

Report on Chuitna Coal Project Aquatic Studies and Fish and Wildlife Protection Plan

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Executive Summary This report summarizes my review of seven environmental reports and documents related to the proposed Chuitna Coal Project: My analysis of these reports focused on whether the aquatic resources studies were conducted using sound methodologies; whether the aquatic resources studies collected enough data and the right kinds of data; whether the aquatic resources studies provide an adequate understanding of the aquatic system; whether the reports provide an adequate foundation for a successful fish and wildlife protection plan; whether the fish and wildlife protection plan will successfully protect aquatic resources; and whether the aquatic resources studies provide adequate information for the U.S. Army Corps to make the required determinations under the 404(b)(1) Guidelines.

I found problems with the data collection methodology, the analysis and conclusions of the baseline aquatic resources studies and the Fish and Wildlife Protection Plan. These include:

- There are many problems and questions about the data collection methodology, data analysis and conclusions of the 2006-2008 studies. These are identified and discussed in the comments on each report. In addition, it is problematic to base conclusions regarding the impacts of mining on fish and fish habitat on the limited amount of data that has been collected on key issues such as smolt outmigration, adult escapement, winter fish studies, and smolt production in the affected stream systems. On most of these issues, only one year's data has been collected. Because salmon populations have historically fluctuated greatly over a 20 or more year cycle, the few years of data collected is not sufficient to determine the natural range in salmon populations that would be affected by the Chuitna coal strip mine. For example adult Chinook escapement into the Deshka River, another upper Cook Inlet stream, ranged from 57,939 fish in 2004 to 7,533 in 2008. Juvenile salmon and other forms of aquatic life show similar variability. A minimum of 5-10 years of additional study is necessary to determine the natural range of variability in fish populations that would be affected by the Chuitna Coal Mine. A credible mitigation and restoration plan cannot be developed without adequate data.
- PacRim has not conducted adequate surface and groundwater studies necessary to: accurately map and quantify the seasonal and long term cycles of groundwater input into streams 2002-2004; determine impacts to the Chuitna River drainage from strip-mining and groundwater pumping associated with mining; provide assurances that essential phreatic groundwater flow to unmined portions of streams 2003 and 2004 can be maintained during mining, or: restore essential phreatic groundwater flow to a reconstructed stream 2003.

- The uninterrupted flow of shallow groundwater to salmonid spawning streams is essential for overwinter survival of eggs and fry. Strip-mining will interrupt this flow and destroy the shallow aquifers that currently provide groundwater to streams. PacRim has not acknowledged this as an issue, provided a plan to restore phreatic groundwater flow, or referenced any scientific studies showing where an aquifer supplying phreatic groundwater to a salmon spawning and rearing stream has been successfully restored after strip-mining. An extensive search of the scientific literature returned many examples of how strip-mining has altered groundwater flow during and after mining but no examples of where groundwater has been restored to premining conditions. None of the stream restoration examples provided by PacRim, Whites Gulch dam removal, Resurrection Creek habitat restoration and the relocation of Moose Creek, to its original channel are relevant to restoration of a strip mined stream when the underlying geological structure is altered.
- The failure to determine the genetic makeup of salmonid stocks in streams 2002-2003 and the Chuitna River system is a serious deficiency of the Chuitna Coal environmental studies and proposed monitoring program. Data on genetic characteristics of salmon populations is critical for quantifying the status of local reproductive units (demes) and evolutionary significant units. There is mounting evidence that individual spawning and rearing streams, such as stream 2003, may be comprised of demes or small locally interbreeding groups of Coho, sockeye and likely other salmonids that are genetically adapted to the unique conditions in their natal streams. If these streams and the genetically unique salmon demes that use them are destroyed or blocked by strip-mining as proposed, it is unlikely that these local salmon stocks could be restored to their former level of productivity even if a new stream channel could be successfully constructed.
- It probably is not possible to reconstruct a new stream with the same level of productivity as the current stream 2003. PacRim has not provided any examples of where a strip-mined salmon spawning and rearing drainage the size of stream 2003 (17.4 km) has been restored to premining productivity. Extensive searches of the scientific literature and discussions with stream restoration experts in Alaska and elsewhere have also not produced any examples of successful restoration of a strip mined salmon stream.
- There are problems with PacRim's plan to use Rosgen's 1996 Applied River Morphology as the basis for stream 2003 reconstruction. Rosgen's 1996 stream classification system has been widely used to inventory stream channel topography in watersheds, but it is increasingly drawing criticism from hydrologists and engineers for its use in stream restoration. Some of the problems

