RESPONSE TO PUBLIC COMMENTS ON THE APRIL 2013 DRAFT OF

AN ASSESSMENT OF POTENTIAL MINING IMPACTS ON SALMON ECOSYSTEMS OF BRISTOL BAY, ALASKA

U.S. Environmental Protection Agency

Region 10

Seattle, WA

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INTRODUCTION

In April 2013, the U.S. Environmental Protection Agency (EPA) released the 2nd external review draft of *An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska.* Following its release, the public was invited to review the draft document and submit comments to EPA during a 60-day public comment period.

There was significant public interest in the April 2013 draft assessment. EPA received comments from a wide variety of public stakeholders, including local community members, fishers, the mining industry, local villages, tribal governments and corporations, state and federal government agencies, businesses, and non-governmental organizations. EPA appreciates the technical input and the range of perspectives shared during the public comment period.

EPA revised the April 2013 draft of the assessment based on these public comments, peer review, and consultation with tribes, and released the final assessment in January 2014.

This document presents an overview of the public comments EPA received on the April 2013 draft of the assessment, the text of technical public comments relevant to the science presented in the assessment, and EPA's responses to those comments. EPA also received many comments that were non-technical in nature; these comments are summarized in the appendices to this document.

Public comments on the May 2012 draft of the assessment and EPA responses to those comments are included in a separate document, which is available online at www2.epa.gov/bristolbay. EPA responses to peer review comments on both the May 2012 and April 2013 versions of the assessment also are available online at www2.epa.gov/bristolbay.

PUBLIC COMMENT PROCESS

The public comment period for the April 2013 draft of the assessment began on April 26 and ended on June 30, 2013. Comments could be submitted to Federal Docket EPA-HQ-ORD-2013-0189 using an online form or by email, letter or fax.

Following this public comment period, an independent EPA contractor, the Horsley Witten Group, Inc. (HWG), organized, summarized, and sorted the comment letters received to help EPA fully consider and respond to all public comments. HWG downloaded all submitted comment letters from the federal docket and maintained a spreadsheet of comment letters received that included information on the commenter and the docket-assigned comment letter number. HWG also created an overview of the public comments that summarized the commenters and general themes and issues represented in the public comments.

HWG organized technical public comment letters that were directly relevant to the science presented in the assessment according to the relevant assessment chapter or appendix. Individual comment letters were typically split into parts and assigned a comment number based on the relevant assessment chapter or appendix. EPA used these chapter-and appendix-specific public comment compendiums as the organizational basis for this response to public comments document.

As HWG completed these tasks, EPA also read through all of the submitted technical public comment letters. As the public comment compendiums were received from HWG, EPA checked that the compendiums included all relevant text from the technical public comment letters submitted to EPA.

SUMMARY OF PUBLIC COMMENTS

EPA received more than 890,000 on-time public comment letters on the April 2013 draft of the assessment. More than 875,000 of these comment letters or petition signatures resulted from 70 different on-time mass-mailing or petition letter campaigns identified by the EPA docket center. Forty-two of these campaigns, generating over 634,000 letters or signatures, requested EPA take action to protect Bristol Bay. Twenty-six campaigns, generating over 240,000 letters or signatures, were not supportive of EPA action. Two campaigns provide no clear opinion. Comments from these mass-mailing campaigns are included in Appendix 1 of this document.

In addition to these mass-mailing and petition letter campaigns, EPA received more than 14,500 on-time unique comment letters. These unique comment letters included technical comment letters as well as more general comment letters, postcards, letters modified from mass-mailing campaigns, and letters from pre-written letter campaigns that were similar in format and overall content. Comments were received from a variety of organizations and individuals.

STRUCTURE OF THE RESPONSE TO PUBLIC COMMENTS DOCUMENT

This document comprises the main document and two appendices. The main document includes the text of the technical public comment letters received on the April 2013 draft of the assessment, as well as EPA responses to those comment letters. Appendix 1 includes the mass-mailing and petition letter campaigns identified by the EPA docket center. The issues raised in the mass-mailing campaign letters are generally similar to many of the issues raised in the non-technical individual comments. Appendix 2 provides comment information (commenter and docket number) for the comment letters included in the main document.

This document is organized according to the structure of the April 2013 draft, and presents public comment text and EPA or appendix author responses relevant to each chapter (Chapters 1 through 14) and each appendix (Appendices A through J). For the mass mailer and petition letter campaigns, the number of copies of each mailer received and the source (where known) are noted.

It is important to keep the following points in mind as you read through this document.

- Individual comment letters that referred to more than one subject were split into parts, so that each part could be included in the relevant assessment chapters or appendices. Both the commenter and the comment letter number (as assigned by the federal docket) are provided for each comment in the main text of the document, and Appendix 2 provides a list of the commenters, docket-assigned comment letter numbers, and chapters in which each comment document occurs. This information may provide a useful way to search for specific comments and responses. The full text of each comment is available to the public at www.regulations.gov under docket EPA-HQ-ORD-2013-0189.

- Numbering for pages, chapters, sections, tables, figures, and text boxes changed between the May 2012, April 2013, and January 2014 versions of the assessment. Numbering cited in the public comments included here may refer to the May 2012 (draft assessment) or April 2013 (revised assessment) versions of the document. Numbering cited in EPA responses typically refers to the April 2013 (revised assessment) or January 2014 (final assessment) versions of the document. Archived copies of the May 2012 and April 2013 drafts of the assessment are available online at:

  May 2012 draft: http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=241743

  April 2013 draft: http://cfpub.epa.gov/ncea/bristolbay/recordisplay.cfm?deid=242810

- In some cases, a comment may be relevant to more than one chapter or appendix. To avoid redundancy, these comments are included only once in this document, at the most relevant location.
- Many commenters submitted similar comment. Instead of repeating a response, readers are referred to the initial response.
- EPA acknowledges and appreciates every comment letter, even those that may not be included in this response document because they did not directly relate to the technical content of the assessment.

PUBLIC COMMENTS AND EPA RESPONSES

Chapter 1: Introduction

Alaska State Legislature – Representative B. Edgmon (Doc. #5058)

1.1 I would also like to commend EPA for the painstaking work it carried out in the field. The agency consulted regularly and in detail with federal, state, and tribal stakeholders. The public meetings EPA held in several locations in the region were well organized and informative and showed consideration for the many points of view of watershed residents.

EPA Response: Comment noted; no change required.

Alaska Department of Law (Doc. #5060)

1.2 The State also requests, as it did a year ago, that EPA immediately post to its website the administrative record for this assessment. Such action would be consistent with President Obama’s recent Executive Order 13642 (dated May 9, 2013), entitled “Making Open and Machine Readable the New Default for Government Information,” which is a priority directive to the federal agencies. This Executive Order, which orders the issuance of an “Open Data Policy,” was published in the Federal Register on May 14, 2013, Vol. 78, Reg. 93.

<u>EPA Response:</u> The State of Alaska requested a year ago that EPA post online the "cited reference, bibliography, and source data materials (approximately 2,000 documents) that are listed throughout the executive summary, assessment, and each of the appendices." EPA is unable to do this as we do not have permission from the copyright owners to post these copyrighted materials online. Securing permission from all publishers would be costly and resource intensive. EPA does not typically secure permission to distribute copyrighted materials, since cited materials are publically available from other sources. This is consistent with EPA's historic practice with respect to Agency risk assessments.

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

1.3 The State has repeatedly expressed concerns regarding the lack of authority for the process EPA is engaging in with this Assessment. Among the issues we have raised:

- The Assessment is premature;
- EPA lacks authority for the Assessment.

These include letters submitted by the State to EPA on September 21, 2010, August 8, 2011, March 9, 2012, April 17, 2012, May 29, 2012, and July 23, 2012, which are included again with this submittal for ease of reference and address legal, process and technical issues with the Assessment.

- EPA's process conflicts with state and federal law;
- EPA appears to rely upon past assessments and draft and/or final guidance that do not have binding legal effect, nor are they tied in any way through formal rulemaking to CWA Section 104;
- The process EPA has engaged in lacks scientific credibility, including use of a hypothetical project (via three scenarios) to speculate on potential impacts from mining on Bristol Bay watersheds;
- EPA's process disregards federal and state laws, processes, and permits, the Statehood Compact, as well as the Alaska Constitution;
- EPA has rushed this process;
- EPA expressly chose to disregard potential social and economic benefits of mining;
- EPA's Assessment process is an unlawful expansion of its authority under the CWA, its 192 Memorandum of Agreement with the U.S. Army Corps of Engineers, and the Administrative Procedures Act;
- Conclusions reached in the Assessment constitute final agency action because they mark the consummation of agency action on specific issues and impacts, these conclusions are not subject to appeal, and these conclusions will have essentially binding effect on third party and state interest and future regulatory reviews; and
- EPA's Assessment violates the Data Quality Act by relying on, for example, non-peer-reviewed literature and data."

To date, EPA has failed to adequately respond to any of the State's legal and process concerns, and these concerns remain relevant to the revised Assessment. We continue to believe the Assessment is inconsistent with law, and question its scientific integrity.

EPA Response: **EPA does not agree with the State's position on these issues. However, EPA's response to public comments on the scientific assessment is not the appropriate forum to engage in a discussion on legal issues. thus, we are only addressing the technical issues raised in this comment here (listed by bullet number in the comment above).**

2nd bullet: The comment lacks the necessary specificity for EPA to understand the comment and craft a specific response.

3rd bullet: The assessment is not intended to be an in-depth analysis of a specific mine, but rather an examination of potential impacts of reasonably foreseeable mining activities in the Bristol Bay watershed, given the nature of the watershed's mineral deposits and the requirements for successful mine development. The assessment analyzes mine scenarios that reflect expected characteristics of mine operation at the Pebble deposit, modern conventional mining technologies and practices, the scale of mining activity required for economic development of the resource, and the infrastructure needed to support large-scale mining. Therefore, the mine scenarios evaluated in the assessment realistically represent the type of development plan that would be anticipated for a porphyry copper deposit in the Bristol Bay watershed.

6th bullet: The purpose of the assessment is to determine the significance of the Bristol Bay region's ecological resources and evaluate potential impacts of large-scale mining on those resources. The potential social and economic benefits of mining are outside the scope of the assessment.

9th bullet: The use of non peer-reviewed literature and data, such as PLP's Environmental Baseline Document, does not constitute a violation of the Data Quality Act. However, before completing the revised draft, EPA had several reports that were submitted during the draft assessment's public comment period independently peer-reviewed. These reports were selected because they provided new data for analyses conducted in the assessment or modeling results that could be used as an independent check on the modeling performed in the assessment. Peer review of these documents was conducted by a peer review contractor. Although the reviewers noted an apparent bias in data interpretation in some of those reports, the data themselves were not found to be biased and were used in the assessment.

1.4 The revised Assessment does not accurately represent the meetings and input for the Intergovernmental Technical Team (IGTT). EPA states, at 1-4 of the revised Assessment, the following:

Throughout the Assessment, we have reached out to interested parties to ensure transparency of the assessment process (Box 1-1). Through public comment opportunities and by engaging an Intergovernmental Technical Team (IGTT) of federal, state and tribal representatives, we were able to identify additional information helpful for characterizing the biological and mineral resources of the watershed. These interactions with members of the community were also helpful in narrowing the scope of the assessment to what was most important to stakeholders.

The IGTT interactions, at least with the State participants, were few. On August 9-10, 2011, State staff from ADNR, the Alaska Department of Environmental Conservation (ADEC), the Alaska Department of Fish and Game (ADF&G), and the Department of Health and Social Services attended an IGTT meeting in Anchorage at EPA's invitation. However, EPA denied the State full participation through IGTT.

First, as part of the State's representation on the IGTT, the State had proposed sending an attorney with significant CWA experience to this meeting, but EPA contacted the State just a few days before the meeting, asking that the State's attorney not attend. Second, those State employees in attendance were essentially asked to react to EPA's proposed approach for the Assessment, but were not asked for input on whether or how EPA should proceed. They participated in break out groups to respond to draft conceptual risk diagrams that EPA had brought already prepared to the meeting. Third, some of the suggestions State employees offered in response to EPA presentations were rejected such as separating construction from operational impacts in separate risk diagrams and considering options to tailings impoundment such as dry stack disposal. Thus, EPA's actions in limiting those who could attend and constraining the topics for discussion on an assessment approach show that EPA had already clearly and substantially laid the framework (including modeling) and significantly limited State involvement from the outset.

On September 9, 2011, EPA contacted ADNR Water Section to invite a state hydrologist or geomorphologist to attend a session in Anchorage on September 28-29 to discuss fisheries, wetland hydrology, and a watershed model (which had not yet been peer reviewed through submission to a journal), and determined it was not applicable to the undeveloped Nushagak and Kvichak watersheds. The State subsequently was told that the invitation was for the watershed modeling session only, not the entire meeting. At that point, the State became very concerned about the way EPA was limiting State participation in a process that has expanded far beyond EPA's statutory and regulatory authority.

One additional webinar meeting of the IGTT was held on January 13, 2012. The purpose of this meeting was to update the IGTT on the progress of the Assessment, including the revised conceptual models based on the input from the August meeting. This was the last request from EPA for any technical participation by the state agencies, except for minimal contact by EPA with some agencies to access publicly available, existing data.

Unfortunately, this pattern of limited consultation with the State on matters of enormous importance to the State of Alaska has been a defining characteristic of the current federal administration. As we have argued repeatedly with federal government officials regarding responsible resource development and other regulatory matters in the State of Alaska, the State is not just another stakeholder in the process- we are the other sovereign entity, with rights and responsibilities defined by the U.S. and Alaska constitutions. We are also the entity with the most expertise and scientific knowledge on responsible resource development and environmental protection in the State of Alaska. As is the case with the EPA's Assessment, when the State's input is limited or ignored, it leads to a legally and scientifically flawed process and result that we believe are not in the best interest of the State of Alaska and its citizens.

<u>EPA Response:</u> EPA sought to engage the State as a partner on the response to Tribal Petitions and the development of the Bristol Bay Assessment from the beginning. The State did not choose to partner with EPA in the assessment development. In March of 2011, EPA reached out to the Alaska Departments of Environmental Conservation, Fish and Game, and Natural Resources (March 15, 2011 letters from McLerran to Hartig, Campbell, and Sullivan) and specifically requested relevant scientific data and information that would inform our assessment.

The IGTT was developed to get input from State, Tribal, and Federal technical staff on the scoping of the risk assessment, including the conceptual models related to risks from large-scale mining. The purpose of the meeting was clearly articulated. EPA did not limit the technical participation of the State. However, since the meeting was intended to provide a forum to discuss technical issues, it was not appropriate for attorneys to attend. EPA did not have legal counsel present.

EPA appreciates the technical input that was provided from State technical staff throughout the assessment, including the IGTT meetings, separate consultations with State experts, and through public comment. EPA gave full consideration to all of the technical information offered by the State and much of it was utilized in the assessment. In fact, we have relied on many State data sources, including those related to anadromous fish and subsistence use.

<u>Curyung Tribal Council (Doc. #5619)</u>

1.5 I also appreciate the public process providing us the ability to make comment. We have long awaited this study and are anxious to see that protections can be implemented. I feel that we, as the whole region and state, have had ample time to review, consider, and make comment on the study.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska State Legislature – Representative M. Costello (Doc. #5814)</u>

1.6 Any development project in Alaska has a right to submit applications for permitting. Alaska's permitting process is in place to ensure projects are designed, operated, and reclaimed in a manner consistent with the public interest; if a project does not meet these requirements, it is not permitted. To preemptively stop development of any kind before and state or federal agency considers the merits of that project is an affront to Alaska's permitting process and those doing business in the state.

<u>EPA Response:</u> The assessment is not a regulatory action and does not propose restrictions on development. No change required.

