Report on Northern Dynasty Water Rights Claims in the Pebble Mine Area

Preliminary Analysis of Application for Water Right, Upper Talarik Creek, Iliamna, Alaska

by

Coble Geophysical Services
Over 10 Years of Service to Alaskans
10/4/06

EPA-7609-0009182_00001

Introduction

Coble Geophysical Services (CGS) presents the following review of the Northern Dynasty Mines (NDM) water right applications referenced above for the Upper Talarik water resource. These comments are preliminary, since there was substantial information lacking from the 7/7/06 water rights application, and the subsequent 9/21/06 water rights application and completeness response documents have not been reviewed as of the publication of this report. The water rights are submitted to the Alaska Department of Natural Resources (ADNR) Office of Project Management and Permitting, Water Resources Section.

Summary Findings

►The proposed diversions of surface water and groundwater from the Upper Talarik will create dry riverbeds in the area of DL-3, eliminating Sockeye spawning and Coho rearing habitat which exist today as shown in Figure 1.
►Diversion of surface water alone from the Upper Talarik will impact Coho rearing habitat and ecosystems far downstream of the diversion point, even reducing the flow in the Upper Talarik at the downriver USGS gauge by up to nine percent of total discharge.
►The un-lined Tailing Storage Facility Site A (TSF-A), is likely located over groundwater recharge areas. The TSF-A is also located in a seismically active area which bears significant long term risks, particularly in regards to the TSF embankments which are expected to reach over 700 feet in height. At that point the pore water pressure in the un-lined reservoir bottom will also have reached several hundred feet.
►NDM requested extracting all surface water at the point DL-3 on the Upper Talarik (Table UT-2 of their surface water rights application), about 29 cfs on average, almost all of it to cover mining tailings.
►NDM also requested 20 cfs of groundwater from the same watershed, almost all of its beneficial use for submerging mining tailings.
►If sufficient water is not diverted to submerge tailings (which are potentially reactive waste materials), oxidation of mining waste can become a serious problem.
►Reservoir water will be contaminated by the mining operation to an extent that is difficult to predict, since it is affected by a number of unknown factors which includes the amount of freshwater diverted to the reservoir.
►Contaminated reservoir water discharged to the Tailings Storage Facility Reservoir could flow underground from the South Fork Koktuli Watershed into the Upper Talarik Creek Watershed.
►Existing groundwater data was not supplied by NDM for their groundwater rights application. Although this was not required by ADNR, it was requested by ADNR to understand the NDM groundwater rights application. Detailed well logs, groundwater tests, and groundwater level information (NDM, Nov. 2005) are all important in the regulatory process for large projects.
►Coastal water resources will be affected by the proposed Pebble Mine activities. Not only does project water flow into coastal areas, coastal infrastructure is planned from this proposed project. The NDM response to approximately seventy separate requests for information from the Alaska Coastal Management Program (ACMP) stated that "Phase I activities would occur approximately 58 miles from the coast, and so did not constitute development in or adjacent to coastal waters". This response is inadequate for any meaningful analysis by the State.

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Current Water Rights Applications (July 7, 2006; September 21st, 2006)
The Northern Dynasty Mines Inc. (NDM) Pebble Mine Project size generally will require many permitting iterations according to ADNR (Prokosh, personal communications) prior to the public comment phase. Information that was requested by ADNR for the NDM September 21st revisions included:

- Separate groundwater rights applications, for example as intended for use by perimeter desaturation wells around the mine
- Location of surface water diversion structures
- Location of water use, for example where water is returned to a surface water body, and where water is diverted from a water body
- A request for the description of water use to be better defined

ADNR requested further research into understanding the groundwater flow potentials between all the affected watersheds, including further quantification of the groundwater-surface water relationships. A thorough investigation of these dynamics would be necessary if any groundwater needed for the project can be quantified.

- A need to quantify and justify the volume of water to be beneficially used by each activity, for example regarding the concentrate slurry transport to proposed marine terminal in Iniskin Bay (communication with ADNR indicates this is to be a closed-loop system).
- A completed coastal project questionnaire (11 AAC 110).

