6/12/07 Workshop
Suction Dredge Mining
Deadline: 6/22/07 Noon

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**From:** Jim Foley <jfoley@sisqtel.net>
**To:** <commentletters@waterboards.ca.gov>
**Date:** Wed, Jun 20, 2007 10:30 AM
**Subject:** Effects of suction dredge mining on water quality

Dear water board members,

At your meeting on June 12, 2007 I turned in a written copy of the comments I presented orally before the board. I would like to replace those comments with the comments attached in this email because I came into possession of further important information after I delivered my comments orally.

Please find my official comments attached on MS Word format.

Thank you,

**Subject:** **Comment Letter - Suction Dredge Mining**
**From:** **James D. Foley**
**35910 Hwy. 96**
**Hamburg, CA. 96050**
**Email:** **jfoley@sisqtel.net**

Dear board members,

Please accept the following comments, as well as all designated attachments, as my official comments on the effects of suction dredge mining on water quality.

**1.** There have been many studies published on the subject of the effects of suction dredge mining on water quality by qualified water quality biologists, universities, U.S. Environmental Protection Agency, U.S. Corps of Engineers, various state government agencies, USGS, NOAA, USDA, USFS and USFWS.

Without exception these studies invariably reach conclusions of "no significant impact," "de-minimus impact," "short term, localized impact" and "no measurable change in water quality."

**2.** In any consideration of how suction dredge mining impacts water quality, it is imperative to keep the scale of an individual suction dredge activity in mind. For example, it has been observed that environmentalists opposing suction dredging would characterize the affects of turbidity from a suction dredge as if it would impact downstream organisms in a manner that system-wide high water flow events might impact them. This approach is entirely inconsistent with the way in which suction dredges operate or generally impact their downstream environment.

**a.** The California Department of Fish and Game (1997) described typical dredging activities as follows: "An individual suction dredge operation **affects a relatively small portion of a stream or river**. The area or length of river or streambed worked by a single suction dredge operator, as compared to total river length, is relatively small compared to the total available area. (See Exhibit 1)

**b.** A report from the U.S. Forest Service, Siskiyou National Forest (Cooley, 1995) answered the frequently asked question, "How much material is moved by annual mining suction dredge activities and how much does this figure compare with the natural movement of such materials by surface erosion and mass movement?" The answer was that suction dredges moved a total of **2,413** cubic yards for the season. Cooley (1995) used the most conservative values and estimated that the Siskiyou National Forest would move **331,000** cubic yards of material each year from natural causes. Compared to the **2413** (in-stream) cubic yards re-located by suction mining operations the **movement rate by all suction dredge mining would equal** ***about 0.7% of natural rates***. (See Exhibit 2)

**c.** A report on the water quality cumulative effects of placer mining on the Chugach National Forest, Alaska found that, "The results from water quality sampling do not indicate any strong cumulative effects from multiple placer mining operations within the sampled drainages." "Several suction dredges probably operated simultaneously on the same drainage, but did not affect water quality as evidenced by above and below water sample results. *In the recreational mining area of Resurrection Creek, five and six dredges would be operating and not produce any water quality changes* (Huber and Blanchet, 1992).

**3.** The results from scientific investigations, presented in the Environmental Impact Reports, prepared by the State of California, Clearwater National Forest and Siskiyou National Forest, provide all the evidence required to support the determination that small-scale suction dredging is *de minimis* and impacts from these dredges are *less than significant*." The now expired California CEQA for suction dredge mining contains all the information needed for determining the effects of this activity on water quality, specifically in the state of California. Nothing has changed in the time since this CEQA was completed, therefore it stands to reason from both a practical, as well as an agency workload standpoint, that since there is no change, that the existing rules, regulations and requirements are sufficient to protect water quality.

**a.** Suction dredge mining has been going on in the state of California for the last 50 years, with no recorded ill effects from the activity. A suction dredge remains the single "best management" tool that both miners and agencies have to remove valuable minerals from streambeds. A suction dredge adds nothing to the water; it simply removes streambed material, passing it over a sluice box and re-deposits the same material in virtually the same place it was taken from. It breaks up impacted streambed material, thus making desirable conditions for fish spawning and fresh water sanctuary in the form of cold water refugia.

