Response to specific questions listed in Attachment 2: Description of Scientific Topics to be Addressed by Reviewers. The responses follow the 1-4 numeration of the attachment. Statements within each of those four headings have been alphabetized in sequence.

1. Sediment/Turbidity and TSS:

1a. Agreed. The scientific literature and physical dispersion models indicate that suction dredge plumes are localized, persist only during dredging activities, and are usually, rapidly dispersed downstream to background TSS levels. This is consistent with my observations of suction dredging operations in California rivers.

1b. Agreed. The scientific literature has shown that plumes at suction dredging may exceed California Basin Plan objectives.

1c. The scientific literature indicates turbidity and TSS concentrations within suction dredging plumes will not normally exceed 50 NTUs and 340 mg/L, respectively. As the report states, some organisms – especially sessile organisms - may be adversely impacted (including killed) by the turbidity and TSS in the plumes, but it does not appear that turbidity and TSS will cause populations measurable adverse impacts to populations of those organisms. Moreover, the proposed criteria for suction dredging will protect sensitive populations by regulating the location and timing of that dredging.

1d. Agreed. The scientific literature indicates that suction dredging turbidity and TSS commonly returns to background levels downstream within hundreds of meters.

1e. As noted above (1c.) "report states, some organisms – especially sessile organisms - may be adversely impacted (including killed) by the turbidity and TSS in the plumes, but it does not appear that turbidity and TSS will cause populations measurable adverse impacts to populations of those organisms. Moreover, the proposed criteria for suction dredging will protect sensitive populations by regulating the location and timing of that dredging."

1f. Agreed. The long-term effects of individual plumes with regards to turbidity from suction dredging should be negligible, based on the requirements proposed for individuals using suction dredges in California waters. These include the requirements on the areas that may be dredged and the treatment of tailings.

2. Mercury

2a. Agreed. It is likely that suction dredging will remobilize mercury in buried sediments within waterways that were previously contaminated from mercury and/or gold mining activities. Much of that mercury will be associated with the finest fraction of those sediments (<63 μm), as reported in the scientific literature. Since those small grain size sediments are not recovered in suction dredging operations and they are suspended longer that larger grain sediments, the mercury associated with the finer sediments will tend to be dispersed to the greatest distances from suction dredging operations.

2b. Agreed. Some of the elemental and cationic mercury remobilized by suction dredging will be converted to organic mercury (e.g., methylmercury) downstream from that activity. This conversion will probably be greatest with mercury associated with fine grained sediments mobilized by that activity, because those resuspended sediments will subsequently be deposited in relatively calm waters downstream from the dredging and then buried by other fine grained sediments. That burial will create the suboxic conditions where the microbially mediated conversion of inorganic mercury to organic mercury by sulfate reducing bacteria and iron reducing bacteria occurs.

2c. Agreed. The scientific literature shows that the bioavailability, bioaccumulation, and biomagnification of mercury is essentially limited to organic forms of mercury (e.g., methylmercury). Since suction dredging operations will remobilize mercury (primarily inorganic species) in sediments (primarily fine grained sediments) and some of that mercury will then be dispersed downstream and deposited in areas that may be relatively more conducive to microbial methylation, some suction dredging operations may cause measurable increases in mercury concentrations in biota downstream from those operations.

2d. Agreed. The threshold for sublethal mercury toxicity in wildlife and humans continues to be lowered, as extensively documented in the scientific literature. For wildlife, the principal problem is associated with the biomagnification of mercury in aquatic food chains; and for humans, the principal of mercury intake is from the consumption of fish. These problems are most often found in areas where industrial activities (e.g., mercury and gold mining) have increased the level of mercury in the environment and/or increased the conditions for microbial mercury methylation (e.g., reservoirs). Consequently, the biomagnification of mercury to potentially toxic levels to wildlife and humans is of special concern in California.

3. Other Trace Metals:

3a. Agreed. Based on the scientific literature, as well as our group’s studies of metals in California waterways, it is unlikely that suction dredging operations will measurably increase concentrations of other trace metals to levels that exceed state and/or federal water quality criteria.

Because of the relatively high concentrations of chromium in some sediments in California and recent studies documenting the sublethal toxicity of hexavalent chromium in humans, it is – theoretically – possible that suction dredging could contribute to an increase of hexavalent chromium in an aquifer downstream from that activity. But based on the scientific literature and our group’s studies on chromium in California watershed and aquifers, I do not believe that possibility is a legitimate concern.

3b. Agreed. Based on the scientific literature, as well as our group’s studies of metals in California waterways, on the proposed restrictions, it is unlikely that suction dredging operations will cause any substantial, long-term degradation of a water body in California by metals – other than mercury.

3c. Agreed. Based on the scientific literature and the proposed restrictions, it is very unlikely that suction dredging operations will measurably increase concentrations of other trace metals through bioaccumulative pathways to levels that pose a health threat to wildlife or humans.

3d. Agreed. The other metals potentially mobilized by suction dredging activities should not result in concentrations exceeding CTR metals criteria, unless those activities occurred in unique places (e.g., acid mine drainage areas and downstream from a copper mine). The proposed restrictions on suction dredging in such places appear to adequately address that potential problem.