<u>Council of Alaska Producers (Doc. #4285)</u>

1.7 The mine scenario in the revised Bristol Bay assessment could not be permitted under existing state or federal law. It is inherently flawed to draw conclusions about the impact of a hypothetical mine that does not fully incorporate modern mining technology, environmental mitigation strategies, and current state regulatory requirements. These issues were raised during the initial public comment period and by the peer review panel, but the EPA has not adequately addressed these concerns in the revised assessment.

EPA Response: We disagree with this comment. The scenarios evaluated in the revised assessment assume the use of modern conventional mining methods and technologies, largely as detailed by Northern Dynasty Minerals in Ghaffari et al. (2011). The assessment then evaluates likely unavoidable impacts resulting from the mine footprint and potential impacts that could result if specific components of the mine—despite modern conventional methods and technologies—were to fail.

The Pebble Limited Partnership (Doc. #5536 and #5752)

1.8 The Assessment presents a biased economic evaluation. While presenting the economic benefits of the ecological resources in Bristol Bay (pages ES-9), the report makes no such valuation of any mining economic benefits. The report states: "These economic data provide background only." The economic effects of mining are not assessed" (page ES-9). However, it does not justify the inclusion of benefit valuation of potential mining operations. While including a statement that revenues from a potential mine could range between $300 billion and $500 billion over the life of the mine (page 1-2), the Assessment fails to include other direct benefits to the local economy, such as employment, income, purchases from and payments to local vendors, and benefits to Native Alaskans. A recent economic study, authored by HIS Global Insight, dated May 2013, demonstrates a wide range of substantial economic impacts that the development of the Pebble deposit could provide to the State of Alaska demonstrating that it is possible to assess the economic effects of mining in the Bristol Bay watershed area. Other assumptions regarding mining operations are made throughout the report, but economic benefit assumptions are not included. The report appears to dismiss this contradiction by stating: "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal.

EPA Response: The purpose of this assessment is to evaluate potential impacts of mining on salmon resources of the Bristol Bay region—not to evaluate the relative economic benefits of mining versus the existing salmon-based economy. No change required. Appendix E is intended to provide a baseline evaluation of current economic activity dependent on a healthy ecosystem. We are aware of the report cited in the comment, but have not included it as economic activity surrounding mine development is not dependent on a healthy ecosystem and thus is outside the scope.

1.9 Page ES-9 does not include any fishing price data or mining job information. The document states "The economic effects of mining are not assessed." As a result, the economic analyses are incomplete and fail to represent actual economic impacts.

EPA Response: See response to Comment 1.8. In the final assessment, we mention the estimated total value of and jobs associated with both the mine and the salmon fishery, but as stated in Chapter 2 the assessment is not a cost-benefit analysis.

1.10 The current analysis does not incorporate the probability of occurrence into any estimates of definitive risk. The document fails to meet EPA guidance for its risk assessment.

EPA Response: We disagree with this comment. Risks of different types of failures are presented throughout the assessment as either quantitative or qualitative probabilities (see Table 14-1 for a summary of the various probabilities considered in the assessment). Further, the Guidelines for Ecological Risk Assessment do not require that results be expressed as probabilities. No change required.

1.11 *2012 State of Alaska Comment*: In regard to the impacts of the proposed mine on streams and fish, the Bristol Bay Watershed Assessment is too general to determine actual impacts of the proposed mine.

Recommended Change: A detailed and site-specific EPA review of the Pebble Limited Partnership (Pebble Limited Partnership) Environmental Baseline Document (Pebble Limited Partnership Environmental Baseline Data) and application of their considerable data to the issues raised by EPA in the Bristol Bay Watershed Assessment would have gone much further to understanding the actual impact.

Comments Regarding Adequacy of Response in Second Draft: Comment Stands.

EPA Response: PLP's Environmental Baseline Document (EBD) provides summary information on the chemical, physical, and biological characteristics of the region. We reviewed information in the EBD and included relevant data throughout the assessment (despite the fact that this document has not yet undergone a complete peer review), because it does represent a wealth of data for the area surrounding the Pebble deposit.

1.12 *2012 State of Alaska Comment:* While there is an economic assessment of the current conditions in the Bristol Bay area (Bristol Bay Watershed Assessment Vol. 3), there is no economic analysis related to the potential fish impacts of the mine, nor of the potential recreational opportunities that develop due to the road.

Recommended Change: Do an economic cost-benefit analysis and other economic issues. While such an evaluation may not be possible with the level of analysis provided by the EPA in the Bristol Bay Watershed Assessment, it would seem possible that a minimal mine-related economic impact on the fisheries could be off-set by mine-related economic benefit of greater proportion.

Comments Regarding Adequacy of Response in Second Draft: Page 1.2, paragraph 4 states This assessment is not an environmental impact assessment, an economic, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal. And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.

EPA Response: See responses to Comments 1.8 and 1.9.

1.13 *2012 State of Alaska Comment:* Much of what the Pebble Limited Partnership can do for environmental protection is based on the economics for the mine. This is not discussed in the Bristol Bay Watershed Assessment. It would be helpful to know the long term economics of the mine, which are described in detail in the Northern Dynasty Minerals, Ltd. Report of

2011, and whether they are based on conservative metal prices. The following list shows prices used in the economics calculated for the Northern Dynasty Minerals, Ltd. Report of 2011 compared to current prices. Copper $2.50/lb Current $3.33/lb, Gold $1,050/ounce Current $1,610/ounce, Molybdenum $13.50/lb Current $14.99/lb, Silver $15.00/ounce Current $28.00/ounce, Rhenium $3,000/lb Current $2,900/lb, Palladium $490/ounce Current $618/ounce.

Recommended Change: Comment Reference; Northern Dynasty Minerals "Preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, pages 12.

Comments Regarding Adequacy of Response in Second Draft: Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.

<u>EPA Response:</u> See responses to Comments 1.8 and 1.9.

1.14 *2012 State of Alaska Comment:* While the assessment lays out a potential mine it does not make an attempt to assess the economic impact or number of workers employed by such a mine. While the assessment notes public sources for data used to determine the so called plausible mine scenario presented. The same attempt is not made concerning economic impacts or workforce, despite there being the publicly available information posted by the Pebble Limited Partnership.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal. And page ES-9 states "The economic effects of mining are not assessed. Comment was acknowledged but not addressed. Therefore the original comment still stands.

<u>EPA Response:</u> See responses to Comments 1.8 and 1.9.

1.15 *2012 State of Alaska Comment:* If the total estimated annual salmon ecosystem direct expenditure is $479.6 million that should be put in context with the value of the mineral resources in the same area.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Section 5.2.3, Pages 5-23 and 5-24, this section is almost identical to previous Section 2.2.4 adding no additional information as recommended. Page 1.2, paragraph 4 states "This assessment is not an environmental impact assessment, an economic, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal. And page ES-9 states "The economic effects of mining are not assessed. Comment was acknowledged but not addressed.

<u>EPA Response:</u> See responses to Comments 1.8 and 1.9.

1.16 Although EPA states that this assessment is "not an environmental impact assessment" (page 1-2), there are many aspects of the Assessment that suggest it is intended to be an impact assessment (e.g., the focus is almost exclusively on a single source – the Pebble Project). In any case, it is not a complete impact assessment, as it is working from hypothetical mine plans, only considers adverse effects (ignoring the benefits of mining, which would be a required component of a NEPA document), and disregards the use of mitigation to reduce impacts.

EPA Response: The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. Proposed mitigation measures are those that could reasonably be expected to be proposed for a real mine in this area, and are described as "permittable" in Ghaffari et al. (2011).

1.17 This distorted picture also results from EPA's failure to follow its own rules for conducting risk assessments. Although EPA continues to invoke its 1998 *Guidelines for Ecological Risk Assessment* (May 14, 1998) ("Guidelines"), the Assessment does not follow those Guidelines. The Assessment's gloomy forecast is achieved by ignoring EPA's own precepts for such assessments. The Guidelines call for a holistic study that uses a wide lens covering the entire watershed, its significant stressors, and the management options for protecting it. EPA's guidance reflects the common-sense principles that assessments be:

- Comprehensive;
- Objective; and
- Scientifically sound.

It calls for the use of *real data to quantify* impacts from significant stressors, and to put those impacts into perspective so they can be understood. It requires accounting for and explaining sources of uncertainty. And it roots the risk assessment process is the *best available data and science*, to be evaluated in a rational and unbiased manner.

The Assessment does none of these things. Instead of evaluating the entire watershed, it effectively ignores most of it. Instead of looking at all significant stressors, it focuses on just one – a hypothetical Pebble mine that does not use best mining practices and fails to perform compensatory mitigation. Instead of using the best real data for its risk predictions, it ignores key information (on the local watershed, local mitigation sites, and modern engineering) and contrives unrealistic failure scenarios. It does not attempt to quantify impacts, because the data will not support meaningful quantification.

EPA Response: We disagree with this comment. The assessment considers potential porphyry copper mines in the entire watershed. The statements in the comment about the Guidelines for Ecological Risk Assessment are not actually cited in that guidance

document. The guidance does not require that an entire watershed be covered. However, the assessment is comprehensive (within its appropriate scope, as described in Chapter 2) and is objective and scientifically sound.

1.18 The significance of EPA's critical failures to apply its own principles cannot be overstated: the Assessment has become a patently biased, close-minded exercise based on improbable guesswork and faulty analysis. EPA itself has written elsewhere: "The Agency's ability to pursue its mission to protect human health and the environment depends upon the integrity of the science on which it relies" U.S. EPA, *Scientific Integrity Policy*, at 1 (:Scientific Integrity Policy), available at http://www.epa.gov/research/htm/scientific-integrity.htm). Here, however, the Agency casts aside scientific integrity, ultimately rendering the Assessment unsuitable for the serious task of evaluating management options for the Pebble deposit.

<u>EPA Response:</u> We disagree with this comment, and no evidence or support for its contentions is provided.

1.19 Omission of the Bristol Bay watershed context violates EPA's risk assessment principles. The Assessment's failure to consider management goals, stressors, and impacts throughout the Bristol Bay watershed conflicts with EPA's watershed assessment guidance. Watershed assessments should evaluate a watershed as a whole, not portions of it in isolation. The Region 10 Watershed Assessment Primer instructs, for example, that sub-watersheds "are designed to be stand-alone assessment areas." U.S. EPA Region 10, *A Watershed Assessment Primer*, EPA 910/B-94/005, at 5 (1994). The Primer explains unequivocally that "[t]o maintain or improve water quality, we need to assess problems, develop responses, and predict changes *at the watershed level*." Id. at 2 (emphasis added).

In contravention of this principle, the Assessment avoids analysis of the broader watershed significance of its hypothetical risk scenarios. In fact, the Assessment is not a "watershed assessment" at all, an omission that did not escape the notice of the peer reviewers.

As peer reviewer David Atkins explained:

> The importance of this impact is not put in context of the watershed as a whole, so it is not possible to determine the magnitude of the risk to salmon.

Final Peer Review Report at 13. Peer Reviewer Dennis Dauble made a similar observation:

> The Integrated Risk Assessment (Chapter 8) did a creditable job of summarizing habitat losses and risks from mine operations. What is missing, however, are quantitative descriptions of habitat lost relative to total habitat available in the larger watershed and individual systems. Habitat loss should be further discussed in terms of salmonid life stage and productivity (i.e., not all stream miles are equal).

Id. at 16. Mr. Dauble further explained that: "What is lacking is quantitative estimates of spawning and rearing habitat that would be lost relative to the total habitat available. Having this information would help provide perspective of overall risk to individual watersheds and the Bristol Bay watershed as a whole." *Id*. at 53.

Reviewer Dirk van Zyl made the same point with specific reference to the Assessment's estimated loss of stream miles:

> It is unclear to the reader how significant a loss of 87.5 km of streams in the Nushagak River and Kvichak River watersheds is to the overall ecosystem.

Id. at 58. All of these peer reviewers are making the same point: unless the Assessment places its imagined impacts in the context of the whole watershed (as called for by EPA guidance) it fails to provide the means to evaluate their significance.

In contravention of this principle, the Assessment avoids analysis of the broader watershed significance of its hypothetical risk scenarios. In fact, the Assessment is not a "Watershed assessment" at all, an omission that did not escape the notice of the peer reviewers. As peer reviewer David Atkins explained: The importance of this impact is not put in context of the watershed as a whole, so it is not possible to determine the magnitude of the risk to salmon.

<u>EPA Response:</u> The assessment is not intended to be a watershed assessment, in the sense of the *Watershed Assessment Primer*, which considers all activities in a watershed. The assessment considers the potential porphyry copper mines and potential impacts resulting from such mining activity.

<u>Northwest Mining Association (Doc. #5559)</u>

1.20 EPA's Revised Assessment purports to be an "ecological risk assessment" but admits that it does not have the necessary data to evaluate the impacts and therefore assumes that the impacts would be. It has been well established that an ecological risk assessment approach cannot be used to evaluate a hypothetical project or any project before there is an actual design that can be tested. A pre-design ecological risk assessment does not have the baseline and the specific design parameters and cannot provide a meaningful analysis. A pre-design ecological risk assessment cannot evaluate and consider the prevention and mitigation strategies that are always part of every mine design evaluation and EIS.

<u>EPA Response:</u> Risk assessments evaluate the potential effects of possible occurrences. Thus, a risk assessment is, by its very nature, an analysis of hypotheticals. Further, the statement that there is no actual design is incorrect, since Northern Dynasty Minerals developed and published a preliminary plan containing a design for a mine and supporting facilities (Ghaffari et al. 2011), which is cited extensively throughout the assessment.

<u>The Nature Conservancy (Doc. # 4315)</u>

1.21 The reorganization of the assessment, as recommended by the peer review, to clarify the purpose and scope and to reflect the ecological risk assessment approach, has resulted in a more compelling and useful document.

<u>EPA Response:</u> Comment noted; no change required.

Natural Resources Defense Council (Doc. #5378)

1.22 A. The 2013 Assessment has been developed in a diligent and transparent manner and is scientifically sound and rigorous.

Based on our review of the 2013 Assessment, the 2012 peer review comments and a range of public comments, we find that the 2013 Assessment provides a rigorous and thorough assessment of the effects of large-scale mine development, operations and post-mining management on the Bristol Bay watershed and its fisheries, aquatic ecosystems, and other associated biological and cultural resources.

Compared to the first review draft of the watershed assessment, the 2013 Assessment has been substantially modified and improved. EPA has done a commendable job of addressing the range of questions raised during the public comment and peer review process. In particular, the Agency: (1) expanded the range of hypothetical mine site sizes, (2) strengthened its analysis of the complex and interconnected hydrology of the region, (3) incorporated the risks and unknowns attendant to projected climate change, (4) added "day-to-day operational risks, (5) enhanced its analysis of cumulative impacts, and (6) added a review of potential mitigation measures. The result is a well-documented scientific analysis of the myriad unacceptable adverse effects that would result from mining, and which dictate in favor of protection under Section 404 (c) of the Clean Water Act. The solicitation of a second round of peer reviewer comments represents a level of diligence and inclusiveness that goes beyond the usual as well as the Agency's own guidelines for peer review.

EPA Response: Comment noted; no change required.

1.23 On May 30th, 2013, Northern Dynasty Minerals (NDM), which with the Pebble Partnership holds mineral rights in the watershed released its written public comments to the 2013 Assessment. In those comments, NDM criticizes EPA's process for development of the assessment and peer review, claiming that it is biased, ignores agency guidelines for scientific peer review, and EPA has restricted public access to the peer review panel. We find no evidence to support any of these claims: to the contrary, development of the assessment was conducted by a large group of scientists from diverse disciplines using all information made available to them with a transparent and well-designed independent peer review and public input process.

EPA Response: Comment noted; no change required.

Alaska Conservation Foundation (Doc. #6803)

1.24 I appreciate the opportunity to comment on the second Draft Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska (Assessment). I find it to be a thorough document based on clear articulation of issues and methodologies, that responds well to the comments from the first round of public input and peer review.