The NDM response to these requests for information was not always comprehensive, and in the case of the coastal data essentially not informative with respect to the actual questions. For example, a lot of data currently exists which could have been sent to ADNR to help with the groundwater rights process as requested. The existing NDM groundwater data (NDM, 2005) was not submitted, with the exception of a well map and some limited interpretation. Not only would the ADNR groundwater rights application process require the groundwater potentials, hydraulic conductivity data, and well logs in order to evaluate the validity of the information NDM did provide, they would also need this information to recommend further necessary data collection in order to properly adjudicate the substantial 20 cfs groundwater right with respect to other economies and the environment.

A project of this size also has many other components that will affect a watershed, not all of which are addressed by the State of Alaska Water Right Application. Some regulators recommended a biologic modeling effort to assess the impacts of this project, citing the Physical Habitat Simulation (PHABSIM) software (a possible requirement by the Alaska Department of Fish and Game (ADF&G) to assess impacts of water diversions on aquatic life). Such models require a large amount of data over time to be representative, however. This data would include discharge data collected alongside habitat structure including riparian vegetation; water quality data including temperature, and energy inputs from the watershed including sediments and nutrients.

Historical Information
While a monitoring effort has taken place in the last two years in regards to defining the water and biologic resources of the Upper Talarik system, CGS found very little biologic and water resource background information collected prior to the current mining interest in the area.

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Figure 1 shows some of the historical biologic information collected in reference to commercial salmon species, and clearly these assessments involved field work. No additional information on historic Upper Talarik Creek discharge events has been located pre-dating the NDM effort. Lack of historical discharge data is commonplace in Alaska, even for some relatively large rivers.

In addition, although some biologic assessments were found pre-dating the NDM-funded work, they are exclusively ADF&G studies focused on commercial species using very infrequent surveys. Scientists have still characterized the area, however, as for example the Iliamna Quadrangle was identified long ago by United States Geological Survey (USGS) scientists who stated its main potential "lies in its recreation possibilities" (Detterman and Reed, 1973).

Preliminary Review and Analyses

>Diversion impacts have not been addressed with respect to the biological resources of the Upper Talarik. The diverted water is to be used for a number of listed purposes, including keeping the tailings pond submerged to prevent oxidation (and subsequent acidification) of the tailings and reduce dust, as well as to make sure the intake barge for return water supply to the mill has a supply of water during the winter months.

>The Pebble mine requests 29 cubic feet per second (cfs) of the Upper Talarik water for use, or essentially all the defined surface water available above their UT100D gauging site for much of the year (their mean annual discharge for UT100D is 27 cfs). In addition to removing this part of the Upper Talarik from its river system, this also means that should the 2004 dry periods be repeated, measured to be at 8 to 9 cfs at UT100D when the USG gauge was approximately 100 cfs, the impacts would be an 8-9% decrease in discharge as measured at the USGS gauge. Depending on the method of withdrawal at the diversion point, and including groundwater withdrawal upgradient (in a groundwater sense) at the pit site, the impacts could become much greater, since the groundwater contribution to Upper Talarik Creek is thought to be significant (e.g. at UT119A).

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>The winter months impacts from a complete diversion of the Upper Talarik into the Site A Tailing Storage Facility (or TSF, Site A located in the South Koktuli watershed) could include freezing of spawning grounds far below the point of diversion. This is because the watershed would then 'start' at the point of diversion, presumably too shallow to support salmon until sufficient tributaries or baseflow recreate a smaller Upper Talarik system at some point downstream. Conditions which cause dry periods such as recorded in August and September, 2004 could then have potentially greater than 8-9% biologic impacts on the Upper Talarik when accounting for channel cross section geometry and other factors.

>There is a section of the ADNR permit where discharge to surface water is requested, although an EPA National Pollution Discharge Elimination System (NPDES) permit has not yet been

applied for. It is not clear at this time if any of the requested water will be discharged back into the Upper Talarik Creek watershed.

