December 3, 2009

Mark Stopher
California Department of Fish and Game
601 Locust Street
Redding, CA 96001

Re: Comments on the Department's Notice of Preparation of a Draft Subsequent Environmental Impact Report Regarding Suction Dredge Mining Rules

Dear Mr. Stopher:

The Sierra Fund is pleased to make the following comments on the Notice of Preparation of a Draft Subsequent Environmental Impact Report (SEIR) regarding suction dredge mining rules.

The Sierra Fund is a nonprofit community foundation, with the mission to increase and organize investment in the natural and human resources of the Sierra Nevada. Since 2006, The Sierra Fund has been working to bring more attention to the environmental and health impacts of historic mining, through our Mining Initiative which is based upon recommendations from our 2008 report entitled *Mining's Toxic Legacy*. (The full report can be viewed on our website www.sierrafund.org/campaigns/mining). We are currently engaged in a Sierra-wide effort to raise public awareness of the problems presented by abandoned mines, mine waste piles, mercury, and other toxins left over from mining in the region, and to involve all stakeholders in designing workable solutions to these problems.

We joined with a number of other organizations in developing collaborative comments on the SEIR, outlining a number of other comments and recommendations for changes. These comments, which are being submitted by the Karuk Tribe and large coalition of organizations, reflect our concerns as well.

In addition, we are here submitting comments focusing on mercury issues that are pertinent to the SEIR. The following comments about the technical elements of the SEIR that address mercury hazards have been developed in large part by The Sierra Fund's Science Director, Carrie Monohan, Ph.D. (see Vitae, attached).

We believe that the broadest interpretation should be made of the scope of the SEIR that was ordered by the California court. Since "new information, which was not known and could not have been known at the time the [original] environmental impact report was certified as complete has become available" (Public Resources Code 21166 (c)) concerning the deleterious and cumulative impact of suction dredge gold mining, the scope of the SEIR must respond to this new information, especially around Air Quality, Biological Resources, Hazards and Hazardous Materials, and Water Quality and Toxicology. We outline some of this new information in the following comments. Our comments on the SEIR are focused on specific changes in the SEIR Environmental Check List that we would like to see adopted.

Comment #1: The Air Quality discussion inadequately characterizes the potential air quality impacts of suction dredging by failing to discuss the impact of mercury that is retorted as part of gold recovery.

The SEIR in section 5.5.7 Processing of Material states:

> Generally, the sluice box does not need to be cleaned until gold is beginning to be deposited below the upper third of the box ...Normal conditions require that the sluice box be cleaned only once or twice per day... The concentrates are filtered through a series of screens and/or panned to work the concentrates down to small batches containing gold, which then can be processed through a final dry process... This final procedure involves the drying of concentrates, filtering, and physical separation using magnets and small hand tools. In addition, chemical separation, by means of mercury and nitric acid, may be used for the amalgamation process...After the mercury has gathered in the gold, it is removed by dissolving it in nitric acid or by driving it off as a vapor by heat, leaving the gold behind. While mercury should be treated as a hazardous waste, some miners collect and store it, while others dispose of it by vaporizing it in a cooking pan on a camp stove.

Despite this information, which clearly points out that mercury is allowed to vaporize into the atmosphere at suction dredge mining operations, and a great deal of public testimony that mercury vapor is commonly released on-site as a part of routine suction dredging for gold, there is no mention in the air quality environmental checklist about this practice or its air quality impacts.

Mercury vapor releases have been acknowledged as a significant air quality impact. Mercury discharges into air are regulated by the Clean Air Act. The Clean Air Act regulates 188 air toxics, also known as "hazardous air pollutants." Mercury is one of these air toxics. The Act directs the EPA to establish technology-based standards for certain sources that emit these air toxics. Those sources also are required to obtain Clean Air Act operating permits and to comply with all applicable emission standards.

Mercury is very dangerous when inhaled. Acute exposure to mercury vapor leads to pulmonary and central nervous system effects. Inhalation of high levels of mercury vapor can cause the onset of symptoms such as cough, dyspnea, chest pain, nausea, vomiting, diarrhea, fever and a metallic taste in the mouth. These symptoms can progress to interstitial pneumonitis and pulmonary edema. Young children are at the greatest risk of developing pulmonary toxicity.