EPA Response: Comment noted; no change required.

1.25 With as many as 5 new chapters, EPA clearly responds to peer review questions and concerns on issues relative to the mine scenario, risk assessment, understanding the hydrologic nature of the watershed, cumulative impacts for other mines and development, and long term impact of climate change. By doing so, EPA provides a more thorough understanding of Bristol Bay's complex water system and notes that impacts from water use and water treatment could have dramatic impacts on wetlands, fish spawning, and fish rearing habitat. In this draft, EPA expanded their assessment of potential large-scale mining to include scenarios as small as 0.25 billion tons as well as scenarios that evaluate up to 6 additional mines in the watershed, with increases of habitat losses by up to 84%, a total footprint of 13,000 acres, and with up to 39 miles of streams eliminated.

EPA Response: Comment noted; no change required.

Members of the Fly Fishing Industry – Montana (Doc. #5655)

1.26 The role of the EPA in assessing mining's potential impact on Bristol Bay is particularly important, because the metals extraction industry has consistently ranked number one in the discharge of toxic material since it was required by federal government in 1997 to provide this information.

EPA Response: Comment noted; no change required.

The Center for Water Advocacy (Doc. #5617)

1.27 The EPA should, therefore, grant the petition originally submitted by the six federally recognized tribes and initiate the public process under Section 404 (c). By initiating the Section 404 (c) process, the EPA can help protect the Bristol Bay watershed and the ecological, recreational, cultural, and commercial interests that it supports.

EPA Response: Comment noted; no change required.

Moore Geosciences, LLC (Doc. #2911)

1.28 The Second External Review Draft is a rigorous and thorough assessment of the potential damage of developing large-scale mining operations in the Bristol Bay watershed. The Assessment is supported by extensive scientific literature and analyses, which substantiates the potential for physical, geochemical and biological impacts from large-scale mining on the Bristol Bay watershed. The revised assessment is strengthened by the addition of a section on climate change, additional quantitative and conceptual modeling and consideration of contaminant release from a range of sources during mine operations, and clarification of the potential effects of tailings release and transport under both routine operations and failure of operations/infrastructure. The assessment is a very conservative document that, in certain areas underestimates risk.

EPA Response: Comment noted; no change required.

Borell Consulting Services, LLC (Doc. #4095 and #6804)

1.29 Every mine is required to have a site specific EIS based on the specific design details and environmental data for all aspects of the mine. Conversely, the EPA Revised Draft uses a hypothetical design to evaluate the potential impacts on a portion of the Bristol Bay watershed. To prejudge any mining project, or any other project, before the full details of the proposal are submitted to the NEPA process and then evaluated pursuant to the law is wrong.

If EPA proceeds with this Bristol Bay Assessment and then makes decisions based on this Assessment a terrible precedent will have been set that will have the potential to adversely impact every other project in the U.S. Such impact not be limited to mining projects but to any activity that the EPA chooses to block.

<u>EPA Response:</u> The assessment is not a regulatory action.

1.30 The Bristol Bay Watershed Assessment, the Revised Draft Bristol Bay Assessment and the actions taken and process followed by EPA are biased to the extreme and should bring shame on the agency.

This Assessment process is the result of a request by groups and individuals that have spent millions of dollars trying to stop Pebble from submitting for permits.

1. By considering stopping a project before the project design and environmental mitigation are defined, the EPA is reaching for new greatly expanded authority it has never had before.
2. The first Draft Assessment, for an area larger than many of the states in this country, was completed in approximately one year whereas the Pebble project has spent more than 5 years and more than $150 million developing the baseline environmental information and design for a few square miles that will become the mine.
3. The draft Assessment was based on the concept of a hypothetical mine. That hypothetical mine could not be permitted under current law in Alaska.
4. The EPA assembled a peer review team which recognized that the agency could not effectively evaluate the hypothetical mine, but EPA did not listen to the comments made by that group of professionals.
5. For an “independent expert evaluation” of the Assessment, EPA used firms that have a decades-long history of opposing mining projects. Incredibly, some of these individuals have admitted in Federal Court, that they knowingly provided erroneous information in previous court proceedings. And yet EPA used them and paid for that “expert evaluation.
6. Four days before the current comment deadline, EPA took the unprecedented step of sending an additional notice to its nation-wide distribution list reminding that the comment deadline was just four days away.

<u>EPA Response:</u>

1. **Section 1.1 of the assessment provides information about EPA’s authority to conduct this assessment. Section 1.2 provides additional information about the use of the assessment. The assessment is not a regulatory action.**
2. **No change required. The comment is incorrect, as EPA has spent almost three years developing the assessment.**
3. **See response to Comment 1.7.**
4. **We disagree with this point. We considered all of the comments from the peer reviewers and made significant changes to the assessment based on their suggestions. Our responses to all peer review comments received on both the original and revised drafts of the assessment are publicly available.**

5. **All of EPA's contractors and subcontractors were selected for their significant professional accomplishments and are highly qualified to perform the tasks they were assigned. The assessment process also included measures to minimize any potential bias, including oversight of contractor work by EPA staff and review of the entire assessment by independent scientific peer reviewers.**
6. **Reminding all members of the public that a public comment period is coming to a close is routinely done as part of EPA's public outreach to interested members of the public.**

M. Satre (#6756)

1.31 Unfortunately, the current draft of the assessment relies on generic assumptions about mining activities to make broad, sweeping statements about potential impacts in the region and thus remains fatally flawed without scientific merit. This is a classic case of garbage in, garbage out.

EPA Response: We disagree with this unsupported comment.

D. Schindler (Doc. #7906)

1.32 EPA has relied heavily on existing peer-reviewed literature for their assessment, and collected little new data. Such a strategy is needed to perform a reasonably rapid assessment of the potential risks of mining development. Such a strategy is a valid and appropriate way to do science. Many misinterpret science as the collection of new data. It turns out that most of science is in the interpretation of existing data as the EPA have done. By focusing on the peer-reviewed literature and from experience with mining impacts on aquatic ecosystems from elsewhere, the EPA has developed a highly defensible assessment of potential threats from mining in Bristol Bay watersheds.

EPA Response: Comment noted; no change required.

Native Village of South Naknek (Doc. #9133)

1.33 In failing to conduct the proper inquiry, EPA also employed clearly biased and questionable individuals as peer reviewers. In this regard, Dr. Borras is clearly biased as evidenced by his advocacy for the anti-mining groups. Similarly, Stratus Consulting, accused of falsifying information, has recently filed sworn statements by its Managing Scientist, Ann Maerst. Thus, as we noted last year, if the purpose of the assessment was to study the causes, affects, extent, prevention, reduction and elimination of pollution, then it would appear to us to make little sense to conduct such studies on a hypothetical model. It makes even less sense to utilize biased reviewers and ethically compromised scientists.

EPA Response: Dr. Boraas co-authored Appendix D, which characterizes the indigenous cultures of the Nushagak and Kvichak River watersheds. He was not an author of the main assessment, which considers potential risks and effects associated with large-scale mining. EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to Wobus et al. (2012) and Kuipers et al. (2006) (the papers co-authored by Dr. Maest) from the final

assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings. Finally, the scenarios evaluated in the assessment are based on those put forth by Northern Dynasty Minerals as "permittable" (Ghaffari et al. 2011), and thus represent realistic examples of how mining would likely develop in the region.

<u>Center for Science in Public Participation (Doc. #5657)</u>

1.34 Attachment A: EPA Watershed Assessment Second Draft Responses to Selected Peer Review Panel Questions and Critiques.

PEER REVIEW COMMENT (Dirk van Zyl): The EPA Assessment does not contain any references to any such materials, which implies to me that the stakeholder process was informal and not robust.

EPA RESPONSE: Meaningful engagement with stakeholders was essential during development of the assessment to ensure that the U.S. Environmental Protection Agency (USEPA) heard and understood the full range of perspectives on the draft assessment itself and the potential effects of mining in the region. USEPA used a verity of tools to involve and inform stakeholders prior to and during release of the draft assessment, including a community involvement plan to ensure that a robust outreach effort is in place and a project webpage and listserv to ensure that assessment-related information is shared with the public. (Second External Review Draft, Box. 1-1. Stakeholder Involvement in the Assessment, p. 1-6)

Chambers Comment: It is interesting to note that EPA has been criticized for spending funds to bring EPA staff to Alaska to conduct public meetings and meet with stakeholders. For example, "The EPA spent $169,381 sending sixteen people – at $10,586 per person – to hold a peer review meeting on the environmental assessment to give the public a chance to comment on the mine's draft assessment." (Dailycaller.com 2013)

The $170,000 will have been well spent whether it leads to the development of a better mine, or to the avoidance of a mine that could lead to the expenditure of tens or hundreds of millions of dollars of public funds necessary for cleanup costs and fisheries restoration efforts.

<u>EPA Response:</u> Comment noted; no change required.

1.35 Attachment C: Notes on Northern Dynasty Minerals 2nd Watershed Assessment Comments.

EPA has created a public and peer review process designed to minimize scientific scrutiny of its work

It is difficult to follow the rationale of this criticism. EPA has presented its second public draft of the document, and has extended the comment period at the request of mine supporters, including the State of Alaska.

It might actually be more appropriate to turn this criticism around, and ask the Pebble Partnership why it purposely chose to release its data in the Environmental Baseline Document in a form that was not easily usable by technical reviewers; why it chose not to include data on geochemistry, potential fault locations for regional earthquakes, and fisheries;

and, why it did not include data more recent than 2008 in a 2011 release, even though this data was available. PLP has not released any additional data subsequent to the 2004-2008 data released in 2011.

EPA Response: Comment noted; no change required.

Chapter 2: Overview of Assessment

Alaska Department of Natural Resources (Doc. #5487)

2.1 It is important to note that ADF&G collects a variety of non-peer reviewed biological data to characterize fish resources and to manage the State's fisheries, including those in the Bristol Bay watersheds. For utilized fish stocks, these data are often compiled over many years to inventory and estimate populations, set harvest limits, and establish salmon escapement goals. These data may be used for real-time fisheries management decisions or to forecast annual run size. This type of raw data is useful and distinct from information in a peer-reviewed journal article that may use such data and test scientific hypotheses. The population assessment data collected by ADF&G that has not been subject to peer review should not in any way connote that the data is not of high quality nor impugn the collection techniques. While the use of some State-generated non-peer reviewed data may be appropriate to characterize certain resources within the Assessment, it is inaccurate to suggest that the State had an opportunity to explain the data and participate in the IGTT when our opportunities were clearly limited, and it is inappropriate for the revised Assessment to utilize and draw conclusions using this State-generated data without affording the State agencies the full opportunity to participate in the IGTT.

The State points out that non-peer reviewed data and reports came from many state and federal agencies (e.g., U.S. Geological Survey, U.S. Fish and Wildlife) and from organizations both in and outside of the U.S. (e.g., Climate data from East Anglia University, U.K., the PRISM climate group from Oregon State University, the Commonwealth of Australia, and the British Geological Survey). Reports from non-governmental organizations (NGOs) were also included as sources despite the considerable potential for bias and publicly stated opposition to mining in Bristol Bay (see document referenced in Footnote 24 of this letter).

EPA Response: Section 2.1.1 of the assessment has been revised to more clearly explain the use of non-peer-reviewed data in the assessment.

2.2 The criticisms the state had about 'scope' and 'scale' with the first Assessment have been partially addressed by reorganization of the executive summary and adding a new section on five spatial scales in the revised Assessment. The five scales are identified as: 1) Bristol Bay watershed, 2) Nushagak and Kvichak River watersheds, 3) the mine scenario watersheds, 4) the mine scenario footprints and 5) the transportation corridor. However, examining an entire ecosystem over an area as large as West Virginia and predicting impacts is still unprecedented for a document informing a CWA Section 404 action, despite the clarifications regarding scale.

EPA Response: Comment noted; no change required.

2.3 The area targeted by EPA in the Assessment is roughly the size of West Virginia. *See* Assessment map at ES-3.

EPA Response: Comment noted; no change required.

Region 10 Tribal Operations Committee (Doc. #5658)

2.4 The Tribal Caucus strongly supports the findings of the Assessment. The revision to the Assessment addressed many of the shortcomings in the previous draft that the Tribal Caucus supports. Particularly, the Tribal Caucus supports the revisions that include:

- Reorganization of the assessment to better reflect the ecological risk assessment approach and to clarify the purpose and the scope.

EPA Response: Comment noted; no change required.

Alaska Miners Association (Doc. #2910)

2.5 EPA used data sets that supported their conclusions, even more when modern and geographically relevant data was available. However, that more relevant data contradicted EPA conclusions.

For example, the analysis in the 2012 draft indicated that likely frequency water treatment failure could not be calculated. The 2013 draft calculated a frequency, but based on it work by an anti-mining group Earthworks, 2012 that evaluated only the results of legacy mines (a fact that EPA neglected to inform the readers). Specifically, the Earthworks publication evaluated 13 mines in the arid southwest United States. Most of the mines were designed and began operation in the early 1900s, some in the 1800s. All began open-pit operation before 1967. Therefore, *all of these mines were designed and put into operation before the advent of modern environmental laws.* Mines designed before modern environmental laws do not represent the safety of today's mines.

Use of this data would not be so egregious if other, more recent data were unavailable. But more recent data is available – EPA just chose not to use it. Alaska's mines are all modern. None has had any significant failure that affected downstream water quality or fish in the last 20 years, and only one event in modern history of Alaska's large mines. EPA decided against using this data, which was available, was much more relevant (i.e., Alaska data), and was offered to them in AMA's and other comments, but would have contradicted their conclusion. Instead, they used data exclusively from legacy mines.

More relevant data is also available from British Columbia. This data is also more modern, and more geographically relevant, but would have contradicted EPA's conclusion and was not used.

Similarly, the Alaska Department of Fish and Game has a large volume of monitoring reports documenting water quality and fish habitat downstream from Alaska's mines. None of that data was used. It too would have contradicted EPA's conclusions. It would have shown that there has been no significant long-term degradation of water quality or fish habitat at any of Alaska's mines.

Taken together, these show extreme bias by EPA. The agency uses anti-Pebble reports; they ignore reports submitted by others. EPA uses conclusions when their peer reviewers tell them not to. They use old data sets that support their conclusions, yet they ignore modern and more geographically relevant data sets that would contradict them. This is a biased report.

EPA Response: The comment is incorrect concerning the Earthworks report. That report includes operating mines, which are operating under modern U.S. and state laws, as well as legacy mines. The comment also contradicts itself, in that it wants the assessment to use only data from mines operating under modern U.S. laws, but then suggests using Canadian cases. There are not enough operating metal mines in Alaska to estimate a failure rate, but individual cases in Alaska are noted in the assessment; none of these cases are analogous to a large-scale mine at the Pebble deposit.

Northern Dynasty Minerals Ltd. (Doc. #3650)

2.6 Geosyntec's 2012 Review identified that, in relation to mine water collection and treatment system failures, inferences drawn in the report do not account for advances in technology or operation practices between the historical case studies examined and present practices. The 2013 Assessment acknowledges that technological advances exist, but then dismisses them with the following discussion:

'The use of data from the historical, operational records of mines, pipelines, and roads is necessary but controversial. It is essential and conventional for risk assessments to use the history of a technology to estimate failure rates. However, developers argue, with some justification, that the record of older technology is not relevant because of technological advances. Despite advances, no technology is perfect, and rates of past failures may be a better guide to future outcomes than the expectation that developers can design a system that will not fail. A classic example is the NASA space shuttle program, which denied that the relevance of failure on launch would be one in a million. The Challenger failure showed that prior failure rate was still relevant, despite updated technology.' (Pg. 2-4)

The 2013 Assessment acknowledges technological advances exist and then uses an example of a very complex and sophisticated system from the NASA space shuttle program to show that even with '*updated technology'* that the *'prior failure rate was still relevant.'* The technology used in mine water collection and treatment does not approach the same level of complexity or sophistication as the NASA space shuttle. Similarly, the years of operating experience in the mining industry far exceed the years of experience with space travel. The comparison to NASA further demonstrates the bias in BBWA.

