nutrients (MDN) from salmon carcasses in the mined areas and the loss of organic carbon from the removal of all of the wetlands in the mine area. Significant loss of stream productivity from premining conditions has been documented in studies of streams in reclaimed stripmines. Matter and Ney (1981) found that "benthic invertebrate and fish populations were significantly lower in abundance in the reclaimed mine streams than in the reference stream and showed less taxonomic richness and stability: they were similar in these respects to the biota of unreclaimed mine streams."

Wetlands and MDN from salmon carcasses are the primary sources of stream nutrients and productivity in salmon streams. There is a large body of scientific literature showing that Pacific salmon are the major vehicle transporting marine nutrients across ecosystem boundaries from marine to freshwater and terrestrial ecosystems. Nutrients from salmon eggs and carcasses play a major role in the productivity of both freshwater and riparian ecosystems and in perpetuating future salmon runs. Most fisheries scientists and progressive fisheries managers have concluded that stream ecosystem health benefits from having the largest number of spawners possible which in turn produces a large number of carcasses (WDFW 1997). The eggs and carcasses from these spawning salmon provide an essential

wetlands can be replaced, stream productivity and fisheries production can not be restored to premining levels of productivity. The National Academy of Science recommends not destroying filling fens and bogs, both found in the Chuitna claims area, because they are "difficult or impossible to restore" (National Academy of Science 2001). For certain types of wetlands such as peat bogs which grow at a rate of less than 1mm annually, replacement is not feasible within geological time. Wetlands whether natural or constructed exist because of the presence of surface or near surface water. The extensive wetlands in the Chuitna River drainage exist in part because weathered volcanic ash a few feet below the surface forms clay like impermeable layer which holds water. Deeper layers of compacted ash act as an aquaitard confining the water table below it and forcing seeps and springs out of the hillsides and into adjacent drainages. Once the existing wetlands and the impermeable soils that currently maintain these wetlands are removed by mining there is nothing to provide a base for construction of new wetlands. There are no studies in the scientific literature which indicates that wetlands have been restored on coal mine spoils on the scale which would be required in the Chuitna River drainage. The risk of failure for many wetlands restoration projects is high, particularly in Alaska where no projects of this type have been documented (Kusler, 2004 and National Academy of Sciences, 2001).

4. **Mining will adversely affect water quality for fish and aquatic life:** Information provided by Pac rim contractors indicates that water quality will change as a result of mining in the Chuitna River drainage. Potential water quality changes include lower Ph, higher turbidity, and releases of heavy metals such as copper. Fish and their food organisms in the Chuitna River drainage have adapted to the unique water quality conditions present in the Chuitna River and its tributaries over thousands of years. Water quality is defined by dissolved elements, marine derived and terrestrial nutrients, and physical factors such as temperature, pH, conductivity, and turbidity. Anadromous species such as salmon, trout, and whitefish also depend on subtle chemical clues present in surface waters in to locate both their natal streams, and spawning locations within tributaries.

Surface water chemistry will be altered by pumping water out of the pit to allow mining and rerouting surface water away from the pit area and into streams. Data collected by Pac Rim contractors indicates that one or more of the aquifers in the mine areas contains elevated levels of copper, zinc, iron, aluminum, manganese and lead. Zinc and manganese levels in ground water within the proposed Chuitna mine area are approximately 4 times and aluminum 20 times greater than average surface water levels in stream within the proposed Chuitna mine area . All of these metals are toxic to fish and aquatic life at levels in the part per billion to part per million ranges. Aluminum interferes with phosphorus metabolism in plants which form the basis of the aquatic food chain in streams. It also precipitates on fish gill membranes inhibiting exchange of oxygen and carbon dioxide which results in asphyxiation. Copper is toxic to rainbow trout at 1.4 parts per billion, and elevated levels (5-20 ppb.) destroys the olfactory organs which anadromous fish use to locate prey and spawning streams. Zinc is toxic in the part per billion range and accumulates in and damages gills, liver, and kidneys. Copper, zinc and lead bioconcentrate (build up to high levels over time) in aquatic organisms. Copper and zinc also act synergistically in the aquatic environment so that the toxicity of the combination is greater than the individual elements.

Moose Creek in the Matanuska River drainage. The damage to salmon streams from alluvial placer mining and is very different from strip mining, which may encompass entire drainages and alter both the surface topography, subsurface geology and the aquifers down to several hundred feet. The objective of most of these stream projects has been to stabilize a short section of an existing stream channel and not reconstruct an entire drainage, stream channel and aquifer.

Although there may have been some benefits to fish, I have not been able to find any reports or scientific studies documenting that these stream relocation or stabilization projects have benefitted fish. Most of these projects such as the USFS projects on Resurrection Creek have attempted to restore both sinuosity and rearing habitat to a stream impacted by placer mining in the early 1900's by moving and grading spoil piles and providing instream cover. Placer miners channelized the stream and left spoil piles in the flood plain but did not destroy the shallow aquifer that provides ground water flow to the stream. It appears that the USFS projects have increased rearing habitat for Chinook and Coho salmon by connecting formerly isolated channels in mine spoils, but no data has been made available to document this. Similarly, it is likely that the rerouting of Moose Creek back into its original channel has provided access to additional upstream spawning and rearing habitat for salmon in previously inaccessible upstream waters but no scientific data is provided to support this. However, this project like the others does not provide any indication of the likelihood of success in completely reconstructing a salmon stream, recreating the existing water chemistry, recontouring and revegetating its drainage, reconstructing all of its wetlands and rebuilding its aquifers from basement sediments on up in the Chuitna River drainage.

7. **A great deal of new information that raises questions about the feasibility of restoring anadromous within the Chuitna River drainage to their premining level of productivity has become available since the 1990 Diamond Chuitna Coal Project Final Environmental Impact Statement.** When the Diamond Chuitna Coal Project Final Environmental Impact Statement was completed in 1990 very little was known about the physical, chemical and biological components of salmon habitat, and the function of in stream flow and ground water, marine derived nutrients, and wetlands in the productivity of salmon streams. Studies of salmon salmon genetics, the effects of mining on salmon streams, and the restoration of salmon streams were in their infancy. The impetus for much of this research was the continued decline of salmon stocks due to human activities. Since 1990 a great deal of scientific research on these subjects has been completed and information has become available. This information support the conclusion that strip mining for coal will severely impact current anadromous waters in the Chuitna River drainage and that it is very unlikely that these waters could be restored to their premining level of productivity

Thank you for your consideration of my request that you grant the Petition to Designate the Streambeds of Anadromous Water Bodies and Riparian Areas within the Chuitna River Watershed, Alaska. as Unsuitable for Surface Coal Mining Pursuant to AS. 27.21.260. If you have any questions you can contact me at the address shown above.

Sincerely,

Literature Cited:

Helsinger, 2010. Upper Cook Inlet Stock of Concern. Letter to Alaska Board of Fisheries October 1, 2010.

Hood, E, R Edwards, D. D'Amore, and B. Lange. 2003. Organic Carbon Sources in Coastal Southeast Alaskan Streams. American Geophysical Union. Fall meeting 2003. Abstract #B31C-0317.

Kusler, 2004. Multi-Objective Wetland Restoration In Watershed Contexts. Association of State Wetlands Managers. 108 p.

National Academy of Sciences, 2001. Compensating for Wetlands Losses Under the Clean Water Act. National Academies Press. 322 p.

For citations not listed here please refer to my 2009 report, Report on Chuitna Coal Project Aquatic Studies and Fish and Wildlife Protection Plan which has been previously provided to ADNR