Recommendation: The acknowledged common practice of retorting mercury on-site as part of routine processing of materials from suction dredge mining has a potentially significant impact on air quality and public health and must be analyzed further in the SEIR.

Comment #2: The Biological Resources checklist understates the problems of heavy metal contamination on fish embryos and the stream benthic community.

Water quality sustains ecological processes that support fish populations, vegetation, wetlands, and birdlife. Water quality is the building block of the aquatic food chain and the impacts of mercury pollution can be seen in fish and birds that depend on aquatic food chain for their food source. Suction dredge mining in waterways with residual mercury has irreversible and long lasting deleterious effect to the environment and to fish because it degrades water quality.

Mercury takes on different forms in the environment. Quicksilver or elemental mercury is a visible form. Methyl mercury is a particularly toxic form that bioaccumulates in the food chain. Mercury can also be present in the air and water in particles too small to see. The microscopic particles of mercury in the water are deleterious to the entire aquatic food chain because they are easily accessed by bacteria.

Bacteria will use mercury and in so doing create methyl mercury. Specifically, sulfur reducing bacteria in warm anoxic environments will reduce mercury and create methyl mercury. Bacteria form the bottom of the food chain. If the bottom of the food chain is polluted with mercury then that contamination is translated to every level of the food chain.

The impacts of methyl mercury contamination in the aquatic food chain are still being studied. However as methyl mercury moves up the food chain it bio-accumulates and biomagnifies and can be found at very high levels in large predatory fish such as bass (USGS Open File Report 00-367, 1999). The Water Board Staff report of May 2005 concludes that the recreational suction dredge that was tested recovered 98% of the mercury it disturbed, but that the mercury concentrations in the fine and suspended sediment in the dredge effluent were more than ten times higher than that needed to classify it as a hazardous waste. This report also states that the floured mercury in fine sediment and mercury attached to clay particles in suspended sediment that were released by the dredge can be carried by the river to environments where mercury methylation occurs (Humphreys, 2005).

In the section on heavy metal contamination the report notes that:

> Suction dredging activities can result in the discharge of mercury (Hg) or other toxic contaminants. These discharges may cause adverse impacts to aquatic organisms and increase the risk of mercury bioaccumulation in the food chain. Strong experimental evidence exists for the adverse effects of mercury on fish reproductive capacity (e.g., decline in spawning activity and fecundity, impaired gonadal development, or testiticular atrophy) (Kirubagaran and Joy 1988; Wester 1991; Kirubagaran and Joy 1992; Friedmann, et al. 1996; Hammerschmidt et al. 2002). This is considered a potentially significant impact and will be analyzed further in the SEIR.

Unfortunately, the environmental checklist only refers to this problem affecting juvenile and adult fish. Despite evidence that mercury contamination affects the entire food chain and gets into the tissues of all organisms that are exposed, there is no discussion on the impacts of this exposure of fish embryos.

Further, the checklist states that effects of dredging on the stream benthic community are localized in that they do not extend beyond the immediate area dredged. This disregards the impact of mobilized, reactive mercury on stream benthic community at a distance from the dredging site. In a survey of biotic mercury concentrations in northwestern Sierra Nevada rivers, it was found that biota were dramatically elevated in mercury in relation to historic mining locations, and that this zone of contamination extended for tens of river miles downstream, indicating extensive and ongoing mobilization and redistribution of mercury, potentially exacerbated by dredging activities (Slotton et al. 1995). This pattern was further confirmed in an intensive study of the Yuba drainage Slotton et al. 2003).

We can find no studies specifically designed to determine if suction dredging contributes to high fish tissue mercury levels. Also, we can find no studies that have been performed to determine whether or not suction dredging affects levels of mercury or methyl-mercury in biota on-site or downstream of dredging operations. These studies need to be done to determine the effect that recreational suction dredge mining has on mercury in fish tissues, and the extent to which this effect extends to downstream environments. No recreational suction dredge mining in the Gold County should be allowed until these questions can be answered.