EPA Response: The analogy was used appropriately to illustrate the fact that any technology, even one as highly designed and sophisticated as the space shuttle, can fail. No change required.

2.7 *2012 Geosyntec Comment:* The inferences drawn in the report also do not account for advances in technology or operational practices between the historical case studies examined and present practices. The assessment acknowledges that some case studies cited incorporated historical and outdated mining practices that would not be allowed under current mining laws. Several passages of text use language that are not technically correct and, as a result, can be confusing or misleading.

How 2013 Assessment Responds to Comment: Technological advances are acknowledged to exist, and are then cited as being additional sources of unforeseen and unpredictable failures.

2-4 ‘The use of data from the historical, operation records of mines, pipelines, and roads is necessary but controversial. It is essential and conventional for risk assessments to use the history of a technology to estimate failure rates. However, developers argue, with some justification, that the record of older technology is not relevant because of technological advances. Despite advances, no technology is perfect, and rates of past failures may be a better guide to future outcomes than the expectation that developers can design a system that will not fail. A classic example is the NASA space shuttle program, which denied the relevance of the failure rate of solid rocket boosters and declared that the shuttle’s rate of failure on launch would be one in a million. The Challenger failure showed that the prior failure rate was still relevant, despite updated technology.’

Discussion on Adequacy of 2013 Response: The report acknowledges technological advances exist and then uses an example of a very complex and sophisticated system from the NASA space shuttle program to show that even with *‘updated technology’* that the *‘prior failure rate was still relevant’*. The technology used in mine water collection and treatment does not approach the same level of complexity or sophistication as the NASA space shuttle. Similarly, the years of operating experience in the mining industry fear exceeds the years of experience with space travel. The comparison to the NASA event simply highlights the bias in the BWWA in assessing the potential for failure of any engineered system.

<u>EPA Response:</u> See response to Comment 2.6.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

2.8 Original Draft Location: Page: Report Number 2.1 through 2.26, Report Section Identification: Chapter 2, Excerpt: [blank]

Original Comment from State of Alaska: Draft Comment: This chapter is lacking sufficient detail expectant of a discussion of current conditions, more appropriately referred to as background or baseline conditions. The area’s biodiversity instead is generalized in tables and figures. There is no discussion of current water quality for each of the 17 hydrogeologic areas nor any habitat mapping, biological survey information, and threatened or endangered information. A more in-depth evaluation of wildlife is provided by the U.S. Fish and Wildlife in Appendix C and should be referenced more prominently in this chapter.

Draft Recommended Change: Include additional information describing current (baseline) conditions and reference Appendix C more prominently.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No additional baseline info specific to species was added and the requested citations were not added to Appendix C. Comment stands. Analysis is inaccurate or incomplete.

<u>EPA Response:</u> These sections are meant to provide a brief overview of the region’s physical and biological environment, particularly in terms of the biological endpoints considered in the assessment. Additional material on physical setting (e.g., geology,

soils, permafrost extent, etc.) was added to Chapter 3, and additional information on biota in the region was pulled into Chapter 5. We also clarified that the appendices contain more detailed information on geological setting (Appendix H), fish (Appendices A and B), wildlife (Appendix C), and human populations (Appendix D) in the region.

2.9 The Federal Data Quality Act requires that analyses completed by federal entities meet certain standards. The standards are specified in EPA guidance and include: (a) an independent reanalysis of the original or supporting data using the same methods to generate similar analytical results, including documentation of methods and identification of data sources, (b) use of best available science, and, (c) preparation of an objective document and analysis. The Assessment fails to meet all three of these prescribed standards.

<u>EPA Response:</u> We disagree with this comment. We used the best available science in the assessment, and have revised the assessment as better science became available. The assessment and the analyses contained within it are objective. However, the requirement for independent reanalysis that the comment claims is a first "standard" in EPA's guidance on implementing the Federal Data Quality Act, *Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by EPA* (October 2002) is not actually contained in the guidance. No other guidance documents or policies with respect to data quality contain that standard, either. With respect to the third standard set forth in the comment, the assessment uses basic descriptive statistics such as means and standard deviations from the PLP's Environmental Baseline Document and a few other documents, but modeling and other more intensive data analyses are original to this report or are presented for the sake of comparison with our results.

2.10 *2012 State of Alaska Comment:* The Pebble Limited Partnership Environmental Baseline Data provides a substantial amount of site-specific data and detail, but the data have not been incorporated into a risk assessment type of document, as likely would have been done through the permitting process. On the other hand, the Bristol Bay Watershed Assessment does a risk assessment with essentially no site-specific data. Neither the Pebble Limited Partnership Environmental Baseline Data nor the Bristol Bay Watershed Assessment allows a clear understanding of the potential risks to the environment, fish, wildlife, or Alaska Natives.

Addressed: No.

Recommended Change: The details provided n the Pebble Limited Partnership Environmental Baseline Data and other site-specific documents must be used to more accurately and more elaborately evaluates and predict risks.

Comments Regarding Adequacy of Response in Second Draft: Comment stands. Available data has not been used in the analysis and the analysis methods do not adequately address risks.

<u>EPA Response:</u> See responses to Comments 1.11 and 2.9.

2.11 Furthermore, the three refined mine scenarios presented in the Assessment do not reflect current worldwide industry standards for porphyry copper mining. Throughout the document, the Agency presumes a level of environmental performance by the mining industry that is entirely unsubstantiated and assumes a level of performance that would violate current State of Alaska and federal laws. Contrary to statements in Chapter 6 of the report (page 6-1, par. 2), the three mine scenarios do not represent realistic, plausible descriptions of potential mine development alternative that are consistent with current engineering practice and precedent. In addition it is extremely unlikely that the three mine scenarios as presented in the Assessment would be able to obtain State, Federal, and local government permits and approvals required to construct and operate a large hard rock mine in Alaska. The scientific and industry literature presented in Chapter 4 and Appendix H describing mines around the world may not be, contrary to EPA claims, either realistic or plausible. Several of the mine examples described in the Assessment were not developed in compliance with laws and regulations currently in effect in the United States.

EPA Response: The scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. Proposed mitigation measures are those that could reasonably be expected to be proposed for a real mine in this area, and are described as "permittable" in Ghaffari et al. (2011).

2.12 *Original Comment:* Box 6-1 uses case histories to extrapolate the impacts of tailings to the current study. However, all three examples are historical mines initially developed in the 1800s that are now Superfund sites. None of the examples would have had tailings tams or mill processes based on current geotechnical, metallurgical and environmental engineering principles or current regulatory standards. EPA states, 'These brief descriptions provide background information and support the use of evidence from these cases in analyzing risks from a hypothetical tailings dam failure in the Bristol Bay watershed'. The descriptions of three sites which had typical/historic operations which occurred decades ago does not support an 'analogous' relationship with what 'may' occur at the Pebble site. For instance, it is hard to compare mining in the Coeur d'Alene River where 'tailings were dumped into gullies, streams, and the river until dams and tailings impoundments were built beginning in 1901', with a modern mining facility designed and permitted under much more stringent regulations than existed over a decade ago. Similarly, analysis of a tailings dam failure in 1950 at Soda Butte Creek in Montana and Wyoming is hardly an analogous situation to what may occur in the Bristol Bay region.

Comments Regarding Adequacy of Response in Second Draft: The same level of analysis and use of these sites as analogous to the Pebble site is presented in the current review draft. This draft states that '*although these cases are highly uncertain sources of information concerning the potential toxicity of spilled tailings, they can be used with confidence to identify or confirm important modes of exposure and the processes leading to exposure. They also confidently demonstrate the persistence of tailings and the leaching of their metals for multiple decades.'* The comparison with sites developed over 100 year ago is inappropriate. Standards and regulations have changed remarkably since those mines were developed. All comparisons with sites that were not developed to modern standards need to be removed. They are misleading and tend to give the reader a sense that project impacts would be much larger than would actually occur in today's regulatory environment.

EPA Response: Standards and regulations have changed, but the processes that control the transport of tailings in riverine systems and the exposure of aquatic biota are not

changed by regulations. The cases were used to illustrate the fate of tailings in streams and floodplains. The means by which they were released is irrelevant for this purpose. The text of the revised assessment has been modified to make that point clear.

2.13 *Original Comment:* The examples provided in the assessment, such as Soda Butte Creek, should be noted that much of the damage is the result of mining practices of the late 1800 and early 1900s, and related to acid mine drainage mobilization of metals. These issues may not apply as directly to the Pebble mine under currently regulatory permitting and oversight conditions.

Recommended Change: Provide analysis of the examples, comparing them with the proposed mine, identifying conditions that are most relevant to the Pebble mine.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The same level of analysis and use of these sites as analogous to the Pebble site is presented in the current review draft. This draft states that 'Although these cases are highly uncertain sources of information concerning the potential toxicity of spilled tailings, they can be used with confidence to identify or confirm important modes of exposure and the processes leading to exposure. They also confidently demonstrate the persistence of tailings and the leaching of their metals for multiple decades.' The comparison with sites developed over 100 years ago is inappropriate. Standards and regulations have changed remarkably since those mines were developed. All comparisons with sites that were not developed to modern standards need to be removed. They are misleading and tend to give the reader a sense that project impacts would be much larger than would actually occur in today's regulatory environment.

<u>EPA Response:</u> See response to Comment 2.12.

2.14 *Original Response/Comment:* There's no effort made to quantify how many of the workers and how much of earnings are made by non-residents. According to Alaska Department of Labor and Workforce Development Research and Analysis Bristol Bay Region Fishing and Seafood Industry Data in 2009, 58.8% of total gross earnings earned by non-resident permit holders and 87.1% of wages were earned by non residents. The characterization of the Bristol Bay Commercial Fishery is incomplete without a reflection of the profits gained from Alaska's fisheries resources by non residents and how much of the gross earnings leave the state, is not spent in Alaska, or in the Bristol Bay region. Similar data presented for the general public is also published in the November 2009 issue of Alaska Economic Trends published by the Alaska Department of Labor and Workforce Development, including that in 2008: -46% of Alaska's crew members lived outside the state -73% of seafood processing employees lived outside the state and they earned $187 million that year –Seafood processing since at least the mid-1980s has been the sector with the highest percentage of nonresidents, both within the fishing industry and in all wage and salary employment in the state. Warren, J. and Hadland J. Employment in Alaska's Seafood Industry in Alaska Economic Trends November 2009. State of Alaska Department of Labor and Workforce Development, Research and Analysis Section. Pp.4-10, p. 6-7 and Exhibit 7. Alaska Department of Labor and Workforce Development Research and Analysis. Fishing and Seafood Industry in Alaska Overall Seafood Industry Data Tables. Fish Harvesting and Processing Workers and Wages. Bristol Bay Region Seafood Industry, 2003-2009.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: This section (page ES-9) makes no mention of out-of-state workers. Failure to include out-of-state workers is a significant shortcoming in the analysis. The analysis is therefore incomplete and misrepresents actual expected effects.

<u>EPA Response:</u> See responses to Comments 1.8 and 1.9.

2.15 *Original Comment:* The use of the tailing dam failure information worldwide from 1917 to 2000 is inappropriate. A large proportion of the failures were likely due to construction that did not incorporate modern standards used in the US. This analysis should be revisited using only data from sites that were constructed to modern standards.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Not addressed; references to 1917 remain. Use of mines developed to standards that are less than those that would be implemented at a new mine as examples of expected impacts is inappropriate. The failures and impacts of historical mines and mines developed outside of the US are not reflective of the impacts that would be expected at a mine that is developed to meet today's standards. Use of these examples results in a substantial overstatement of likely project effects.

<u>EPA Response:</u> Historic failure rates were not used to estimate the probability of failure in the scenarios. We have revised the text to clarify that historic tailings dam failure data were used to set a reasonable upper bound for the dam failure probability. We acknowledge several times that modern design, construction, and monitoring practices may reduce failure rates below historic levels by an order of magnitude or more.

2.16 *Original Comment:* No one can refute that some level of impacts to fish, wildlife, and their habitat(s) will result if the mine is built and operated for many years. The question is 'what are the risks'. The Bristol Bay Watershed Assessment repeatedly emphasizes the 'possible' effects, but other than the simple risk based screening of average leachate concentrations to water quality criteria, there is essentially no other site-specific assessment of the impacts to species and the quantification of lost habitat. The conclusions are oversimplified to the extent that it is not applicable to individual species or their populations. Pre-emptive action by the EPA in an area designated by a state as a potential mining area is unprecedented.

Recommended Change: Pebble Limited Partnership has collected a massive amount of relevant site-specific data, made public in their Pebble Limited Partnership Environmental Baseline Data, that has not been incorporated into any ecological risk assessment of the potential mine impacts. Unless there is a pre-emptive political decision to disallow development of the mine because of the 'pristine' nature of the Bristol Bay Watershed, then Pebble Limited Partnership should be allowed to use their data to develop a mine development and management plan, and a risk assessment/mitigation plan for the proposed mine. Then, agencies responsible for environmental impact and permitting review can better assess the degree of impact and either request further mitigation/assurances or deny the permit. Or, if the EPA wants to continue engagement in this process, then they could do the site-specific study, but it would seem that any EPA work would then have to be subject to interaction and review by the permittee.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Comment stands. Available data has not been used in the analysis and the analysis methods do not adequately address risk.

<u>EPA Response:</u> See responses to Comments 1.11 and 2.9. Relevant data are used in the assessment and risks are addressed. The only recommendations in this comment have to do with hypothetical future assessments, data generation, and decisions, which are not relevant to this assessment.

2.17 EPA identified one of the key areas of improvement as a reorganization to better reflect the ecological risk assessment approach and to clarify the purpose and scope. The reorganization of the work presented in the Assessment does not improve consistency with the EPA's ecological risk assessment methodology. The Agency no longer refers to the assessment as a watershed assessment (which it never was), and now refers to the work as simply an "assessment". The executive summary states that the report follows EPA ecological risk assessment framework (page ES-4, par. 2), yet the report does not meet its own guidance for performing either a baseline ecological risk assessment or screening-level risk assessment.

<u>EPA Response:</u> The title of the assessment was simplified to minimize confusion about the difference between an ecological risk assessment that evaluates a potential activity in a watershed and a watershed assessment that evaluates the current condition of a watershed given all activities in the watershed. The assessment is an ecological risk assessment, and it is consistent with the USEPA's 1998 *Guidelines for Ecological Risk Assessment*. This point has been clarified in Chapter 2.

2.18 *Original Comment:* The document states that the hypothetical scenarios used would 'result in the direct loss of 87.5 km to 141.4 km of streams and 10.3 and 17.3 km^2 of wetlands.' This does not adequately put the projected impact in perspective because there is no attempt to relate this to a percentage of the entire watershed. An abstract should be an overview or big picture and in this case the big picture is the entire Bristol Bay Watershed.

Recommended Change: Express the hypothetical stream and wetland loss as a percentage of the entire Watershed.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The use of watershed-wide comparisons has not been incorporated into the revised document. The document fails to use the appropriate scales when relating the size of impacts. Because of this, the document fails to adequately represent the overall effects and is biased towards maximizing perceived impacts.

<u>EPA Response:</u> Table 2-1 of the revised assessment presents the relative size of the different geographic scales considered in the assessment. The goal of the assessment is to estimate effects and their likelihood of occurrence, not to minimize them by expressing them as proportions of the entire watershed. To express results as proportions of the entire watershed would imply that the loss of a kilometer of stream is less important in the Bristol Bay watershed than in smaller watersheds. However, the

scales are presented so that the reader can make comparisons they consider appropriate.