**4.** The issue of turbidity from suction dredge mining has come to the forefront in most agency consideration to examine water quality issues connected with the activity. Turbidity, as a result of suction dredge mining is rather miniscule in comparison to other activities such as boating, and especially when comparing it to natural, or even seasonal sever weather conditions, which impacts water quality on a system-wide scale.

**a.** Any turbidity resulting from a suction dredge is short lived and very localized. "During a dredging test carried out by the California Department of Fish and Game on the north fork of American River, it was concluded that turbidity was greatest immediately downstream, returning to ambient levels within 100 feet. Referring to 52 dredges studied, Harvey (1982) stated "...generally rapid recovery to control levels in both turbidity and settable solids occurred below dredging activity."

Hassler (1986) noted "...during dredging, suspended sediment and turbidity were high immediately below the dredge, but diminished rapidly within distance downstream." He measured 20.5 NTU 4 meters below a 5-inch dredge that dropped off to 3.4 NTU 49 meters below the dredge. Turbidity from a 4-inch dredge dropped from 5.6 NTU 4 meters below to 2.9 NTU 49 meters below with 0.9 NTU above. He further noted "...water quality was impacted only during the actual operation of the dredge...since a full day of mining by most Canyon Creek operators included only 2 to 4 hours of dredge running time, water quality was impacted for a short time." Also "...the water quality of Canyon Creek was very good and only affected by suction dredging near the dredge when it was operated."

**5.** This quote from the last CEQA on suction dredge mining should speak volumes this board regarding actual studies effects to water quality. “Effects from elevated levels of turbidity and suspended sediment normally associated with ***suction dredging as regulated in the past in California appear to be less than significant with regard to impacts to fish and other river resources*** because of the level of turbidity created and the short distance downstream of a suction dredge where turbidity levels return to normal” (CDFG, 1997).

**6.** There seems to be some concern in recent years concerning elevated water temperatures where suction dredge mining occurs. Suction dredges have no means of adding heat to the water column. They simply take in ambient cold water and discharge it very rapidly back into the water column, without adding heat or any other substance to the water column.

**a.** These quotes from the Siskiyou National Forest study should put any question of added heat to rest. “Responsible suction dredge miners do not dredge stream banks (it is illegal). Dredging occurs only in the wetted perimeter of the stream. Therefore, it is unlikely suction dredging will cause a loss of cover adjacent to the stream.

Solar radiation is the single most important energy source for the heating of streams during daytime conditions. The loss or removal of riparian vegetation can increase solar radiation input to a stream increasing stream temperature. ***Suction dredge operations are confined to the existing stream channel and do not affect riparian vegetation or stream shade*** *(SNF, 2001).*

Suction dredging could alter pool dimensions through excavation, deposition of tailings, or by triggering adjustments in channel morphology. Excavating pools could substantially increase their depth and increase cool groundwater inflow. This could reduce pool temperature. If pools were excavated to a depth greater than three feet, salmonid pool habitat could be improved. In addition, ***if excavated pools reduce pool temperatures, they could provide important coldwater habitats for salmonids living in streams with elevated temperatures*** *(SNF, 2001).*

Dredge mining had little, if any, impact on water temperature (Hassler, T.J., W.L. Somer and G.R. Stern, 1986). In addition, the Oregon Siskiyou Dredge Study states, “***There is no evidence that suction dredging affects stream temperature***” *(SNF, 2001).*

**7.** Concern has been raised that small-scale dredge operations may increase the metal load of the surface waters. It is important to note that small scale suction dredge operation remove a substantial amount of toxic mercury, as well as lead from both fishing and hunting activities. This is very beneficial to the overall chemistry of our rivers as well as contributing to the assurance of good water quality. (See Exhibit 3)

**a.** "In 2000, EPA and California's Division of Toxic Substance Control worked in concert with other State and local agencies to find the regulatory flexibility needed to collect mercury in a simple and effective manner. In August and September, 2000 the first mercury "milk runs" collected 230 pounds of mercury. A Nevada County household waste collection event held in September 2000 collected about 10 pounds of mercury. The total amount of mercury collected was equivalent to the mercury load in 47 years worth of wastewater discharge from the city of Sacramento's sewage treatment plant or the mercury in a million mercury thermometers. This successful pilot program demonstrates how recreational gold miners and government agencies can work together to protect the environment."(US EPA, 2001).