>Most of the world's earthquakes (90%, and 81% of the largest according to Wikipedia) take place along the boundaries of the Pacific Plate, which includes the Iliamna Lake area. The Tailing Storage Facility Site A (TSF-A) therefore bears significant long term risks, particularly in regards to the TSF embankments which are expected to reach over 700 feet in height. At that point the pore water pressure in the un-lined reservoir bottom will also have reached several hundred feet. This is an issue for the un-lined TSF-A, which likely is located over groundwater recharge areas.

Conclusions

This report is funded by biologic and natural resource entities already in place which the State of Alaska has drawn benefits from since Statehood. These parties need to know exactly what the impacts of the NDM proposal are on the Upper Talarik Creek to evaluate those effects on their economies. At this point it is not clear how to satisfy these interests given lack of knowledge on the effects of this proposed project, as well as the huge precedence set by this one project in the general area.

Figure 2 shows the Iliamna Lake area has a large catalog of mineral resources of over 600 square miles that have so far been recognized (from the Department of the Interior Draft Environmental Supplement, Iliamna National Resource Range, U.S. Fish and Wildlife Service, 1980), despite the area being largely unexplored. The NDM proposal could be the beginning of a long-term mining infrastructure in this area encompassing many of the resources and mining claims shown in Figure 2. The State of Alaska should evaluate the impacts to its fisheries from all projected development, perhaps including the PHABSIM modeling approach. Otherwise, any one stakeholder beginning the process could set a precedence the State will not be able to reverse later due to lack of consideration for the overall picture. This overall picture includes the cumulative effects of roads, tailings facilities, pipelines and other infrastructure for all future mining development here. The area of mineral wealth cited in the Department of the Interior paper occurs in an area of over 600 square miles.

In addition, the true costs of reclamation may never be quantified. This problem is caused by many factors, which include the evolving nature of these projects, as well as the 50-year history proposed for this one facility alone. Generations of career regulators (as well as mining staff), along with their knowledge of this project will have come and gone before the mine is proposed to close. History shows that the resultant mine history may become complicated with water contamination issues. The remote location makes regulation more expensive and difficult, even if the fees are addressed during the mine's life through water rights fees. Problems obviously can occur after ceasing water use. It is hard to predict who will regulate mine reclamation activity so far into the future (50 years). The State of Alaska does not generally plan that far ahead.

References

Detterman, Robert L. and REed, Bruce L., 1973. Surficial Deposits of the Illiamna Quadrangle, Alaska, U.S. Geological Survey Bulletin 1368-A.

Northern Dynasty Mines, 2005. Draft Environmental Baseline Studies, 2004 Progress Reports, Chapter 5. Ground Water Hydrogeology, November 2005.

USFWS, 1980. Department of the Interior Draft Environmental Supplement, Iliamna National Resource Range, U.S. Fish and Wildlife Service.