2.19 Consistent with EPA ERA guidance, the Assessment presents a conceptual model, which serves as a basis for analyzing and characterizing risks (Box 2-1, p. 2-2). The conceptual model clearly includes consideration of "modifying factors," which "influence the delivery, expression or effects of stressors." However, the term "modifying factors" is never used again in the Assessment. This highlights one of the primary flaws of the report – the nearly total lack of consideration of any mitigation or management measures that may avoid, minimize, or mitigate the impacts of mining in the Bristol Bay watershed.

<u>EPA Response:</u> **As stated throughout the assessment, the scenarios evaluated assume the use of modern conventional mining practices and technologies, including mitigation measures (see response to Comment 2.11). Modifying factors in the conceptual diagrams are used to illustrate environmental factors (e.g., water chemistry) that modify the causal relationships; these factors are explicitly called out and incorporated throughout the analyses.**

2.20 Throughout the Assessment, statements are made that appear to cross multiple spatial scales. For example, the conceptual site models presented for salmon impacts do not reflect the different spatial scales of impacts. Furthermore, the footprint of the mine evaluated for spatial impacts reflects those of a hypothetical mine scenario rather than an actual project description, so any conclusions on this scale are inherently not accurate.

<u>EPA Response:</u> **The use of different spatial scales (referred to as geographic scales in the final assessment) in different sections of the assessment is explained in Section 2.2.2. Although the spatial impacts under the assessment's scenarios may not exactly match the location of impacts under a specific mine plan, they do represent a reasonable, defensible estimate of the kind and extent of impacts that could be expected for a mine of this size and type.**

2.21 The Assessment blurs and distorts the scale of the hypothetical mine scenarios, and the associated hypothetical impacts, which results in a lack of critical context for its quantitative conclusions, and misleads the reader regarding the significance of its findings.

The report claims to consider five spatial scales (p. 2-7):

- Bristol Bay watershed – 115,500 km^2;
- Nushagak and Kvichak River watersheds – 59,890 km^2;
- Mine Scenario watersheds - 925 km^2;
- Mine Scenario footprint (max Pebble 6.5 scenario) – 75 km^2; and
- Transportation Corridor – 113 km.

The Assessment is entitled An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska, but in fact, the Assessment does not attempt to assess impacts to salmon at the Bristol Bay watershed scale. The Bristol Bay watershed is referenced in characterizing the importance of the fishery and other resources of the watershed, but no impacts are discussed at this scale. In fact, although the five spatial scales are described in the Executive Summary and repeated in the Introduction, the fish resources analysis fails to perform legitimate analysis, if any, at the intermediate scales.

The Assessment states that it focuses on the Nushagak and Kvichak River watersheds, but in fact it does not. No impacts to the Nushagak or Kvichak Rivers are identified related to normal mine operations. In fact, the only potential impact to these rivers identified in the report relates to a tailings dam failure.

The Assessment is really an assessment of potential mining impacts at the Mine Scenario Watershed and Mine Scenario footprint scales, focusing largely on worst case scenarios. All impacts occur at this scale, which represent 0.8% (Mine watershed) and 0.06% (Mine Max Scenario Footprint) of the Bristol Bay watershed (Table 2-1, p. 2-8). This sense of the relative scale of the hypothetical mine scenario is not discussed in the Assessment, which is unfortunate, because it would give the readers a true sense of the scale of the potential impacts related to the hypothetical scenarios.

<u>EPA Response:</u> See responses to Comments 2.18 and 2.20.

2.22 Impacts to wetlands resulting from mining scenarios are quantified by acreage, but the assessment does not similarly quantify the total acreage of wetlands in the BBA's study area. The BBA report discusses five spatial scales; however it does not present a specific scale to gage the context of these results. We recommend the BBA add the percentage of impacted wetlands as a component of all the assessment area's wetlands, and does so at several watershed scales such as the local level (North Fork and South Koktuli, and Upper Talarik), the Kvichak and Mulchatna watersheds, and EPA's full assessment area.

For example, Alaska contains over 174 million acres of wetlands (Hall et al. 1994). Wetland coverage throughout the EPA assessment area of Bristol Bay is not well documented, but can be inferred through the National Wetlands Inventory Mapping (NWI). The NWI mapping units surrounding the Pebble Project are available. These maps include Iliamna quads D-2 to D-7 and C-2 and C-3. Within these quad maps, there are over 151,000 acres of wetlands, covering approximately 16% of the land surface (USF&WS 2011). Sixteen percent wetland coverage is likely a low proportion of wetland coverage throughout the Bristol Bay region. USF&WS found that much of the region, the Kuskowim Highlands and the Bristol Bay Coastal Plan, include up to 55% wetlands (Hall et al. 1994). Since NWI mapping is unavailable for much of the region, the following estimate will use the former value of 16%, with the understanding that it is likely a conservatively low number. The EPA assessment area covers 15 million acres. If a minimum of 16% wetland coverage is assumed across this area, then there are more than 2.4 million acres of wetlands within the EPA assessment area.

<u>EPA Response:</u> The comment is correct that much of the Bristol Bay watershed (Scale 1) lacks NWI mapping, and we cite this fact in Box 7-1 when discussing wetland impacts due to the mine footprints. We would expect to have a better idea of wetland coverage and impact at all spatial scales with improved and expanded mapping. However, due to the variety of physical and aquatic habitats within the region, it is likely that wetland coverage and density varies markedly across the landscape, making large-scale extrapolation of wetland coverage difficult and prone to high uncertainty. Although we decided to focus our analysis of wetland impacts to areas of known NWI coverage, we

acknowledge wetland coverage variation when discussing possible wetland and stream impacts at smaller, more discrete mining claim blocks with more complete NWI coverage (Chapter 13). To provide greater context for wetland coverage in the assessment area, we have added sentences referencing Hall et al. (1994) and the data contained therein to Chapter 7.

<u>**Resource Development Council (Doc. #5489)**</u>

2.23 RDC requests the EPA address our concerns about the recommendations in the BBA which are based on research from a discredited scientist, Ann Maest, as well as the deference given to work done by groups actively opposed to development of the Pebble Project. RDC is concerned that these sources further result in lack of credibility of the report.

Moreover, RDC believes the EPA did not use the best available science in development of the assessment, and that the engineering modeling in the BBA is seriously flawed and not based on realistic, modern standards. The EPA should also explain the geology background of the BBA, or lack thereof, and include the credibility of the geologists and their knowledge/work in the Bristol Bay area.

<u>**EPA Response:**</u> **EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to Wobus et al. (2012) and Kuipers et al. (2006) (the papers co-authored by Dr. Maest) from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings. All authors and contributors to the assessment are identified, and although not all have worked in the Bristol Bay watershed prior to this assessment, they are highly experienced in mining, geology, and environmental sciences.**

2.24 Furthermore, the revised draft has not clarified the purpose and scope of the assessment, and has resulted in more confusion and uncertainty. RDC is concerned this will further hamper investment in Alaska. Investors already see Alaska as more expensive to do business, in part due to logistics and climate, but also because of the long lead times in the permitting process and regulatory uncertainty.

<u>**EPA Response:**</u> **The comment does not specify how the revised assessment has increased confusion and uncertainty about its purpose and scope, so we are unable to respond.**

<u>**National Mining Association (Doc. #5557)**</u>

2.25 EPA's reliance on papers by environmentalist organizations in the draft assessment also compromises the value of the document, particularly in light of issues raised by several peer reviewers. Specifically, EPA cites to an Earthworks report throughout the assessment in sections concerning probability of contaminant releases, failures of water collection and treatment, water quality degradation, and aquatic exposures from pipeline spills.

<u>**EPA Response:**</u> **The Earthworks report was externally peer reviewed by an independent panel and was found to be biased in its rhetoric but not in its factual conclusions. It is these factual conclusions that are referenced in the assessment.**

The Pebble Limited Partnership (Doc. #5752)

2.26 EPA's failure to use the best available information concerning mitigation is a fatal flaw in the Assessment. Ecological risk assessments should always incorporate the best available information and data. This standard is essential to ensuring any measure of reliability and to avoid bias. It is especially critical given that the information in the Assessment may be used to support policy decisions respecting potential future mining, and policymakers are instructed to "weigh the *best available science*, along with additional factors such as practicality, economics, and societal impact, when making policy decisions." Scientific Integrity Policy at 3-4 (emphasis added).

The mandate to use the best available information is reinforced throughout recent Agency guidance. In its most recent (2008) watershed risk assessment guidance, EPA repeatedly stresses that "[e]ffective risk communication must accurately translate *the best available and most useful scientific information* in a manner understandable to managers and stakeholders." U.S. EPA, *Application of Watershed Ecological Risk Assessment Methods to Watershed Management* ("2008 Watershed Guidance"), EPA/600/R-06/037F, at 3 (Mar. 2008) (emphasis added); *see also id*. at 52 ("Effective risk characterization must accurately translate the best available information about a risk into a language nonscientists can understand …"). EPA's 2002 Risk Characterization Handbook similarly emphasizes the importance of using the highest quality information, observing that "[r]easonableness is achieved when … the characterization is based on the *best available* scientific information." U.S. EPA, *Science Policy Council Handbook: Risk Characterization* ("Handbook"), EPA 100-B-00-002, at 18 (Dec. 2000) (emphasis added). The Handbook also identifies "[u]se [of] best available scientific information" as one of the specific "Criteria for a Good Risk Characterization." *Id*. at 19.

Recognizing the importance of using the best available information, EPA has also expressly adopted an adapted version of the Safe Drinking Water Act's quality principles for use in conducting "influential" scientific risk assessments. These principles require that the "substance of the information is accurate, reliable and unbiased," which in turn necessitates:

(i) the *best available science and supporting studies* conducted in accordance with sound and objective scientific practices; and

(ii) data collected by *accepted methods or best available methods* (if the reliability of the method and the nature of the decision justifies the use of the data).

Finally, the 1998 Guidelines (the claimed basis for the current Assessment) emphasize the importance of taking an "inclusive approach, which evaluates all available information…" Guidelines at 114 (emphasis added). Where different evidence supports differing conclusions, risk assessors should "*investigate possible reasons for any disagreement rather than ignore inconvenient evidence*." Id. at 115 (emphasis added). Unfortunately, the current Assessment does just the opposite: it deliberately relies on articles by known opponents of a Pebble mine (discussed below in Section VII), while largely ignoring the detailed, pertinent (but inconvenient) information contained in Pebble's environmental baseline data ("EBD"). The Assessment's failure to consider *all* of the available research and to use the *best* available information (instead of articles that reach conclusions that EPA finds congenial) has led to scientifically indefensible conclusions.

<u>EPA Response:</u> We disagree with this comment. The assessment is based on the best available science and evaluates all available information, including that in the PLP's Environmental Baseline Document as well as other sources. Northern Dynasty Mineral's preliminary mine plan (Ghaffari et al. 2011) and PLP's Environmental Baseline Document are both used as sources in the assessment far more often than reports by mining opponents.

2.27 Throughout the Assessment, EPA fails to take into account significant information from PLP's EBD or other such sources, despite the fact that PLP – whose planned activities are the basis for the Assessment – is by far in the best position to provide key information on specific site characteristics, mining operations, best mining practices, and other minimization and mitigation options. The Assessment's failure to consider best mining practices and mitigation options is particularly egregious. As the EPA guidance recognizes, such factors carry enormous implications with respect to ultimate risk and impact levels. "If … [they] are not identified and taken into account in risk analysis, results will be 'noisy,' masking any real relationships that might exist between source types, stressors, and effects." *Id*. at 40-41; *see also* Handbook at 18 "Reasonableness is achieved when … appropriate plausible alternative estimates of risk under various candidate risk management alternatives are identified and explained."). The guidance concludes that "[a] solution to this challenge is to *involve people in the [assessment] who are knowledgeable about the watershed and can help 'ground-truth' risk analyses*." 2008 Watershed Guidance at 41 (emphasis added).

In the case of this Assessment, those most knowledgeable about mining practices and potential impacts to the watershed were kept at a distance, resulting in an Assessment that ignores critical information. In the end, the Assessment's failure to use key evidence from PLP, including evidence about mitigation and important data included in the EBD, ultimately precludes any meaningful analysis of impacts that might occur.

<u>EPA Response:</u> See responses to Comments 1.11 and 2.11.

2.28 It is a fundamental precept that ecological risk assessments, like any other scientific research developed by the Agency, reflect high quality science based on the best available data. Not surprisingly, EPA represents the Assessment as an unbiased "scientific investigation" based on "a review and synthesis of available information." Assessment at 1-2, 1-4. The Assessment's myriad omissions, uncertainties, and miscalculations, however, ultimately add up to a larger failure to apply rigorous science based upon the best available data relevant to the watershed and a potential future Pebble mine. In particular, the Assessment fails to seriously consider the most complete site-specific information and analysis – Pebble's own Environmental Baseline Document, developed for the specific purpose of planning for a future mine – in characterizing the risks and evaluating the magnitude of potential impacts. By failing to use the best science and information available, the Assessment contradicts EPA guidance in a number of respects, identified below.

Good, objective science is necessary for good, objective decision-making. Government-wide directives and EPA policy have reiterated this principle. In 2009, the President issued a memorandum on this subject, referring to it as "Scientific Integrity." The memorandum responded to the need to assure that the vast range of scientific work undertaken by the federal government, and the policies and actions resulting from such work, reflect good science that can be reasonably relied upon. In the President's words:

> *The public must be able to trust the science and scientific process informing public policy decisions. Political officials should not suppress or alter scientific or technological findings and conclusions.*
>
> *The White House, Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity (Mar. 9, 2009).*

To address the President's concerns, the Director of the Office of Science and Technology Policy was required to develop guidance to ensure that each agency put in place a program to "ensure the integrity of the scientific process." *Id*. Accordingly, the Director issued a subsequent memorandum to this effect, requiring each agency to develop policies recognizing, among other things, that "[s]cientific progress depends upon honest investigation, open discussion, refined understanding, and a firm commitment to evidence. Science, and public trust in science, thrives in an environment that shields scientific data and analyses from inappropriate political influence …" John P. Holdren, *Memorandum for the Heads of Executive Departments and Agencies on Scientific Integrity*, at 1 (Dec. 17, 2010).

EPA is subject to the President's directive to promote and practice scientific integrity. Indeed, EPA has adopted its own scientific integrity policy recognizing that "[t]he environmental policies, decisions, guidance, and regulations that impact the lives of all Americans every day *must be grounded, at a most fundamental level, in sound, high quality science*." Scientific Integrity Policy, at 1 (emphasis added). Accordingly, the Policy requires that *all* EPA employees (including scientists) "[e]nsure that the Agency's scientific work is of the *highest quality, free from political interference or personal motivations*." *Id*. at 3. Finally, the Policy declares it "essential that … scientific information and processes relied upon in policymaking manifest scientific integrity, quality, rigor, and objectivity." *Id.* at 3.

The Assessment is lacking in these most basic qualities. It reaches conclusions that are not grounded in the evidence, and which fail to take into full consideration all relevant information, data, variables, and uncertainties. It looks to known opponents of the Pebble mine for support for its risk characterization. And it was rushed – a project of unprecedented geographic and conceptual scale, drafted in an extraordinarily short amount of time. Because the Assessment fails to use good science – and fails to do so in an objective manner – it violates both government-wide and EPA policies demanding scientific integrity.