This quote from the Alaska study to determine effects of suction dredging on water quality chemistry should put any concerns to rest.

**b.** "The U.S. Geological Survey and the Alaska Department of Natural Resources cooperated in a project, on Fortymile River, to provide scientific data to address these questions. This river is designated a Wild and Scenic Corridor by the Alaska National Interest Lands Conservation Act. Current users of the river include placer mine operators, as well as boaters and rafters. Along the North Fork Fortymile River, and just below its confluence with the South Fork, mining is limited to a few small suction dredges which, combined, produce as much as a few hundred ounces of gold per year. In this area, some potential environmental concerns have been raised associated with the mining activities, including increased turbidity of the river water; adverse impact on the overall chemical quality of the river water; and potential additions of specific toxic elements, such as arsenic, to the river during mining operations.

Field measurements were made for pH, turbidity, electrical conductivity (a measure of the total dissolved concentrations of mineral salts), and stream discharge for the Fortymile River and many of its tributaries. Samples were collected at the same time for chemical analyses, including trace-metal analyses

Water-quality samples were collected at three points 200 feet behind each of the two operating suction dredges. One sample was collected on either side of the plume, and one in the center of the plume. The samples were passed through a filter with a nominal pore size of 0.45 micrometers and acidified to a pH less than about 2. Results are shown in the following table. Samples 1A, 1C, 2A, and 2C are from either side of the plume behind dredges 1 and 2, respectively. Samples 1B and 2B are from the center of each plume. All concentrations given are in micrograms per liter, except pH, which is expressed in standard units.

The data show similar water-quality values for samples collected within and on either side of the dredge plumes. Further, the values shown in the table are roughly equal to or lower than the regional average concentrations for each dissolved metal, based on the analyses of 25 samples collected throughout the area. Therefore, ***suction dredging***

***appears to have no measurable effect on the chemistry of the Fortymile River*** within this study area. We have observed greater variations in the natural stream chemistry in the region than in the dredge areas.” (Wanty, R.B., B. Wang, and J. Vohden. 1997).

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## Exhibit 1

**Subject:** **Comment Letter - Suction Dredge Mining**
**From:** **James D. Foley**
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**Hamburg, CA.96050**
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**doi: 10.1577/1548-8659(1986)6<401:EOSGDO>2.0.CO;2**
***North American Journal of Fisheries Management:* Vol. 6, No. 3, pp. 401–409.**

# Effects of Suction Gold Dredging on Fish and Invertebrates in Two California Streams

BRET C. HARVEY

*Department of Wildlife and Fisheries Biology, University of California, Davis, California 95616, USA*

*Abstract.*—I examined the impact of small suction dredges (hose diameter, <16 cm) on fish and invertebrates in two California streams (North Fork of the American River and Butte Creek) in a 2-year study. I studied both the effect of one dredge (1980) and the effects of an average of six dredges in a 2-km section of stream (1981). Ten replicate Surber samples per station were taken monthly to compare macroinvertebrate abundances at control and dredged stations before, during, and after dredging in both years. Dredging significantly affected some insect taxa when substrate was altered. A recolonization experiment showed that numerical recovery of insects at dredged sites was rapid. Mask-and-snorkel censuses and observations of tagged fish indicated that major changes in available habitat caused local decreases in fish density. Dredging affected riffle sculpins (Cottus gulosus) more severely than rainbow trout (Salmo gairdneri), probably because of differences in microhabitat requirements. Local turbidity increases below active dredging probably did not affect invertebrates and fish.

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## Exhibit 2

**Subject:** **Comment Letter - Suction Dredge Mining**

**From:** **James D. Foley**
**35910 Hwy. 96**
**Hamburg, CA.96050**
**Email:** **jfoley@sisqtel.net**

**United States Department of Agriculture**
**Forest Service**
**Siskiyou National Forest**
**200 NE Greenfield Road**
**Grants Pass, OR 97526-0242**

Date: October 16, 1995

Subject: A comparison of stream materials moved by mining suction dredge operations to the natural sediment yield rates

To: The Record

A question that has frequently been asked is how much material is moved by annual mining suction dredge activities on the Siskiyou National Forest and how does this figure compare with the natural movement of such materials by surface erosion and mass movement? At the conclusion of the 1995 summer suction dredge season, the responsible minerals personnel on each Ranger District of the Siskiyou National Forest were asked to make a quantitative estimate of the number of cubic yards of material that was moved over the season by suction dredge operations. The estimates were based on on-the-ground observations carried out over the summer. Quantities of moved material ranged from 23 to 1920 cubic yards per district with a Forest total of 2413 cubic yards for the season.