Recommendation: Reactive mercury that has been mobilized by suction dredge mining has potentially significant impacts on fish embryos and stream benthic communities. These impacts must be studied and analyzed further in the SEIR.

Comment #3:   The Hazards and Hazardous Materials checklist fails to discuss fully the potential hazards of mercury both used and recovered by suction dredge miners.

In the discussion of hazards, the SEIR does describe some potential hazards associated with nitric acid and mercury, stating that when these materials are used or disposed of "improperly", they may

> …pose a risk to public health and safety from contamination or exposure. This includes accidental or purposeful spillage into waterways and/or upland areas. Because suction dredging and related activities are associated with the routine use of hazardous materials, the implementation of the Program could potentially endanger the health of the public or the environment.

The SEIR should not only focus on "improper" disposal of mercury, but must instead look at every way that mercury in the suction dredge process is handled, including storage on-site, transportation of the material to and from the site, how mercury is applied and retorted, and how it is disposed of.

Mercury is a highly toxic material, and is regulated under Proposition 65 and numerous other statutes. If a blood pressure cuff breaks in a doctor's office spilling mercury, a Proposition 65 warning is required including routine notification of the public through the newspaper of record, and emergency hazard response professionals are called to the scene. Similar precautions need to be taken with mercury used in suction dredge mining operations.

There are two ways that mercury is part of suction dredge mining:

i. Use of "clean mercury" and nitric acid as part of the mining process: The use of nitric acid to process the concentrates creates a waste product, mercuric nitrate, that is water soluble, extremely acidic, and toxic to the environment. Mercuric nitrate is mercury that has been oxidized and is essentially one step closer to becoming methyl mercury. Mercuric nitrate is a hazardous waste that has been found in glass jugs in recreational suction dredgers' camps. Mercury that is brought to the suction dredge operation has the potential to introduce more mercury into the environment.

Mercuric nitrate is the substance responsible for "Mad Hatters" disease, a neurologic disorder associated with exposure to inorganic and organic forms of mercury. Chronic exposure to inorganic mercury manifests as mental confusion, prominent behavioral changes (including psychosis), and abnormal movement. Alkyl mercury poisoning may occur through ingestion of contaminated seafood or grain, and its characteristic features include vision loss, deafness and other neurological impacts. Exposure to mercury has been found to be particularly damaging to children, especially in the developing fetus. Acute intoxication may be associated with gastrointestinal disturbances, mental status changes, even death.

ii. Mercury recovered from creeks, rivers and other water bodies as part of the suction dredge mining process: An estimated 26 million pounds of mercury were used to extract gold from ore in California, most of it in the Sierra Nevada Gold Country (Alpers et al, 2005). Of this, an estimated 10 million pounds were lost to the environment in placer mining operations and another 3 million pounds were lost from hard rock mining (Churchill, 2000).

Elemental mercury or "quicksilver" is still commonly encountered in Sierra watersheds. In the suction dredging process, miners remove gravels from the riverbed with a suction hose powered by an engine, and then use pans or other methods to retrieve the gold. Suction dredgers often encounter mercury and gold-mercury amalgam, which tend to fall into the cracks of the riverbed like gold. Dredgers collect the mercury and amalgam, and retort it or treat it with nitric acid to release any gold that may have amalgamated with the mercury.

Recommendation: The hazards associated with nitric acid and mercury use as part of routine suction dredge gold mining including the handling, transportation, storage, use and disposal of mercury must be analyzed further in the SEIR.

Comment #4: The Hydrology and Water Quality section needs to be revised to address the many hazards associated with mercury and suction dredge gold mining.

The SEIR discussion about the impacts of suction dredge mining practices on mercury and water quality needs to be greatly expanded.

Under the Clean Water Act, states adopt water quality standards for their rivers, streams, lakes, and wetlands. These standards identify levels for pollutants, including mercury, which must be met in order to protect human health, fish, and wildlife. No person may discharge pollutants, including mercury, into waters unless the person has a permit.