with using Rosgen's natural channel design classification system in stream restoration include: alluvial streams are open systems that adjust to altered input of energy and materials and Rosgen's form-based system largely ignores this component; Rosgen C5 channels composed of different bank sediments adjust differently and to different equilibrium morphologies in response to identical disturbances, contradicting the fundamental underpinnings of natural channel design and the reference reach approach that PacRim proposes to use to reconstruct a new stream 2003, and; Rosgen's system fails to integrate and quantify fluvial processes and channel response. This is important because PacRim has not adequately gauged or conducted adequate in stream flow studies in any of the streams likely to be impacted by the project.

- Even in the unlikely event that Stream 2003 could be successfully restored to full physical function, it probably isn't possible to restore it to its former level of biological productivity because of the long term loss of marine derived nutrients (MDN) from salmon carcasses and the removal of all of the wetlands in the mine area. Wetlands and MDN are the primary sources of stream nutrients and productivity in salmon streams.
- The offsite mitigation offered in the plan (i.e. removal of the Big Lake Dam, bridge repair etc.) has little or no potential to offset the loss of fish populations and 17.4 km of high-value fisheries habitat that would be destroyed or altered by mining.
- There is a good chance that the spawning channels offered as onsite mitigation for the loss would not be successful. Even if these channels were utilized by spawning salmon, any fry produced in spawning channels would probably not survive unless the equivalent of 17.4 km of high-value rearing habitat could also be created.

The information provided in the PacRim Coal 2006-2008 Environmental Studies and the summary of the 1980's studies is not adequate to determine the effect of the proposed Chuitna Coal Mine on fish and fish habitat in the Chuitna drainage. It is also inadequate to develop a mitigation plan and a restoration plan for fish populations and habitat that would be impacted by mining. Additional studies are needed and are identified in Appendix 1 of this report. However, there is no scientific evidence or examples in the scientific literature to support the contention that that stream 2003 could be restored to its former level of productivity after mining

Chuitna Coal Mine baseline monitoring and restoration plan review

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Executive Summary

The development of the Chuitna Coal Mine will lead to unavoidable impacts to the Chuitna system which are not addressed in the current plans. This scientific review found critical elements missing from the Chuitna system baseline aquatic reports. The failure to address food webs, trophic linkages, interactions among upstream-downstream, stream-riparian, streammarine, and basin-wide linkages (below and above ground) severely undermines the ability of the mining plans to protect ecosystem function during mining and to restore it post-mining.

Further, the lack of consistent, long-term sampling does not provide the needed estimate of annual biological variability or range of variability, and therefore does not provide a reference to which post-mining rehabilitation effects can be compared. Finally, recreating the structural complexity and interconnectivity of the below-ground sediment layers in the back-filled mine pit will be impossible, permanently and negatively affecting the natural flowpaths and hyporheic function (including natural upwelling and downwelling) upon which existing biological productivity and biocomplexity depend. While the individual studies reviewed for this report provide important biological information about the Chuitna system, the baseline reports are missing critical information. My specific concerns are summarized and reproduced here.

- 1) By all accounts it appears it will be impossible to recreate the complex 3D network and interconnected underground channels of variously sorted sediments typically found below and lateral to streams, including streams like 2003. Flowpaths that influence aquatic productivity, and salmon spawning and egg development, which depend upon these hyporheic and groundwater networks, will be severed during the mining process. Recreating these highly complex and sorted networks and flowpaths in a fashion that reconnects them to the natural flowpaths of the intact, surrounding sediment veins will not be possible.
- 2) Compaction and settling over time of the refilled mined area will change the nature of surface flow in these areas, changing them from what they were previously into something unknown and impossible to predict.
- 3) Nothing is known about the actual food webs themselves, including what prey are important for the fish, where these prey are produced and delivered to the fishes, and when and where they are important. This needs to be understood in order for mining and reclamation plans to be developed that will maintain existing aquatic productivity.