Three documents were examined to determine a reasonable estimate of natural sediment yield rates. A published 1985 study by Michael P. Ainaranthus et al entitled "Logging and Forest Roads Related to Increased Debris Slides in Southwestern Oregon" found that natural erosion rates for debris slides in the Klamath Mountains of southwest Oregon averaged about 0.5 cubic yards per acre per year. This same study found that erosion rates on roads and landings were 100 times those on undisturbed areas, while erosion on harvested areas was seven times that of undisturbed areas. In another study (unpublished) done in 1988 by Jon Vanderheyden et al entitled "Siskiyou National Forest Silver Fire Recovery Process Paper", surface and channel erosion rates were estimated and then an estimate of total natural erosion rates was made by summing a debris slide rate with surface and channel rates. The debris slide rate was developed for the Siskiyou National Forest from an inventory that examined landslide activity between 1956 - 1976 on 137,000 acres of the Forest. This 1985 study estimated that baseline sediment yield (total natural erosion rate) in the Silver Creek basin averaged about 14.2 tons per acre per decade. For the Indigo Creek basin sediment yield averaged 8.0 tons per acre per decade. Putting these figures on an annual basis and using a generally accepted average of 1.5 tons per cubic yard of material would produce sediment yields of 0.95 and 0.53 cubic yards per acre per year for Silver and Indigo Creeks respectively. The Siskiyou National Forest Land and Resource Management Plan of 1989 estimated that the average natural sediment yield rate for the Forest from both mass movement and surface erosion was 0.5 tons per acre per year. This figure equals about 0.33 cubic yards per acre per year and is the most conservative of the natural sediment yield figures found in the literature readily available.

There are 1,092,302 acres on the Siskiyou Natural Forest. Using a factor of 0.33 cubic yards per acre per year times 1,092,302 acres will produce a very conservative estimate that 331,000 cubic yards of material move each year from natural causes compared to the 2413 cubic yards that was moved by suction dredge mining operations in 1995 on the Siskiyou. This would be a movement rate by suction dredge mining that equals about 0.7% of natural rates.

/s/ Michael F. Cooley
MICHAEL F. COOLEY
Recreation, Lands and Minerals Staff Officer, Siskiyou National Forest

## Exhibit 3

**Subject:** **Comment Letter - Suction Dredge Mining**
**From:** **James D. Foley**
**35910 Hwy. 96**
**Hamburg, CA.96050**
**Email:** **jfoley@sisqtel.net**

June 15, 2007

Subject: **SUCTION DREDGE MINING**

Dear Board Members,

It has been claimed, at your recent June 12th Board meeting, that reintroduction of mercury in the water traveling through a suction dredge will pose an environmental risk. In the unlikely event that mercury would escape the sluice box recovery system on a suction dredge, its very nature would cause it to instantly mix with the other bottom materials moving through the sluice box and cause it to settle deep within the stream or river bottom overburden. The density of mercury is 13.53 grams per cubic centimeter ($g/cm^3$). The density of gold and lead are, respectively, 19.28 $g/cm^3$ and 11.34 $g/cm^3$. Lead, the least dense of the three metals, is routinely found in the cleanup of the dredge sluice boxes which are also collecting lost fishing weights.. That is a very good indicator that the heavier mercury is being captured and held in the sluice box. There is no new harm… but there is the very real benefit to the environment from the removal of the associated mercury and lead.

It has been proven that suction dredges are ideal for the safe recovery of lead and mercury from stream and riverbed sediments. In fact, they do such a good job that rather than disparage the use of suction dredges, it would serve the public good and increase the effectiveness of it's own mission (i.e.; to protect the environment) by encouraging even more suction dredge activity, and providing safe and secure disposal sites for these recovered metals.