The National Pollutant Discharge Elimination System (NPDES) is the permit system established by the Clean Water Act (CWA) to regulate direct wastewater discharges from wastewater treatment plants and industry. Wastewater dischargers may be required to comply with a specific mercury discharge limit (concentration and/or mass limit) or may only be required to monitor their discharges for mercury. Local discharge limits in California for mercury range from 0 to 0.1 ppm (or mg/l). The Total Maximum Daily Load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. TMDLs determine what level of pollutant load would be consistent with meeting water quality standards. The TMDL regulatory process also allocates acceptable loads among sources of the relevant pollutant.

A single recreational suction dredge operating 8 hours per day for 30 days disturbing 1-10sq/meters of stream bed in an area with a background concentration of mercury in the stream bed of 30ppb-1ppm would be responsible for mobilizing more mercury than the amount of mercury mobilized over the course of a dry water year for an entire watershed (Alpers, personal communication 12/2/09; CVWQCB 2008). NPDES permits have not been given to recreational suction dredgers nor have TMDLs been developed for the waterways in which recreation suction dredging currently takes place in California. As such, recreational suction dredging in areas with mercury contamination is likely in violation of the Clean Water Act.

Recreational suction dredging exacerbates the existing mercury contamination problems in water bodies and increases the levels of mercury contamination in fish for the following reasons:

- **Dredging exposes encapsulated mercury.** Suction dredge miners target deep river crevices where heavy materials including gold and mercury can be found because they have not been disturbed by natural processes for many years. Dredging these areas of "pay dirt" disturbs mercury that would otherwise have remained encapsulated.

- **Floured mercury is released back into the water body.** The Project Description of recreational suction dredging acknowledges the fact that miners encounter mercury when operating dredges. This does not address the fact that the mercury that is not captured by the dredge is instead floured by the dredge and re-released back into the water body in a form that is more likely to methylate and be incorporated into the food chain (RWQCB, 2005). The floured mercury that is released back into the water body has been changed by the dredging activity and is considered more likely to methylate because as it travels through the intake hose, educator, and header box the mercury is disturbed and broken up into very small pieces. These small pieces, or floured mercury, are likely to be carried in suspension long distances from the dredging operation, and are readily available to bacteria because it is small (high surface area to volume ratio), oxygenated, and dispersed. The increase in surface area from changing large blobs of mercury to fine-grained floured mercury likely increases the rate of mercury oxidation. The oxidation of these fine mercury particles may be further enhanced by transport in an oxygenated water column of a flowing river. It is the oxidized mercury that is considered the "reactive" fraction that is most available to mercury-methylating bacteria.

- **Mercury travels downstream.** The mercury that is not captured by the dredge but is instead discharged into the water body travels downstream in suspension through varied and diverse habitats where it can be taken up by bacteria that live on the banks of the river and form floodplain wetland environments. The floodplain environment of upland rivers includes the entire 100 year floodplain because this is the area that is inundated by storm events when the rivers swell and overtop the banks. It follows that dredge effluent containing mercury deposited anywhere between the high water mark and the 100 year floodplain is likely to contaminate the aquatic food chain. The literature review states that:

  > Dissolved Hg, floured liquid Hg, and fine particle/colloid bound Hg may be transported long distances to environments favorable to methylation, e.g. wetlands, Yolo Bypass, or the Delta. It is well-known that methylation occurs in these environments (e.g., CVRWQCB 2008).

  In addition, it is important to note that mercury may not need to travel long distances to be methylated, in fact methylation is likely to occur in the hyporheic zone, in backwater channels and as benthic exchange in many carbon-rich, low-oxygen environments.

- **Recreational suction dredging takes place during the warm summer months of heightened biological activity.** Recreational suction dredges disturb and release mercury primarily in the summer months when the water is warm and the flows are low and there are an abundance of bacteria-rich environments where mercury methylation is likely to occur (Alpers et al., 2008; Stewart et al., 2008). Once mercury gets into fish it can result in impaired water body listings or 303(d) listings, and fish consumption advisories. There are numerous fish consumption advisories for fish in mercury impaired water bodies in the Sierra as a result of mercury contamination (OEHHA, 2009).

- **Further studies need to be done to understand mercury methylation.** The different environments, times of year and extent of mercury methylation has not been studied, nor have the effects of recreational suction dredging on methylation in these different environments. Until the areas with the greatest mercury contamination and methylation potential are known it is prudent to not operate recreational suction dredges, otherwise the mercury contamination problem in California may worsen.