<u>**EPA Response:**</u> **We disagree with this comment. We used the best available science in the assessment, and have revised the assessment as better science became available. The assessment and the analyses contained within it are objective and uncertainties are clearly recognized throughout.**

2.29 Some time following the issuance of the first External Review Draft of the Assessment, EPA engaged peer reviewers for the apparent purpose of legitimizing at least seven reports written by mine opponents that EPA intended to use in the final Assessment. EPA wrote that "[o]ther non-governmental organizations have collected data specific to the Pebble deposit site. USEPA subjected some of these documents to external peer review before incorporating this information into the assessment." Assessment at 2-3. EPA has never explained which reports were given this peer review, or why those reports were selected. Unlike the relatively transparent peer review process for the first draft Assessment, this peer review process was conducted in the dark. PLP has now obtained copies of those peer review reports from EPA's website. Their content (described below) probably is the reason why EPA described them so vaguely in the draft Assessment.

A. <u>*The peer reviewers recognized that the newly relied-on reports are biased and have little scientific value.*</u>

The seven peer-reviewed reports are so biased that they have no place in an assessment that purports to be objective. In fact, the peer reviewers themselves identified the biased nature of these reports, and their comments reveal that these reports have little scientific value. What little value they have comes from compilation of the results of studies by others, although those studies were apparently selected to support the authors' own anti-Pebble (or anti-mining) agenda. These circumstances suggest that EPA chose to use them not because of their scientific value, but because of their slant. Below we describe the peer reviewer comments about each of these reports.

1. U.S. Copper Porphyry Mines Report: The Track Record of Water Quality Impacts Resulting from Pipeline Spills, Tailings Failures, and Water Collection and Treatment Failure (Earthworks 2012)

Earthworks is a U.S.-based organization opposed to mining. In Kuipers 2006 (discussed below), Earthworks is described (on the cover page for the report) as "a non-profit organization dedicated to protecting communities and the environment from the destructive impact of mineral development in the U.S. and worldwide." Earthworks' point of view is evident in its report's introduction, which candidly explains that "[t]he purpose of this report is to compile the record of pipeline, seepage control and tailings impoundment *failures* at operating copper porphyry mines in the U.S., and to document associated water quality impacts." Earthworks Report at 4 (emphasis added).

EPA selected four peer reviewers for this report: David Atkins, Robert Kleinmann, Dina Lopez, and Christian Wolkersdorfer. Robert Kleinmann wrote that "I find the report, by its nature, to be very biased. In reality, a similar report emphasizing problems and mistakes could probably be written for most human activities." *Final Peer Review Summary Report: External Peer Review of Kuipers et al. 2006 (Comparison of Predicted and Actual Water Quality at Hardrock Mines) and Earthworks 2012* (*U.S. Copper Porphyry Mines Report*), at 20 (Nov. 15, 2012). David Atkins, one of the original peer reviews of the initial draft Assessment, observed that "[m]ost of the mines considered are quite old facilities with operations often initiating in the 1880s and with large-scale, open-pit operations initiating in the post WWII era …" *Id*. at 22. He noted that "[t]he conclusion that we can expect a similar or worse track record for a new mine is, however, not supported by the information presented." *Id*. at 24. Christian Wolkersdorfer wrote that "[b]ecause [the authors] did not provide reasons for [spills or impoundment or treatment failures] the 'innocent' reader might draw the conclusion that copper porphyry mine operations cannot be operated on a environmentally sound basis." *Id*. at 28. He later concluded that "this is not the case as many incidents are only of minor importance and modern day mining has more stringent requirements than the older mines investigated." *Id.* at 29. Mr. Kleinmann concluded: "Most of the report is based on guilt by association." *Id*. at 29.

2. Comparison of the Pebble Mine With Other Alaska Large Hard Rock Mines (Levit and Chambers 2012)

EPA selected the following peer reviewers for this document: David Brett, Andy Fourie, Robert Kleinmann, and Natalia Ruppert. Peer reviewer Robert Kleinmann wrote that this report "is clearly intended to convince the reader that the Pebble Mine should not be permitted to operate …" *Final Peer Review Summary Report: External Peer Review of Chambers and Higman 2011 (Long Term Risks of Tailing Dam Failure) and Levit and Chambers 2012* (*Comparison of the Pebble Mine with other Alaska Large Hard Rock Mines*), at 20 (Dec. 30, 2012). Mr. Kleinmann later noted that "[i]ts intended audience is clearly the general public rather than informed scientists and administrators." *Id*. at 21. Peer Reviewer Natalia Ruppert wrote that "it seems that the whole point of this report was to emphasize how much more threatening Pebble project's impact would be" than other projects. "Therefore, the report lacks impartiality." She concluded: "I remain suspicious as to soundness of the conclusions presented in this report… I am suspicious of what the authors chose not to mention in order to maintain their perception of the Pebble mine threats." *Id*. at 16. Peer Reviewer David Brett wrote that the report "does tend to go into a relatively shallow commentary of potential impacts from the particular mine." *Id*. at 17. He later concluded that "some of the language used is a bit alarmist and not based on presented data." *Id*. at 19.

3. Comparison of Predicted and Actual Water Quality at Hardrock Mines (Kuipers et al 2006)

One of the co-authors of this report is Ann Maest, whose work – as described in more detail below – in support of a lawsuit against Chevron was publicly disavowed by her employer (Stratus Consulting). The report announces that "[t]his publication was made possible by EARTHWORKS …" It also credits project advice, input, and "internal peer review" from Dave Chambers, the author of the report discussed immediately above.

EPA selected four peer reviewers for this report: David Atkins, Robert Kleinmann, Dina Lopez, and Christian Wolkersdorfer. Mr. Wolkersdorfer pointed out that the report's "summary table only describes old mines – where environmental requirements might have been less stringent than today." *Final Peer Review Summary Report: External Peer Review of Kuipers et al. 2006 (Comparison of Predicted and Actual Water Quality at Hardrock Mines) and Earthworks 2012 (U.S. Copper Porphyry Mines Report),* at 6 (Nov. 15, 2012). He added that "the conclusions drawn by Kuipers et al. are correct for the 25 mines they investigated in 2006, but they cannot be used to predict the outcome of future predicted water qualities during or after mining." *Id*. at 7. Ms. Lopez concluded that "[b]ecause of the lack of statistical proof that the core findings of their presentation (e.g., 25 case studies) are representative for all past and future mines, the value of this report for the EPA assessment is questionable." *Id*. at 18. Mr. Wolkersdorfer made the same point. *Id*. at 4. Mr. Kleinmann pointed out that the study failed to consider that the mines "had operated over very different time periods, during which the state-of-the-art was rapidly changing." *Id*. at 15.

Notwithstanding these criticism, EPA relies on the report in the Assessment and states that the report's mine selection "*is not apparently biased*." Assessment at 8-53 (emphasis added). In fact, it is *overtly* biased. The authors selected 25 of 71 hard rock mines that resulted in NEPA water quality predictions. The second selection criteria priority was mines "indicating water quality impacts." *Kuipers* at 87. Thus the criterion *excluded* mines *without* water quality impacts. There is no clear explanation for EPA's assertion that the report methodology is not biased except perhaps to mislead the Assessment's readers.

4. Long Term Risks of Tailing Dam Failure (Chambers and Higman 2011)

This report provides an overview of tailings dam risks. EPA selected four peer reviewers for this report: David Brett, Andy Fourie, Robert Kleinmann, and Natalia Ruppert. David Brett observed that "some statistical interpretation is misleading." *Final Peer Review Summary Report: External Review of Chambers and Higman 2011 (Long Term Risks of Tailing Dam Failure*) and Levit and Chambers 2012 (*Comparison of the Pebble Mine with other Alaska Large Hard Rock Mines*), at 3 (Dec. 30, 2012). He went on to explain that "[r]ecent failures in China that I have personal knowledge of are due to inappropriate flood design parameters and lack of emergency spillway provisions. These cases affect the statistics and do not allow modern design practices and operations in well regulated environments to be fully appreciated." *Id*. at 4. Mr. Brett noted that the number of tailings dams far exceeds the 3,500 number quoted from another report – there are over 13,000 tailings dams in China alone – "many from small operations. Nevertheless failure of these is likely to be included in the statistics." *Id*. He concluded that the authors had "not fully understood the data" from a key source. *Id*. at 9. Mr. Fourie noted that "[t]he information presented is thus not derived from the authors' own research or investigations," but from independent sources. *Id*. at 5.

5. Fish Surveys in Headwater Streams of the Nushagak and Kvichak River Drainages Bristol Bay, Alaska, 2008-2010 (Woody and O'Neal 2010)

This report was done for The Nature Conservancy. EPA selected four peer reviewers to review the report: Michael Donaldson, James Helfield, Dennis Scarnecchia, and William Wilson. The report's stated purpose, as noted in its Preface, was "to determine whether salmon habitat could be affected by potential mining activity" at the Pebble prospect. Mr. Wilson observed that "I did not see that purpose reflected in the body of the report. There was no discussion of impact assessment methodology or documentation of an environmental assessment, which would be needed to attain the stated purpose." *Final Peer Review Summary Report: External Peer Review of Woody and O'Neal 2010 (Fish Surveys in Headwater Streams of the Nushagak and Kvichak River Drainages Bristol Bay, Alaska, 2008-2010) and Woody and Higman 2011 (Groundwater as Essential Salmon Habitat in Nushagak and Kvichak River Headwaters: Issues Relative to Mining),* at 4 (Dec. 30, 2012). He criticized the "disjointed and advocacy-laced Preface, which unfortunately sets the scene for a report that bears little resemblance to the Preface." *Id*. at 10.

Mr. Scarnecchia observed that "[t]here is no discussion section at all where results are qualified and discussed, and the conclusion section has an array of new methods, results, and discussion, with no specific conclusions identified." *Id*. at 5. Mr. Wilson similarly observed that "[t]he conclusions of the report are meagerly supported by the evidence provided." *Id*. Mr. Sarnecchia observed other aspects of the methodology that were never explained, including the basis for selecting streams for sampling, how fish life stages were identified, or even why most of the habitat information was collected. *Id*. at 8-9. Mr. Wilson's observation exposes the bias of the study authors: "A statement on page 23 requires considerable explanation and referencing: 'As illustrated by this stud[y], headwaters comprise a significant proportion of essential habitat for salmon.' This report provides no justification or supporting data or analyses for this statement." *Id*. at 11.

6. Groundwater as Essential Salmon Habitat in Nushagak and Kvichak River Headwaters: Issues Relative to Mining (Woody and Higman 2011).

The purpose of this report is to show that ground water is an essential habitat for salmon in the headwaters of the Nushagak and Kvichak River watersheds. EPA selected four peer reviewers for this report: Michael Donaldson, James Helfield, Dennis Scarnecchia, and William Wilson. Mr. Scarnecchia wrote that "[t]his paper is best characterized as an overview paper … presenting a range of plausible concerns" about changes in ground water quality associated with potential mining that might affect salmon habitat. *Final peer Review Summary Report: External Peer review of Woody and O'Neal 2010 (Fish Surveys n Headwater Streams of the Nushagak and Kvichak River Drainages Bristol Bay, Alaska, 2008-2010) and Woody and Higman 2011 (Groundwater as Essential Salmon Habitat in Nushagak and Kvichak River Headwaters: Issues Relative to Mining),* at 15 (Dec. 30, 2012).

Mr. Wilson, after noting that the report provided a good literature review on the ground water/surface water connection and sound field observations, wrote that "[t]he conclusions in this report, however, are not supported by the information provided. This report strays from the purpose as outlined in the title to a series of hypothetical and often random statements about mining impacts, concluding that a specific development, the Pebble Prospect, has the potential to 'significantly impact' fish without providing in this report data or information on the mine development plan, locations of specific mine facilities, mitigation measures to be employed, and many other unknowns." *Id*. at 16. Mr. Sarnecchia similarly commented that the third objective of the report was to "identify *potential risks*" (emphasis in original) and it used words "such as 'potential,' 'can,' and 'may,' recognizing that more detailed studies are clearly needed." *Id*. at 16. Mr. Wilson referred to the conclusions as "a series of hypothetical statements." *Id.* at 18.

Mr. Donaldson commented that the premise for the one-day field study discussed in the report – that open water seen in March 2011 is from ground water upwelling – "represents a weakness" because open water could result from other factors (including temperature changes) other than ground water upwelling. *Id*. at 19. Mr. Wilson concluded that "[o]nly a single field trip is described, and that effort was a single day in the field completing aerial surveys of over 175 miles (or more?). The study has limited application to impact assessment since it does not document actual fish presence in areas identified as open water and potential fish habitat. Overall, this study is interesting and relevant, but limited in scope and too general in nature to contribute to quantitative assessment of development impacts." *Id*. at 24.

7. *Potential Hydrologic and Water Quality Alternation from Large-scale Mining of the Pebble Deposit in Bristol, Bay, Alaska: Results from an Integrated Hydrologic Model of a Preliminary Mine Design (Wobus 2012)*

This report was prepared for The Nature Conservancy by Cameron Wobus and Ann Maest of Stratus Consulting. Its goal was to develop a hydrologic model of the Pebble deposit area to "improve the understanding of the potential effects of mining" on local hydrology and water quality. *Wobus* at 2. In the conclusion section, after noting that data uncertainties "limit the ability of the model to make specific numeric predictions[,]" the authors conclude that if leachate management systems fail, copper concentrations would likely exceed water quality criteria "with potential for significant adverse effects" on salmonids and other aquatic biota. *Id*. at 39.

EPA selected Michael Gooseff, Andrew Ireson, Thomas Meixner, and John Stednick to peer review this report. All of them identified significant problems with the model, the report, and the lack of support for the conclusions. Mr. Stednick, who also was selected to be a peer reviewer of the initial draft Assessment, observed that "the writing and tone of the report suggests less than an objective approach." *Final Peer Review Summary Report: External Peer of Wobus et al. 2012: Potential Hydrologic and Water Quality Alteration from Large-scale Mining*

Dr. Ann Maest is a "Managing Scientist" with Stratus Consulting. On April 12, 2013, a sworn declaration was filed in a New York federal district court by Mr. Douglas Beltman, Executive Vice President of Stratus, referring to work carried out by Stratus and Dr. Ann Maest, where he declared that he has "disavow[ed] any and all findings and conclusions" in certain Stratus reports relating to alleged oil contamination in Ecuador. *Chevron Corp. v. Donziger, et al.,* Witness Statement of Douglas Beltman, at par.76, S.D.N.Y. No. 1:11-cv-00691-LAK (filed April 12, 2013). Mr. Beltman disavowed the Stratus scientific work, in part, because his own public statements regarding this project were "misleading" (par. 66), and public statements by others associated with the project (including Dr. Maest) were unsupportable. *See, e.g.*, par.73 ("I have no scientific bases to believe any of the public statements referenced above to be true."); *see also id.* par.22 ("I supervised the preparation by Dr. [Ann] Maest and other Stratus personnel or subcontractors of 11 of the 24 sub-reports and appendices …"). For more information regarding Dr. Maest, see American Resources Policy Network, *A Response to the EPA's Release of its Revised Bristol Bay Watershed Assessment* (Apr. 29, 2013), *available at* http://americanresources.org/a-response-to-the-epas-release-of-its-revised-bristol-bay-watershed-assessment/ *of the Pebble Deposit in Bristol Bay, Alaska*, at 4 (Nov. 2, 2012). After quoting some of the report's conclusions, Mr. Stednick wrote that "[n]one of these observations are defended in the report and suggest a lack of objectivity. This lack of objectivity tempers the study results and leaves me questioning other results." *Id*. at 12. He later explained that, among other things, "[q]uantitative model results are not presented and some of the comments read like editorial opinions rather than reporting scientific results [and] … model efforts were not adequately described. Comments like 'a very good qualitative fit' and 'does predict the general degree and direction of potential impacts' (both on page 39) are value judgments rather than conclusions." *Id*. at 5.

Mr. Ireson concluded that "the credibility of the model is questionable …" *Id*. at 13. He noted that "[t]he conclusions are weakly supported by the evidence provided. . . . The conclusions about mine impacts are dependent on the model and, therefore, those too are not strongly supported." *Id*. at 5. Mr. Gooseff, after expressing doubts about the accuracy of key representations in the model (*id*. at 7) concluded that it "should not be considered a prognostication for the future." *Id*. at 8.