**Studies and a trial program prove the effectiveness and benefits of the recovery of mercury during suction dredge mining operations.** The US EPA Region 9 **(San Francisco, CA office)** has recognized the benefits associated with suction dredger mining as a method of aiding their efforts in environmental cleanup at no cost to the tax payer and have touted the benefits of suction dredgers removing mercury from the environment.

## US EPA REGION 9, MERCURY RECOVERY FROM RECREATIONAL GOLD MINERS

http://www.epa.gov/region09/cross_pr/innovations/merrec.html

**The Challenge:**

Looking for gold in California streams and rivers is a recreational activity for thousands of state residents. Many gold enthusiasts simply pan gravels and sediments. Serious recreational miners may have small sluice boxes or suction dredges to recover gold bearing sediments. **As these miners remove sediments, sands, and gravel from streams and former mine sites to separate out the gold, they are also removing mercury**.

This mercury is the remnant of millions of pounds of pure mercury that was added to sluice boxes used by historic mining operations between 1850 and 1890. Mercury is a toxic, persistent, and bioaccumulative pollutant that affects the nervous system and has long been known to be toxic to humans, fish, and wildlife. Mercury in streams can bioaccumulate in fish and make them unfit for human consumption.

**The Solution:**

**Taking mercury out of the streams benefits the environment**. Efforts to collect mercury from recreational gold miners in the past however have been stymied due to perceived regulatory barriers. Disposal of mercury is normally subject to all regulations applicable to hazardous waste.

In 2000, EPA and California's Division of Toxic Substance Control worked in concert with other State and local agencies to find the regulatory flexibility needed to collect mercury in a simple and effective manner. These groups agreed to test two different mechanisms for collecting mercury during the summer of 2000. One approach was to add mercury to the list of materials that are collected at regularly scheduled or periodic household hazardous waste collection events sponsored by local county agencies.

Another mercury collection approach was to set up collection stations in areas where mercury is being found by recreational miners. One possibility would be to advertise a fixed location where people could bring mercury on a specific date and time. Another was to create a mercury "milk run" where state, local, or federal agency staff would come to locations specified by individuals or organizations such as suction dredging clubs, and pick up mercury that had been collected.

**The Results:**

In August and September, 2000 the first mercury "milk runs" collected **230 pounds of mercury**. The total amount of mercury collected was equivalent to the mercury load in 47 years worth of wastewater discharge from the city of Sacramento's sewage treatment plant or the mercury in a million mercury thermometers. This successful pilot program demonstrates how recreational **gold miners and government agencies can work together to protect the environment**. In the summer of 2001, State agencies planned to extend the program to six counties and include collection of mercury at summer mining fairs. (US EPA, 2001)

Getting 230 pounds of mercury out of the environment is an achievement that would not have been accomplished without the aide of the suction dredgers. The mining community of today is in my opinion the only group that are in a position with the technology to help out and at a very economical price to the public. Any residual mercury remaining after dredging in a location is that much less to worry about in our nations waterways.

## THE 1999 FINAL REPORT FOR THE 40-MILE RIVER STUDY

## Heavy Metals

For the unfiltered samples, two metals, copper and zinc, showed distinct increases downstream of the dredge. Total copper increased approximately 5-fold and zinc approximately 9-fold at the transect immediately downstream of the dredge, relative to the concentrations measured upstream of the dredge. For both metals, the concentrations declined to near upstream values by 80 m downstream of the dredge. The pattern observed for total copper and zinc concentration is similar to that for turbidity and TFS, suggesting that the metals were in particulate form, or associated with other sediment particles. Zinc, arsenic, and copper displayed an average value downstream of the dredge that was greater than the average value measured upstream of the dredge (note that samples sizes are low, particularly upstream of the dredge). Copper displayed the greatest change, increasing by approximately 3-fold downstream of the dredge. Dissolved lead concentrations did not appear to be affected by operation of the dredge**. Values of dissolved mercury actually were greater upstream of the dredge, suggesting that any effect of the dredge was likely within the range of natural variation.** (The operator reported observing deposits of liquid mercury within the sediments he was working.) For both dissolved and total concentrations, budgetary limitations precluded multiple sampling across either space or time, thus the results of heavy metal sampling are only indicative of likely conditions. (Prussian, A.M., T.V. Royer and G.W. Minshall, 1999)

Conclusions from the US EPA's commissioned Forty-Mile River study documented that heavy metals in sediments were not a concern and any contaminated sediments containing mercury were not a problem in gold bearing rivers and streams.