Recommendation: The effect of recreational suction dredging on water quality should be considered first and foremost among the impacts of the project. The impacts of disturbing and re-distributing mercury in the environment, on water quality, wildlife health and fish populations need to be fully analyzed in the SEIR.

Comment #5: Many of the concerns raised in our comments about the SEIR are focused on public health, water and air quality and other issues outside of the charge of the lead agency.

The issues we raise in the above comments are in some cases outside of the jurisdiction of the California Department of Fish and Game, and are instead regulated by the State Water Resources Control Board, Department of Toxic Substances Control, and the California Air Resources Board. Their expertise and guidance is needed in this effort.

Recommendation: State agencies charged with protecting air and water quality must be part of the regulatory mechanism permitting suction dredge mining, and should be included in the development of the Environmental Impact Review as well as developing any new regulations or procedures promulgated as part of this effort.

In Conclusion
Thank you for this opportunity to comment. Please feel free to call if you have any questions about these materials.

Sincerely,

Elizabeth "Izzy" Martin
CEO
The Sierra Fund

References used in these comments

Alpers, C.N., Stewart, A.R., Saiki, M.K., Marvin-DiPasquale, M.C., Topping, B.R., Rider, K.M., Gallanthine, S.K., Kester, C.A., Rye, R.O., Antweiler, R.C., and De Wild, J.F., (2008), Environmental factors affecting mercury in Camp Far West Reservoir, 2001–03. U.S. Geological Survey Scientific Investigations Report 2006-5008, 358 p. http://pubs.usgs.gov/sir/2006/5008/

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May, J.T., Hothem, R.L., Alpers, C.N., and Law, M.A. 1999. USGS, Open File Report 00-367, Mercury Bioaccumulation in Fish in a Region Affected by Historic Gold Mining: The South Yuba River, Deer Creek, and Bear River Watersheds, California, 1999.

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Slotton, D.G., S.M. Ayers, J.E. Reuter, and C.R. Goldman. 1995. Gold mining impacts on food chain mercury in northwestern Sierra Nevada streams. *California Water Resources Center, Project W-816*.

Slotton, D.G., S.M. Ayers, and Ronald D. Weyand. 2003. Upper Yuba River Studies Program: U.C. Davis biological mercury component. *Report for the U.S. Geological Survey and the California Bay-Delta Authority*.

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Key Qualifications

Dr. Monohan received her Ph.D. from the University of Washington College of Forest Resources, Center for Water and Watershed Studies. Her dissertation work addressed the relationship between water quality in agricultural streams and diminishing salmon habitat. Since completing her dissertation she has contributed to the scientific and regulatory communities' understanding of the legacy impacts from historical gold mining in California, specifically, the effects of mercury, the process of mercury methylation and potential human exposure routes.

EDUCATION:

2004 Ph.D. Forest Engineering and Hydrology, College of Forest Resources, Center for Waterand Watershed Studies, University of Washington, Seattle, Washington. USA Multi-disciplinary degree with emphasis on water quality.

2000 B.Sc. (Honors), Biology, Robert D. Clark Honors College, University of Oregon, USA

RELATED POSITIONS HELD:

2007-date *Science Director, The Sierra Fund, Nevada City, CA*
Director of Science for the Mining Project Initiative to address legacy mining issues across the Sierra Nevada mountain range, issues include both human exposure routes and environmental degradation.

2008-date *Consulting Scientist, The Nevada Irrigation District, Grass Valley, CA*
Development, design, and permitting of a reservoir sediment and mercury removal project.

2006-2009 Consulting *Hydrologist, Friends of Deer Creek, Nevada City, CA*
Position is the project manager for a US Environmental Protection Agency funded Brownfield Project.

2004-2008 *Senior River Scientist, The Natural Heritage Institute.100 Pine St. Suite 1550, San Francisco, CA 94111* Project manager for the development of a Mountain Meadows Integrated Regional Watershed Management Plan and development of environmental flow targets for the Sacramento and Feather Rivers.