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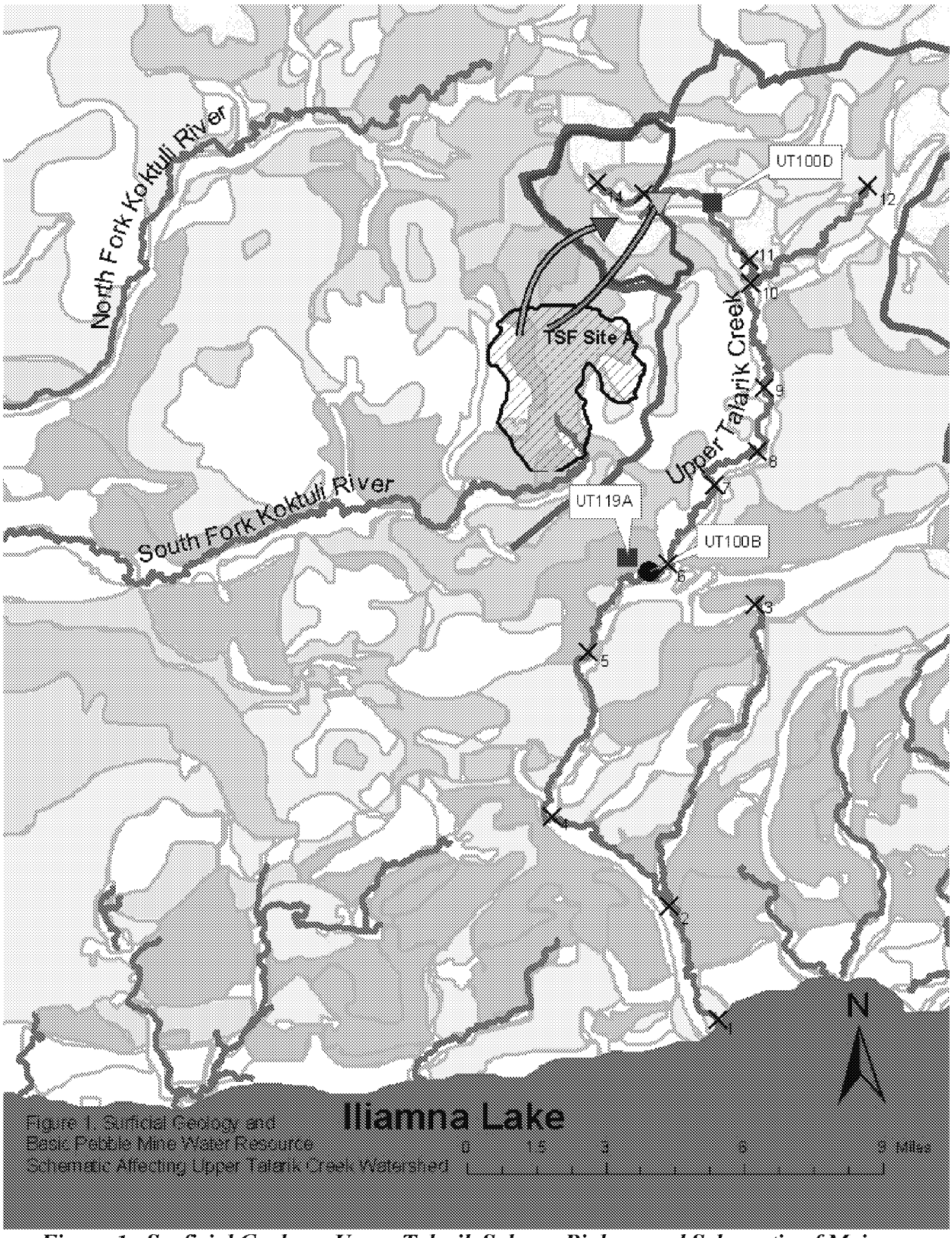

Figure 1. Surficial Geology, Upper Talarik Salmon Biology and Schematic of Major Water Resources and Proposed Pebble Mine Diversion for the Upper Talarik Watershed (adapted from Detterman et al., 1973).

Legend

Surficial Deposits

- Flood Plain Alluvium
- Ground Moraines
- Solifluction Deposits
- Stream Terrace Deposits
- Swamp Deposits
- Outwash Plains
- Terraced and Modified Morainal Deposits
- Talus and Rubble Deposits
- Moraine of the Kvickak Stade
- Ground Moraines
- Moraine of the Iliamna Stade
- Hanging Delta and Outwash
- Beach Ridge Deposits
- Landslide Deposits

- TSF Site A (Proposed Tailings Storage Facility)
- Area of Water Extraction
- Schematic of Water Diversion
- Watershed Boundary (Based on Topography)
- USGS Discharge Gauge
- U119A

Proposed Downstream Limit of Water Extraction in the Upper Talarik

- GEP-3
- GEP-5

Salmon Spawning Areas

- 1 Ss, Ks, COr, ACp
- 2 Ss
- 3 Ss
- 4 Ss, Ks, COr, ACp
- 5 Ss, Ks, COr, ACp
- 6 ACp
- 7 Ks, Kp
- 8 Kp, Kr
- 9 Ss, Kr, COr
- 10 Ss, Kr, COr
- 11 COr
- 12 COr
- 13 COr
- 14 Ss