4) General trophic connectivity throughout the watershed (upstream-downstream connections) is unknown but also needs to be understood for the same reasons as above.

5) The sampling completed to date has been inconsistent and insufficient. Multiple years of consistent and continuous sampling is needed to provide critical information on long-term annual variability and to provide better statistical power when assessing impacts.

Report on Chuitna Coal Project of PacRim Coal

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Impacts from mining coal from the wetlands and forests above the Chuitna River will cause destruction of over 4,000 acres of wetlands and is highly likely to permanently change the ecosystem of the area and the productivity of the Chuitna River.

The ecosystem is a woven fabric of wetlands, tundra, forests, and tiny headwater streams that gather to build larger streams, to eventually pour into the Chuitna River. Forty-one percent of the watershed will be directly impacted from mining and backfilling of the mine. What occurs in these headwaters, wetlands, tundra, and forests is vital to the water quality and the fish downstream. It is in these areas that carbon is stored and nutrients are cycled from detritus to microbes, from microbes to insects. The wetlands in particular are vital to storing water that seeps down into flow paths beneath the earth, to surface at the bottom of streams, keeping them flowing when there is no rain or snow. As water trickles through wetlands, microbes in the muck and peat remove heavy metals and purify the water. Wetlands are the source of both pure water and primary nutrients such as carbon, nitrogen, and phosphorous which make up the very base of the food chain.

Wetlands water seeps up to become headwater streams, disproportionately rich in biodiversity for their small size, and the source of much of the food that arrives downstream. Headwaters provide breeding and nursery grounds for insects that spend the rest of their lives in larger streams and rivers, and are an important food source for fish. Headwaters provide spawning grounds and help to regulate stream temperature. The rich biodiversity found here buffers the streams so they recover more rapidly from rapid changes such as climate swings, flooding, and human damage.

Tundra, wetlands, and headwater streams will all be destroyed during mining. And there is little chance they will be restored. Tundra is very sensitive and only revives when specific conditions are met, including maintaining corridors to more tundra throughout the mining process. Wetlands and headwaters cannot be restored to ecological function if the very material that they rely on – deep sediment structure and long-entrained flow paths – are mined through, ground up, and replaced in the mining pit as a relatively homogenous pile of rubble and dirt.

One stream, "Stream 2003" also called Middle Creek, will be completely destroyed. It will not be "impacted", but rather mining will go down hundreds of feet beneath it, completely removing the stream bed and any remnant of the stream for 11 miles. While stream reconstruction has been done successfully by re-grading and re-vegetating banks, or adding or removing debris to create habitat, no one has simply created a new stream where none exists. A new ditch can be dug where the old stream used to be, and can have the same curves and shape. But it will not have the exchange of surface and groundwater at the streambed, upwelling areas for fish to lay their eggs in, biodiversity of insects that headwater streams provide as food for fish, the purity of water and nutrients wetlands provided.

Nor is PacRim attempting to assess the functions of the stream and its associated ecosystems as they are now. Without such an assessment – rates of nutrient cycling, flood control, sediment control, water purification, and more – PacRim has no end goal to attempt to reach.

In summary, there are three main areas of concern with the mitigation plan:

First, the applicants have not directly measured ecosystem functions and thus have not applied current science to the mitigation issues. Without these functional assessments, they do not know exactly what natural resource values are being lost and thus what they need to mitigate for. Second, the approach proposed for replacing the lost streams (especially Stream 2003) is outside the realm of stream restoration or rehabilitation practices. Their approach basically amounts to channel “creation” in an area in which the earth has been disturbed to depths of 300- 500 feet, the natural flow paths destroyed, and landscape topography reshaped. Indeed, there is ample evidence in the peer-reviewed literature that the approach they propose (Natural Channel Design) typically fail ecologically. Third, impacts to the watershed and the headwater streams from the mining activities will fundamentally alter the chemical, hydrologic and sediment regimes which are master variables controlling the water quality and productivity downstream.

In sum, based on the most current and rigorous science, the impacts of this project are very significant and there is no evidence that the restoration and mitigation plans that are proposed will compensate for the natural resource losses.