SELECTED TECHNICAL REPORTS AND PAPERS:

Monohan, C. and J. Cain. 2008 Estimating Environmental Flow Objectives for the Sacramento and Feather Rivers. Report produced for the Conjunctive Use Integrated Regional Watershed Management Plan. Submitted to the Department of Water Resources.

Henson S., C. Monohan and J. Hild. 2008. Deer Creek Watershed Mercury Survey. Submitted to the Regional Water Quality Control Board, Total Maximum Daily Load Unit.

Cornwell, Kevin, K. Brown, and C. Monohan 2007. Mountain Meadows and their contribution to the Sierra Nevada Water Resources. EOS Trans. AGU, 88(52) Fall Meet. Suppl. Abstract H31D-0642.

Monohan, C. 2007, Principal Science Advisor and co-author of *Mining's Toxic Legacy: An Initiative to Address Mining Toxins in the Sierra Nevada,* published March 2008 by The Sierra Fund

Soderstrom, E., M. Connor, J. Cohen, and C. Monohan 2005. Citizen Monitoring and Adaptive Management Handbook. Volume 1 Citizen Monitoring Essentials, Volume 2 From Data to Action: Interpretation, Analysis, Presentation and Use of Monitoring Data. Produced by The South Yuba River Citizens League and the Natural Heritage Institute.

Doctoral Dissertation, Nov 2004. Monohan, C. 2004, Riparian Buffer Function with Respect to Nitrogen Transformation and Temperature Along Lowland Agricultural Streams in Skagit County, Washington

Riparian Restoration Design, Feb 2003-June 2003. Monohan, C. 2003. Fish Friendly Landscape Design for Riparian Areas on Private Land. Submitted to City of Bellevue and Adolfson and Associates

White Paper, June 2001. Monohan, C. and S. Bolton. 2001. A Review of the Literature and Assessment of Research Needs in Agricultural Streams in the Pacific Northwest as it Pertains to Freshwater Habitat for Salmonids. Submitted to Snohomish, King, Skagit and Whatcom Counties, WA

NMFS Technical Report, October 2001. Riley, S., P. Kiffney, and C. Inman. 2001. Habitat inventory and salmonid stock assessment in the Cedar River and tributaries. Submitted to Seattle Public Utilities

Graduate Fellowship Grant for National Science Foundation, Fall 2000. Inman, C. 2000. Riparian Functional Types Response to Nitrogen Loading: Retention Mechanisms. Honorable Mention

Honors Senior Thesis Research, Summer 1999- Spring 2000. Inman, C. The Effect of Ultraviolet Radiation on Cyanobacterial Matt Community Structure. Yellowstone National Park. Ecology and Evolution Department. University of Oregon. Eugene, OR.

Independent Study, Fall 1997. Inman, C. A Fish Biodiversity Study in a Flood Plain Habitat of the Okavango Delta. Heil Openheimer Okavango Research Center. School for International Training. Botswana, Africa.

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Ms. Martin has years of experience in evaluating environmental impact reports as a decision maker on local government boards. In addition, she has developed nationally recognized expertise in the impacts of mercury from legacy gold mining, including being asked to serve as an expert witness in Congressional Hearings held in November 2009 on the issue of abandoned mines and mercury in California.

RELATED EXPERIENCE

CEO The Sierra Fund	December 2004 - present
Nevada County Supervisor, District 4 Nevada County, California	January 1999 - January 2003
Nevada County Planning Commissioner Nevada County, California	1991 – 1993, again from 1996 - 1998

EDUCATION

B.S, Environmental Policy Analysis, magna cum laude, UC Davis 1979

RELATED LEADERSHIP POSITIONS

Chair, Nevada County Board of Supervisors, 2001
Nevada Power Authority, 2001 - 2002
Nevada County Local Area Formation Commission 1999 - 2003
Nevada County Solid & Hazardous Waste Commission 1999 – 2003
Chair, Nevada County Planning Commission, 1996
Sierra Nevada Working Group, Resources Agency 2000 - 2002

SELECTED PUBLICATIONS

Principal Author, *Mining's Toxic Legacy: An Initiative to Address Mining Toxins in the Sierra Nevada,* published March 2008 by The Sierra Fund