An important benefit of suction dredging for gold is that through gravity separation other heavy metals such as mercury are also trapped in the riffles of the sluice box and can be readily collected for disposal or resale.

Mercury Contamination from Historic Gold Mining in California. USGS Fact Sheet FS-061-00 (2005**)**

# MERCURY METHYLATION and BIOMAGNIFICATION

Mercury occurs in several different geochemical forms, including elemental mercury [Hg(0)], ionic (or oxidized) mercury [Hg(II)], and a suite of organic forms, the most important of which is **methylmercury** $(CH_3 Hg^+)$. Methylmercury is the form most readily incorporated into biological tissues and most toxic to humans. The transformation from elemental mercury to methylmercury is a complex biogeochemical process that requires at least two steps, (1) oxidation of Hg(0) to Hg(II), followed by (2) transformation from Hg(II) to $CH_3 Hg^+$; step 2 is referred to as **methylation.**

Methylation of mercury is controlled by sulfate-reducing bacteria and other microbes that tend to thrive in conditions of low dissolved oxygen, such as near the sediment-water interface or in algal mats. Numerous environmental factors influence the rates of mercury methylation and the reverse reaction known as demethylation. These factors include temperature, dissolved organic carbon, salinity, acidity (pH), oxidation-reduction conditions, and the form and concentration of sulfur in water and sediments. (USGS 2005)

An important fate of mercury, in contaminated overburden, is to be transported to downstream areas. **This occurs naturally every year during high flow episodes.** However, because the rivers and streams of the Northwest are highly oxygenated, and would be slow in transforming mercury to methyl mercury, there have been few methyl mercury problems reported.

## MERCURY IN THE ENVIRONMENT, USGS FACT SHEET 146-00 (October 2000) WHERE METHYL MERCURY IS A PROBLEM

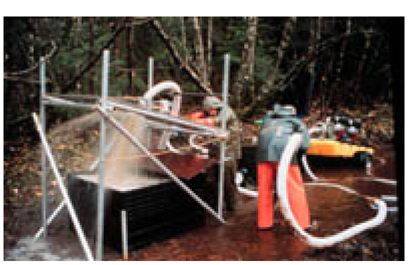
Although mercury is a globally dispersed contaminant, it is not a problem everywhere. Aside from grossly polluted environments, **mercury is normally a problem only where the rate of natural formation of methyl mercury from inorganic mercury is greater than the reverse reaction**. **Methyl mercury is the only form of mercury that accumulates appreciably in fish.** Environments that are known to favor the production of methyl mercury include certain types of wetlands, dilute low-pH lakes in Northeast and North central United States, parts of the Florida Everglades, newly flooded reservoirs, and coastal wetlands, particularly along the Gulf of Mexico, Atlantic Ocean, and San Francisco Bay. (USGS 2000)

**Since none of these areas listed by the USGS are areas that suction dredge mining occur to a large extent** and for the fact that methylation occurs in anaerobic sediments under complex conditions effected by many factors including pH and temperature **the likelihood of any major mercury problem is highly unlikely in most gold bearing rivers and streams.**

Suction dredging is used by other agencies as a means to clean up streambed sediments for habitat restoration activities:

**NOAA: http://www.photolib.noaa.gov/ habrest/crp_duc.html**

## DUCK CREEK WATER QUALITY AND ANADROMOUS FISH HABITAT RESTORATION



Duck Creek, a surface water body in Alaska, is impaired by urban runoff from non-point source **pollutants including, heavy metals**, hydrocarbons, iron flocs and excess nutrients. This small coastal stream originates from a spring that drains runoff from Mendanhall Valley, a relatively high residential and business area.

Historically there were runs of nearly 10,000 chum salmon and Coho runs of about 500 fish in Duck Creek. Currently the chum run is extinct and the Coho run consists of only 20 fish. Restoration at Duck Creek involves the development and implementation of bio-remediation methods to restore water quality and anadromous fish habitat in impaired streams.