Mr. Meixner wrote that the report's assumption that copper is "conserved" (does not interact chemically with other substances in the soil or water as it moves) "is flawed." *Id*. at 10; *see also id*. at 3 and 13. Mr. Stednick (*id*. at 11) and Mr. Gooseff (*id*. at 8) made similar observations. Mr. Gooseff wrote that "the lack of any potential interaction of the dissolved copper in the stream as it travels . . . suggests this is perhaps a worst-case result for this site." *Id*. at 8.

The reviewers had similar concerns about the authors adding one standard deviation to the concentration of the waste rock leachate. Mr. Ireson wrote that "one standard deviation was added to the concentrations of the waste rock leachate. There is no justification provided for the choice of adding one standard deviation, and this could be seen as an attempt to bias the outcome of the study . . . ." *Id*. at 9. Mr. Stednick similarly noted that "[n]o justification for this [one standard deviation] inflation was provided." *Id*. at 4.

None of the reviewers expressed confidence in the model that served as the foundation of this report. The report suffers from inadequate data (site geology and hydrology), unrealistic chemistry (conservation of copper), arbitrary inflation of data (adding one standard deviation to the copper leachate concentration), and unsupported conclusions about mine impacts.

B. *<u>The authors of the reports are committed mine opponents.</u>*

It is hardly surprising that the peer reviewers found bias in the foregoing studies. The authors of the seven reports are opponents of the Pebble Project.

David Chambers is the president of the Center for Science in Public Participation ("CSP2"), which opposes mining in general and the Pebble project specifically. Its website is located at http://www.csp2.org/. The website's project page discusses the organization's activities opposing Pebble and its involvement with others whose articles were selected by EPA for peer review. The website explains in relevant part: Since 2007 CSP2 has been providing technical support to a loose coalition of groups opposed to the proposed [Pebble] mine. Dave Chambers, (general mining), Kendra Zamzow, (geochemistry), and Stu Levit, (reclamation and regulatory), have provided support from CSP2. CSP2 also utilized consultants Carol Ann Woody, Ph.D., and Sarah O'Neal, M.S., from Fisheries Research and Consulting to provide support on fisheries biology, and Ann Maest, Ph.D., and Cam Wobus, Ph.D., from Stratus Consulting to provide technical support on geochemistry and hydrology. Bretwood Higman, Ph.D., from Ground Truth Trekking provided fault and seismic research.

The research efforts of this technical team have led to a significant number of publications and professional presentations. Dave Chambers, and CSP2 consultant Bretwood Higman, developed a paper on the "Long Term Risks of Tailings Dam Failure" which has been presented at several professional meetings. Kendra Zamzow collected and analyzed water quality data from several sites in the area of the proposed mine "Investigations of Surface

Water Quality in the Nushagak, Kvichak, and Chulitna Watersheds, Southwest Alaska, 2009-2010." Stratus Consulting has developed a state-of-the-art computer hydrologic model that is being used to develop predictions of groundwater and surface water flows, and the geochemistry of those waters, which would result from the development of the mine. Fisheries Research and Consulting has been involved in a multi-year survey to collect data on the presence of salmonids in the area, "Fish Surveys in Headwater Streams of the Nushagak and Kvichak River Drainages, Bristol Bay, Alaska, 2008–2010."

EPA released its Draft "Bristol Bay Watershed Assessment" in May, 2012. This is a significant scientific effort to evaluate the potential impacts of the Pebble mine on the Bristol Bay ecosystem. Dave Chambers and Kendra Zamzow provided technical critiques of the Draft to EPA with recommendations for improvement. *CSP2 is also working with the Bristol Bay Native Corporation in its effort to convince EPA to invoke its power under section 404(c) of the Clean Water Act to veto the Pebble Project* because it would have an "unacceptable adverse effect" on fisheries resources in the Bristol Bay region.

CSP2, http://www.csp2.org/projects (last accessed June 24, 2013) (emphasis added). Of these authors, Mr. Higman is the most versatile: he co-authored papers both on tailings dam failures (with Mr. Chambers) and on ground water being essential salmon habitat (with Ms. Woody). The Assessment also uses works by Ann Maest, Cam Wobus, and Kendra Zamzow, all of whom helped Mr. Chambers' firm provide technical support "to a loose coalition of groups opposed to the proposed mine."

In addition, the Assessment's appendix on Native cultures (Appendix A) was authored by Professor Alan Boraas, who has been an open opponent of the Pebble Project since at least April 2007, when he was described as "a frequent op-ed contributor to the Anchorage Daily News. One of his regular targets for criticism is the Pebble copper project in southwest Alaska." On at least one occasion, he has presented his work at an event sponsored by organizations opposing Pebble who used the event to gather increased opposition to the project.

We request that the peer reviewed reports we have mentioned above and Professor Borass' study be removed from the final document. EPA's reliance on this information highlights a bias that fundamentally undermines what should be an objective, scientific process. In addition, the CSP2 website reveals that Ms. Zamzow began working for EPA's Office of Research and Development ("ORD") in Washington, D.C. in August 2012 and will continue to work for EPA until September 1, 2013. ORD is one of the authors of the Assessment. If Ms. Zamzow's work at ORD influenced the Assessment (which uses papers that she has authored) that would be cause for even further doubt about the objectivity of the Assessment.

<u>EPA Response:</u> We used information from both mine proponents and mine opponents in the assessment. In particular, the two most used sources were Northern Dynasty Minerals' preliminary mine plan (Ghaffari et al. 2011) and the Pebble Limited Partnership's Environmental Baseline Document (PLP 2011), both of which are not peer-reviewed documents.

Before completing the revised draft, EPA had several reports that were submitted during the draft assessment's public comment period independently peer-reviewed. These reports were selected because they provided new data for analyses conducted in

the assessment or modeling results that could be used as an independent check on the modeling performed in the assessment. Peer review of these documents was conducted by a peer review contractor. Although the reviewers noted an apparent bias in data interpretation in some of those reports, the data themselves were not found to be biased and were used in the assessment.

EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to Wobus et al. (2012) and Kuipers et al. (2006) (the reports co-authored by Dr. Maest) from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.

Dr. Boraas' appendix is provided as part of the characterization of resources in the Bristol Bay region. We have no basis for concluding the information in the report is biased, and the comment provides none. Dr. Zamzow did not participate in the assessment.

2.30 The Assessment's exaggerated risk scenarios fail to comply with EPA guidance.

EPA's Guidelines point out that a "risk assessment that is too narrowly focused on one type of stressor in a system (e.g., chemicals) could fail to consider more important stressors (e.g., habitat alteration)." Guidelines at 8. The Assessment focuses on a single potential stressor – a Pebble mine. That potential stressor is never placed in context of the Bristol Bay fishery or the other stresses that have caused salmon populations to rise and fall for many decades.

<u>EPA Response:</u> The assessment focuses on a complex of potential sources of impairment stemming from large-scale open pit porphyry copper mines and evaluates multiple heterogeneous stressors stemming from those sources. The purpose of the assessment is to evaluate potential impacts of this kind of mining on the region's salmon resources, not to evaluate <u>all</u> potential sources that may affect salmon.

2.31 The Assessment's failure to address its uncertainties, its reliance on inadequate data, and its unrealistic scenarios all violate EPA's own guidance.

Because the uncertainties in the Assessment are (1) insufficiently accounted for, and (2) extend beyond any scientifically supportable bounds, the Assessment is contrary to Agency policy in several important respects.

First, EPA is required to properly identify and account for sources of uncertainty. The Region 10 Primer instructs that risk assessments are properly shaped by the scope of assessment constraints, including uncertainties in the data and analysis. *See* Watershed Assessment Primer at 3. Ultimately, "[n]o matter what technique is used, the sources of uncertainty … should be addressed." Guidelines at 64-65. EPA fails to satisfy this requirement. Peer reviewer John Stednick pointed out that EPA's conclusions went beyond the data underlying them:

> The conclusions of the Executive Summary are strongly worded (e.g., pages ES 13 to 24), yet the uncertainties presented later in the report make the strong conclusions

> tenuous. An expanded discussion of uncertainties and limitations may temper those "conclusions."

Final Peer Review Report at 19.

Second, the Guidelines call for EPA to rely on precise, accurate data to the fullest extent possible. The Agency must not rest its conclusions on data that are insufficient for a scientifically-supportable risk assessment. Unlike EPA's other watershed risk assessments,[1] even those with predictive components, the Assessment focuses entirely on future, hypothetical stressors and activities, with no site-specific historical data to support its conclusions. The unprecedented over-reliance on unknown and speculative information and data clearly exceeds the limits of uncertainty contemplated by EPA's Guidelines. Peer reviewer David Atkins noted that the uncertainty underlying the Assessment hampered evaluation of its predictions:

> [T]he report stresses the wide range of uncertainty, depending on design and environment. Without a more detailed understanding of the mine plan and associated engineering, as well as additional detailed analysis, it is difficult to determine if the failure probability estimates presented in the Assessment are reasonable.

Final Peer Review Report at 61. Peer reviewer William Stubblefield commented that because the Assessment preceded an actual mine proposal, the resulting uncertainty put its usefulness into question:

> Although interesting, the potential reality of the assessment is somewhat questionable. It is also unclear why EPA undertook this evaluation, given that a more realistic assessment could probably have been conducted once an actual mine was proposed and greater detail about operational parameters available… Unfortunately, because of the hypothetical nature of the approach employed, the uncertainty associated with the assessment, and therefore the utility of the assessment, is questionable.

Id. at 22. Peer reviewer Roy Stein wrote that the Assessment stands at "the outside edge" (and beyond) of its "semi-predictive models," leaving the conclusions on "tenuous ground":

> However, from the list of uncertainties, we are operating at the outside edge (and beyond in many cases) of the semi-predictive models used in anticipating the impacts of the mine footprint, the routine operations of the mine, and the impacts of failures of TSF, pipelines, and water/leachate collections on extant salmon populations. And our knowledge of the baseline populations of the seven species of salmonids is no better, for

[1] Compare U.S. EPA, Clinch and Powell Valley Watershed Ecological Risk Assessment, Office of Research and Development, National Center for Environmental Assessment, Washington, DC, EPA/600/R-01/050 (2002), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=15219), and U.S. EPA, Waquoit Bay Watershed Ecological Risk Assessment: the Effect of Land Derived Nitrogen Loads on Estuarine Eutrophication, Office of Research and Development, National Center for Environmental Assessment, Washington, DC, 600/R-02-079 (2002), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=15221; see also U.S. EPA, Ecological Assessment for the Middle Snake River, Idaho, Office of Research and Development, National Center for Environmental Assessment, Washington, DC, EPA/600/R-01/017 (2002), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29097&partner=ORD-NCEA (incorporating predictive assessment, but doing so based on prior and existing area land use activities and effects).

> we do not know the size, diversity, distribution, or vital rates (i.e., recruitment, growth, and survival across life stage) of these fishes.
>
> Couple these two sets of uncertainty and the prognosis outlined in the report is suspect, at the very least, and somewhat anticipatory at best (I cannot bring myself to use the word "predictive"), … it seems to me that we are on tenuous ground when we attempt to predict the impact of the Pebble Mine on salmon, associated wildlife, and Native Alaskan cultures in the Bristol Bay Watershed.

Id. at 107. The point made by all three reviewers is that the information used in the Assessment is insufficient to support its goals – it is scientifically inadequate to predict impacts on the selected endpoints.

Third, EPA's guidance explains the importance of quantifying impacts,[2] yet very few of the risks analyzed in the Assessment are capable of being quantified, and many of these hypothetical risks are not even conducive to meaningful qualitative description.[3] Even where the Assessment attempts to estimate impact levels, it often cannot do so with any degree of certainty. Peer reviewer Paul Whitney pointed out that the Assessment's qualitative approach is not useful:

> Merely stating that a qualitative increased risk for fish will also result in a qualitative increased risk for wildlife is not adequate. I am not satisfied with such an obvious and general conclusion. Id. at 25.

<u>EPA Response:</u> The comment states that the assessment does not address uncertainties, but then cites Dr. Atkins' comments that we "stressed a wide range of uncertainty" and Dr. Stein's comments about the acknowledged uncertainties in the fish population data. The peer reviewer's statements cited in the comment all address the May 2012 draft assessment. The peer reviewers were satisfied with our responses to those comments, which were submitted to the peer reviewers with the revised assessment (and are available to the public). The comments about EPA's watershed assessments, which describe the current condition of watersheds resulting from all sources, are irrelevant to this risk assessment of potential future copper mining in the Bristol Bay watershed. They are different types of assessments. The title of the assessment was changed to eliminate confusion concerning watershed assessments.

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[2] 2008 Watershed Guidance at 27 ("Quantified target values of assessment endpoints should be specified, where applicable, as a means of evaluating and communicating whether a given management alternative meets management objectives.").

[3] See, e.g., Assessment at 14-13 to 14-14 ("The effects of mining on fish populations could not be quantified because of the lack of quantitative information concerning [fish] populations and their responses. The occurrence of salmonid species in rivers and major streams is generally known, but not their abundances, productivities, or limiting factors. Estimating changes in populations would require population modeling…"); see also id. at 7-26 ("Of the total wetlands area eliminated or blocked by the footprint, the proportion used by anadromous salmonids or resident fish species is unknown. Fish access to and use of wetlands are likely to be extremely variable in the mine area… Given our insufficient knowledge of how fish use wetlands in the deposit area, it is not possible to calculate the effects of lost wetland connectivity and abundance on stream fish populations.").

Trout Unlimited (Doc. #5527)

2.32 We believe the Assessment and supporting materials demonstrate a thorough evaluation based on scientifically sound methods and informed by the best available science and information from a wide range of sources, including industry reports, Pebble Limited Partnership (PLP) data, peer reviewed publications, agency reports and non-governmental organization research.

EPA Response: Comment noted; no change required.

Center for Science in Public Participation (Doc. #5657)

2.33 Attachment C: Notes on Northern Dynasty Minerals 2nd Watershed Assessment Comments

EPA has shunned the best available scientific and environmental data at its disposal.

It is difficult to see how NDM can assert that EPA has not considered available scientific and environmental data that is publically available. This material is well-referenced in the Watershed Assessment.

NDM is critical of the use of reports from "Environmental Organizations and paid Anti-Pebble Activists." These reports were independently commissioned and produced, and have been peer reviewed – unlike the NDM's expert reports which were commissioned by and paid for by NDM, and which were not peer reviewed.

NDM is also referring to the use of data from the PLP Environmental Baseline Document, to which there are numerous references in the Watershed Assessment Second Draft. It should be noted that NONE of the Pebble Limited Partnership's data has been peer reviewed, and that the data made available to the public and EPA in the PLP Environmental Baseline Document is in a raw, undigitized format with little or no interpretation, so that it is extremely difficult and time consuming to use. In its data release PLP did not publish any data on geochemistry or fisheries, although that data was available. They also released only data collected from 2004-2008, and have not made subsequent data available. So, although NDM claims $150 million has been spent on data collection, most of the data and interpretation is not available to EPA or the public, and none of it has been peer reviewed.

EPA Response: Comment noted; no change required.

Iliamna Village Council (Doc. #5488)

2.34 ANCSA subsurface owners are responsible for resource development projects as authorized by federal and state laws. ANCSA subsurface owner in the region may not have fully evaluated ANCSA lands of the Bristol Bay Watershed. As we understand from the ANCSA subsurface owner in the Bristol Bay watershed does not support the Pebble project because of shareholder political pressures. We do not believe the ANCSA subsurface owner have yet to complete a full assessment of oil, gas, mineral potentials on ANCSA lands in the Bristol Bay region.