Figure 1 (cont.), Legend

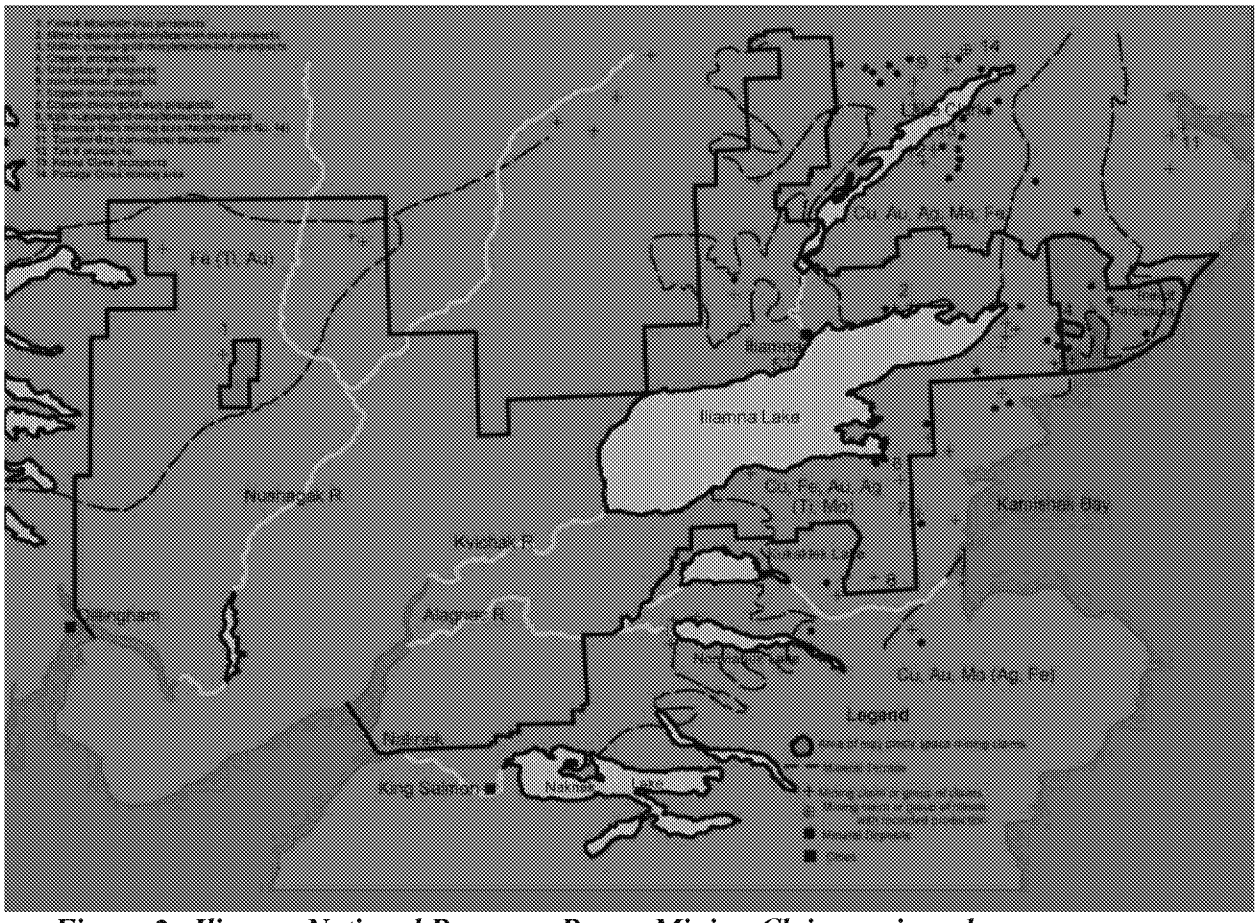

Figure 2. Iliamna National Resource Range Mining Claims: mineral resources, prospects, and areas geologically favorable for the occurrence of mineral deposits (USFWS, 1980).