NOAA scientists attempted to correct the degraded conditions by using high-pressure jet pumps and **suction dredges to remove fine sediment from the streambed**. Researchers also added natural structures to direct stream flow and increase oxygen levels. The removal or replacement of perched culverts that impair fish habitat will also take place to reduce flood hazards. **This project demonstrates the benefits of restoration and the importance of aquatic habitat protection in maintaining healthy aquatic ecosystems.** (NOAA, 2006)

**As should be obvious to all, the benefits extremely outweigh any negative concerns of heavy metals in sediments of gold bearing streams and rivers mined using suction dredge techniques.**

**A recent study was conducted by Washington State Department of Ecology, entitled:**

## <u>THE EFFECTS OF SMALL-SCALE GOLD DREDGING ON ARSENIC, COPPER, LEAD AND ZINC CONCENTRATION IN THE SIMILKAMEEN RIVER</u> (March 2005).

Their findings were deemed a "*worst-case assessment in several respects*". The study was conducted because ambient arsenic concentrations in the Similkameen River substantially exceed Washington State human health criteria due to natural conditions. The following depicts these findings: (1) Metals concentrations in the effluent and plumes would be subjected to further dilution in the river; (2) Sub-samples for the effluent composites were only taken when the suction hose was in contact with the streambed; (3) Less restrictive water quality criteria would apply at other times of the dredging season when hardness levels are higher; and, (4) Once the effluents are discharged, the metals will partition in to dissolved and particulate fractions. The dissolved fraction is the primary toxicity concern.

It was interesting to note that the Department of Ecology found, ***"The metals concentration measured in gold dredge effluents during the present study were at or below aquatic life criteria"***. Therefore, criteria exceedances would not be anticipated in the Similkameen River, regardless of the number of dredges operating.

A series of dilution calculations were done to estimate what effect multiple dredges would have on metals concentration in the river. As a point of reference, the maximum number of dredges Ecology personnel have observed on the Similkameen is approximately 20, during average September flows. The report estimates that it would take somewhere between 17 and 57 dredges operating continuously (i.e. 24 hours a day) to increase dissolved zinc, lead and copper concentrations by 10%. Further, the report states, *"It would take between approximately 200 and 520 dredges to have the same effects on total recoverable and dissolved arsenic, respectively. In order for zinc, lead, or copper concentrations to be doubled in the river, anywhere from 170 to 570 dredges would need to be operating. Arsenic concentrations in the dredge effluents are too low to cause an increase of that magnitude, regardless of river flow. As demonstrated elsewhere in this report, a 100% increase in the ambient arsenic, copper, lead, or zinc concentrations in the Similkameen River would not result in exceedances of aquatic life criteria."* (Johnson, A. and M. Peterschmidt, 2005)

Results showed that the metals concentrations discharged from small-scale gold dredges are not a significant toxicity concern for aquatic life in the Similkameen and that it would take large numbers of dredges to effect a small change in the river′s arsenic levels, even at low-flow conditions. (Johnson, A. and M. Peterschmidt, 2005)

As the scientific literature clearly shows that suction dredging has little effect, if any, on heavy metal contamination that may arise from redistribution of the bottom substrate during normal mining activity. Most importantly, suction dredge miners aid in recapturing mercury and other heavy metals such as lead that otherwise would be continuously transported in heavy winter flows to be relocated further down stream.

I hope you find this information of value and I appreciated the chance to provide it for your consideration in this matter.

## LITERATURE CITED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NOAA, 2006: Duck Creek Water Quality and Anadromous Fish Habitat Restoration **http://www.photolib.noaa.gov/ habrest/crp_duc.html**

Prussian, A.M., T.V. Royer and G.W. Minshall, 1999. Impact of suction dredging on water quality, benthic habitat, and biota in the Fortymile River, Resurrection Creek, and Chatanika River, Alaska, FINAL REPORT. US Environmental Protection Agency, Region 10, Seattle, Washington.

USEPA, 2001. Mercury Recovery from Recreational Gold Miners. **http://www.epa.gov/region09/cross_pr/innovations/merrec.html**

USGS, 2000. Mercury in the Environment, USGS Fact Sheet 146-00 (October 2000) Environments Where Methyl mercury is a Problem.

**USGS, 2005. Mercury Contamination from Historic Gold Mining in California. USGS Fact Sheet FS-061-00 (2005). Charles N. Alpers, Michael P. Hunerlach, Jason T. May, and Roger L. Hothem**

**http://ca.water.usgs.gov/mercury/fs06100.html**

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