4. Trace Organic Compounds:

4a. Agreed. Based on the literature, there does not appear to be high levels of toxic organic compounds (excluding methylmercury) in potential suction dredging locations in freshwater locations. There may be locations that have relatively high levels of those compounds, but I am not aware of any of them.

4b. Agreed. Based on the relatively low concentrations of toxic organic compounds (excluding methylmercury) reported for potential suction dredging in freshwater locations, there is no indication that activity would increase levels of any of those above state and/or federal water quality criteria.

4c. Agreed. Based on the relatively low concentrations of toxic organic compounds (excluding methylmercury) reported for potential suction dredging in freshwater locations, there is no indication that activity would cause levels of any of those compounds to increase to the point where they had a measurable adverse effect on any beneficial uses of those water bodies.

4d. Suction dredging will mobilize trace organic compounds that have been scavenged onto sediments and/or buried under sediments in water bodies, but I am not aware of any potential suction dredging location in California freshwaters where the amount of any of those organic compounds (with the exception of methylmercury) represents a potential environmental and/or human health threat.

Response to "The Big Picture" questions in Attachment 2:

In general, I am quite impressed with the depth and breadth of the material that I reviewed for the Water Quality Impacts of Suction Dredging for Gold. It shows that (1) a great deal of effort has been invested in the project and (2) the multiple environmental and human health problems that could potentially be caused by suction dredging operations in California's fresh water systems have been carefully assessed. Most importantly, those assessments are substantiated – whenever possible – by references to peer-reviewed reports in scientific journals and texts.

What makes the assessment so comprehensive is that one of the principal concerns with suction dredging in those water systems – the remobilization inorganic mercury and its subsequent biotransformation to methylmercury that can be biomagnified to toxic levels – has been investigated by the USGS. That study was outstanding. It built on numerous other studies of the sources, transport, biogeochemical cycling, bioaccumulation, and biomagnification of mercury in California's watersheds by multiple investigators at state and federal agencies, universities, and environmental companies. Therefore, while the impact of suction dredging on mercury cycling in California's fresh waters can only be truly quantified by studies at each site and each dredging activity, there is a wealth of information available to address those potential impacts – and that information has been carefully and objectively addresses in the draft report on Water Quality Impacts of Suction Dredging for Gold and the associated material that I reviewed.

My main concern with the material that I reviewed was that it should have been more carefully edited. The errors in grammar and composition, along with the inconsistencies in terminology, sometimes made it difficult – or at least frustrating – to read the material. More importantly, those editorial shortcomings detracted from the scientific rigor of the report.

As noted in my cover letter, I would prefer that the report used terms other than "significant", which has a defined statistical value, and "substantial", which does not have defined value. However, I have not been able to come up with other words for either term that would be more appropriate.

Other Comments:

The following comments address some other questions that I had in reading the material.

Section 228(16) "requires dredgers to avoid the disturbance of eggs, redds, tadpoles, and mollusks" (page 4.3-28 and elsewhere). I am not an aquatic biologist (although my BS and MS were in the biological sciences) so I had to look up what a "redd" was; and the report discusses the difficulties of observing some eggs, tadpoles, and mollusks in fresh water systems Therefore, I wonder how effective that requirement will be.

I believe the "several limitations" to studies discussed on pages 4.3-38 t0 39 are notable.

I find the comment that "Benthic communities seem to recover over time frames of 30-60 days after the disturbance ceases and the adverse impacts of suction dredging are not evident after a year (unless there is a very small population that is threatened or endangered)" is problematic because it appears to assume that there will not be more than one dredging event in a year or dredging events in successive years. Consequently, I have concerns with the subsequent Finding that "If left unrestricted, the impacts of suction dredging on stream benthic communities would be less than significant with respect to all significance criteria" (page 4.3-39).

"Section 228(k)(2): Prohibits dredging within 3 feet of the current water level; at the time of dredging" is an example of the credibility problems created by poor editing.

I suggest a consistent use of "Hg" or "mercury", "MeHg" and "methyl mercury", and other chemical terminology. The inconsistent use of those terms in Chapter 4.2 and the rest of the material (often within a single paragraph) gives the appearance that chapter was assembled by committee and not carefully reviewed.

"Human health" but not environmental health concerns are listed in the sentence at the top of page 4.2-15, but both "human and wildlife exposure" are then discussed in the following paragraph.

With modern instrumentation, it is possible to measure all trace metal concentrations in essentially any sediment and it is also possible to measure trace concentrations of "synthetic organic compounds (e.g., pesticides)" in even the most pristine environments, so the discussion of those materials should be based on concentrations at potentially toxic levels – rather than simply whether they "may be present" (page 4.2-15).

Rainbow trout are "piscivorous", just less piscivorous than some other fish – in contrast to the statement on page 4.2-47.

"Although smaller nozzle sizes will still cause mercury releases when dredging mercury enriched sediment, the amount of mercury discharged would be lower than with larger nozzle sizes" is (1) grammatically incorrect and (2) only true is the durations of dredging are comparable.

Finally, I apologize for any editorial deficiencies in this brief review. It does not have the importance of your report, so I don't feel it needs rigorous editing. Still, I do feel a little hypocritical about not having someone proof these comments.