In the interest of ANCSA subsurface we are concerned of the ANCSA agreement between the ANCSA regional corporations of placing huge amounts of ANCSA lands for closure to development thus affecting future value. Is the EPA ready to pay for future value of such surface and subsurface properties for closure? We do not think so. Future ANCSA revenues and relative economic impacts are particularly pertinent to discussions regarding proposed large mine developments as these are industries dependent on maintenance of clean water and productive fisheries habitat, two resources that are most often adversely impacted by mining activities. In considering the value of mine developments, it is important to weigh the potential risks to other economic activities of ANCSA companies. Definitely the future value of ANCSA surface and subsurface lands should be included in the Bristol Bay Watershed Study. We support costs and benefits of resource development of ANCSA lands and we are bound to protect such assets from any due harm that may diminish their present and future value.

<u>EPA Response:</u> The scope of the assessment is limited to potential risks to salmon from large-scale mining and resulting salmon-mediated effects to indigenous culture and wildlife, and does not include an economic cost-benefit analysis. The assessment is not a regulatory document and does not discuss or recommend "closure" of ANSCA lands. EPA will continue to consult and coordinate with Tribes and corporations.

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

2.35 Although EPA does not need to wait to see the details of any specific permit application to determine whether unacceptable impacts will occur, the hypothetical scenarios utilized by EPA are modeled on preliminary plans for the Pebble Project as described by Northern Dynasty Minerals in its 2006 Alaska Department of Natural Resources Water Rights application and its 2011 Wardrop Report (Ghaffari et al.). These materials provide detailed information, maps, and descriptions on which to assess a fact-based hypothetical mining scenario.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Oil and Gas Association (Doc. #5485)</u>

2.36 In addition, EPA's revised draft assessment continues to disregard the best available science, repeatedly relying on information selected by organizations that openly oppose mineral development. In an effort to evaluate the projects they are exploring, private companies are the largest producers of scientific data. The Pebble Partnership alone has invested over $120 million in environmental and socioeconomic studies, ranging from studies on air, water quality, hydrology, and noise to cultural resources and traditional knowledge. More than 50 consulting firms and more than 500 scientists from Alaska and around the world have worked on data collection for the Pebble project. EPA, however, used very little of this information for the assessment. The EPA's preemptive action to judge a project before all the data is collected and evaluated is a disservice to the public process and will undoubtedly discourage companies from investing in prospective scientific activities.

<u>EPA Response:</u> See response to Comment 1.11.

<u>The Pebble Limited Partnership (Doc. #5535)</u>

2.37 USEPA no longer refers to the assessment as a watershed assessment (which it never was) and refers to the work simply as an 'assessment.' The reorganization of the work presented in the Assessment does not improve consistency with the EPA's ecological risk assessment (ERA) methodology. The Assessment claims to be an ERA (pg 2-1), but that type of analysis is reflected neither in its title, nor in its methodology.

EPA Response: **See response to Comment 2.17.**

Kachemak Bay Conservation Society (Doc. #1118)

2.38 I believe that this assessment needs to consider all impacts associated with future large-scale mining in the Bristol Bay watershed, including:

- The development of a deep-water port.
- The development of a large-capacity, electricity-generating power plant(s) to power the mine and the port.
- In addition to the possible 45 square mile industrial footprint, the effects of induced development from this large-scale mining in the region needs to be addressed.
- The assessment considers risks from routine operation of a mine designed using modern conventional mitigation practices and technologies and with no significant human or engineering failures. We believe that human and engineering failures should be addressed.
- I think that the loss of habitat scenarios around the hydrologic drawdown zones around each mine pit scenarios need to be estimated.
- I would like more information regarding the possibility and the results that change of mine ownership would have in the future.

EPA Response: **We agree that the development of a large-scale porphyry copper mine could have many other significant effects in the region, as well as effects beyond the region, in addition to those evaluated in the assessment. Thus, in many cases the assessment provides a conservative estimate of potential impacts. The scope of the assessment is clearly stated in Chapter 2.**

Natural Resources Defense Council (Doc. #5378)

2.39 The scope, purpose, and structure of the document have been made clearer. The 2013 Assessment describes and explains the nature and purpose of an Ecological Risk Assessment (ERA), and its organization is consistent with Ecological Risk Assessment guidance. It articulates clearly the purpose of the ERA as a tool to inform environmental decision making, citing routine use of the ERA process to evaluate potential impacts when considering management decisions. It states up front that risk assessors, among others, determine the topical, spatial, and temporal scope needed, within which the ERA considers the potential effects of an activity. It also details the applications in which the assessment will be useful to risk managers such as scientists, resource managers, regulatory agencies, and other interested stakeholders.

The limitations of the assessment are discussed and the sources and methods used are clearly presented. The 2013 Assessment details the high level of interest concerning the impacts of potential large-scale mine development on the watershed's ecological resources, and is clear about the role of the assessment as a resource for interested stakeholders, members of the public, scientists and resource managers evaluating future projects, and future environmental assessments conducted under the National Environmental Policy Act. It also makes clear that the ERA focuses on a limited set of sources, stressors, and endpoints based on decision-maker needs, rather than the full set of factors that could be associated with the development of large-scale mining. This revised assessment includes risk evaluations for a broader range of biological and cultural resources, including resident fish species, aquatic invertebrates, wildlife and Alaska native cultures.

The focus of the assessment is on impacts to salmon, which is appropriate given the strong scientific understanding of salmon biology and their environmental requirements.

<u>EPA Response:</u> Comment noted; no change required.

<u>World Wildlife Fund, Arctic Field Program (Doc. #5537)</u>

2.40 Expand studies on the potential impacts of the planned mine on avian life in this region. The coastal fringe of Bristol Bay, including eelgrass beds, extensive coastal lagoons, deltas, wetlands and estuaries, supports an abundance and diversity of waterfowl in the region. According to the National Audubon Society, there may be no place else on Earth so important to millions of birds from so many different continents as Bristol Bay. Four migratory flyways overlap here, with birds from Africa, Asia, North America, South America and the Central Pacific Islands, all migrating to and from the region.

<u>EPA Response:</u> Potential direct effects on waterfowl are acknowledged in the assessment, but full consideration of this topic is outside the scope of the assessment. See response to Comment 2.38.

<u>National Parks Conservation Association (Doc. #5558)</u>

2.41 We understand that the EPA initially chose to focus the Assessment's scope of analysis on resources outside of designated conservation units. However, the fish, wildlife, waters, and high quality connectivity of natural processes within this landscape do not recognize property boundaries. Likewise, this "Assessment of Potential Mining Impacts of Salmon Ecosystems of Bristol Bay" should not stop at our national park boundaries. The revised Assessment identifies three mine prospects in the Chulitna River valley upstream of Lake Clark National Park and Preserve. Therefore, it is especially important for the EPA to assess potential impacts to park resources and to apply protective measures for the Chulitna watershed that will ensure surface and groundwater flowing into our national park and to downstream communities remains unimpaired by mining operations and waste disposal.

<u>EPA Response:</u> The assessment did not exclude parks or other protected areas, but it focuses on the two Bristol Bay watersheds most likely to be impacted by mining—which is in part because these watersheds do not contain as many protected areas as other Bristol Bay watersheds (as illustrated in Figure 2-3).

<u>North Coast Rivers Alliance (Doc. #5061)</u>

2.42 The Scope of the Assessment is too narrow.

EPA states that the Assessment is intended to "determine the significance of Bristol Bay's ecological resources and evaluate the impacts of large-scale mining in these resources." Assessment ES-1. This is an appropriate objective for EPA's review and analysis. However, as written the Assessment falls short of this objective.

First, the Assessment is limited to examining the effect of mining on fisheries and water quality, and considers the effects of mining on other wildlife, and on Alaska Natives, "only as affected by changes in salmonid fisheries." Assessment ES-2. Because the Assessment focuses only on mining's effects on salmon, it ignores its impacts on other wildlife. Yet wildlife other than fish is surely an "ecological resource" of Bristol Bay, and would be directly affected by mining and its accompanying development. For example, mines would initially require an estimated 86 mile transportation corridor, including a gravel road and four pipelines. Assessment ES-10. Roads and pipelines harm wildlife by: disrupting migration, nesting and foraging; degrading and fragmenting habitat; disturbing watershed flow and drainage; causing leaks of oil and other contaminants; triggering soil erosion and stream sedimentation; creating noise and night-time glare; and killing and injuring wildlife through collisions with trucks and other vehicles. Yet the Assessment neglects to even mention these effects.

Second, the Assessment inexplicably excludes from its scope the additional development that would be necessary to support the Pebble Mine, and the further secondary development that the mine would induce. The Assessment states that it does not consider the "impacts of the one or more large-capacity, electricity-generating power plants that would be required to power the mine and the port. It also does not assess the effects of induced development that could result from large-scale mining in the region." Assessment ES-4, emphasis added. The Assessment also excludes from analysis a potential underground extension that would almost double the size of the mine under even the largest scenario – and increase the size of the mine under the smallest scenario almost fifty-fold. Assessment ES-10.

Because the Assessment ignores necessary and foreseeable development that the mine would create, it greatly understates the impacts of mining on fisheries, on other ecological resources, and on Alaska Native communities.

<u>EPA Response:</u> See response to Comment 2.38. We agree that other development associated with mining (e.g., secondary development, generation and transmission of electricity, port development) would have significant effects on the region's resources, but these issues are outside the scope of the current assessment.

2.43 EPA should also expand and correct its Assessment to analyze the effects of mining on all Bristol Bay's ecological resources and its Alaska Native communities. The Assessment should be revised to discuss the potential impacts of the massive foreseeable development that would accompany mining, such as power plants, a deep-water port on Cook Inlet, support services for mine employees and their families, and the additional development that increased access to the area would induce. EPA should also address the potential for major human or engineering failures and their ecological consequences. In addition, EPA should model worst-case scenario failures rather than blithely assuming that "conservative estimates" provide an accurate picture of the effects of foreseeable accidents.

Only by enlarging the scope of the Assessment in these ways can the document provide a full picture of the disastrous foreseeable impacts of mining projects such as the Pebble Mine on Bristol Bay and its tributary watersheds.

EPA Response: **See responses to Comments 2.38 and 2.42.**

Borell Consulting Services, LLC (Doc. #4095)

2.44 This Revised Draft is by definition arbitrary and capricious. It has been arbitrarily applied to one project even though it has not been used previously; it has not utilized the public comments raised with the original Assessment; it has not utilized the comments its own review panel raised with the original Assessment; it has not considered the actual permitting process that such a project must follow; EPA has used known Pebble opponents to provide so-called peer review; and it has not considered the wealth of information which proves that mining can be accomplished without adversely impacting adjacent fisheries.

EPA Response: **We have considered all public and peer review comments submitted on both the draft and revised assessment, and have documented our responses to each comment in publicly available "response to comments" documents. EPA did not select the peer reviewers and they represent a range of expertise and opinions (also see response to Comment 2.46).**

Kachemack Resource Institute (Doc. #9123)

2.45 The extensive draft review did not include enough sociological data regarding inevitable developments of services for mining employees and families. These new residents will expect to hunt and fish, educate children, draw permanent fund dividends and have the usual array of recreational facilities.

EPA Response: **We agree that these factors would contribute to the impacts that large-scale mining would have in the region. However, as detailed in Chapter 2, these issues were considered outside the scope of the current assessment. See response to Comment 2.38.**

Northern Dynasty Minerals Ltd. (Doc. #3650)

2.46 This letter comments on the overall peer review process by stating that "EPA has ignored its own peer review guidelines and failed to provide for an open and transparent peer review process that keeps the public fully aware of the Panel's activities. EPA has restricted access to the Panel, ignoring the need to ensure that Panel members consider a range of perspectives, data, and analysis from a wide variety of stakeholders."

[Further details are provided in the comment letter.]

EPA Response: **We disagree with this comment. The peer review process has followed EPA guidelines and has been transparent. Most of the peer reviewers selected were nominated by the public. Although we did not require peer reviewers to review all public comments that were submitted, we did provide the reviewers access to all of these comments so they could consult them as they wished. In addition, reviewers**

participated in a full day of public testimony at the peer review meeting, during which they heard speakers that represented a range of perspectives.

Chapter 3: Region

Natural Resources Defense Council (Doc. #5378 and #5436)

3.1 The 2013 Assessment identifies the Bristol Bay watershed as pristine habitat that supports diverse aquatic and terrestrial ecosystems, valuable commercial, recreational and subsistence fisheries, and cultural resources dependent on the watershed's productivity and beauty. The watershed, which is characterized by highly interconnected surface and groundwater resources, is virtually undeveloped – one of last remaining roadless areas in United States. In addition to one of the world's largest Chinook salmon fisheries, the Bristol Bay watershed is the stronghold of the world's largest wild sockeye salmon fishery: for the 1956-2005 period, the watershed produced 46% of the global abundance of wild sockeye salmon. A recent economic analysis valued the Bristol Bay fishery in 2010 at $1.5 billion. [Footnote: This report, which is available at: http://fishermenforbristolbay.org/wp-content/uploads/2013/02/CFBBISER-FINAL-REPORT-5-10-2013.pdf, was published after the 2013 Assessment and should be reviewed and considered for the final Bristol Bay watershed assessment.] As EPA correctly notes, the importance of the watershed for salmon "takes on even greater significance when one considers the status and condition of Pacific salmon populations throughout their native geographic distributions." Pacific salmon have been eliminated from large percentages of their historic range in the western United States and, where they persist, their numbers and population viability are reduced. Evaluated on the basis of its salmon fisheries alone, the Bristol Bay watershed is a valuable and irreplaceable resource and sanctuary that the EPA correctly describes as a "significant resource of global conservation value."

EPA Response: Comment noted; no change required. We are aware of the report cited in the comment, but have not included it in the assessment as it is outside the assessment's scope. Our valuation of the commercial fishery uses ex-vessel and wholesale data reported by the State of Alaska, and does not consider the supply chain multiplier impacts examined in the cited report.

3.2 The Bristol Bay watershed – and the salmonid, wildlife, and native communities that call it home – exist in a rare and pristine state of self-sustainability, undisturbed by significant human development. Large-scale human impacts are absent, and the watershed forms part of one of the last remaining virtually roadless areas in the United States. Bristol Bay is home to the largest sockeye salmon fishery in the world, supporting half of the world's wild sockeye salmon and generating $1.5 billion annually. [Footnote: Gunnar Knapp et al. 2013 (…) This report was completed after publication of the second draft Watershed Assessment and should be reviewed and considered in the final Watershed Assessment.] Approximately 70% of the salmon returning to spawn are harvested, and the commercial salmon harvest has been successfully regulated to maintain a sustainable fishery and, in turn, sustainable salmon-based ecosystems. The Bristol Bay watershed, and its high quality commercial, recreational, and subsistence fisheries, represent an aquatic resource of national – and global – importance.

<u>EPA Response:</u> Comment noted; no change required.

3.3 (…) we reviewed EPA's process for conducting this Assessment and applaud the agency for thoroughly addressing the questions raised in response to the first draft by the peer review panel, stakeholders, and members of the public. EPA has elicited extensive input, provided open access and communication, and sought independent review, resulting in an Assessment that is analytically rigorous and scientifically beyond reproach.

Specifically, EPA responded to public comment and peer review by supplementing its analysis to include: (1) an additional mine scenario, (2) potential mitigation measures, (3) the risks and unknowns attendant to projected climate change, (4) a strengthened analysis of the complex and interconnected hydrology of the region, (5) impacts from "day-to-day" operational risks, and (6) enhanced analysis of cumulative impacts. Each of these additions contributes to the force of the analysis and lends additional support to the request for 404(c) protection.

<u>EPA Response:</u> Comment noted; no change required.

3.4 An additional and acute risk of mining in Bristol Bay stems from the region's diverse hydrologic landscapes, which "shapes the quantity, quality, diversity, and distribution of aquatic habitats throughout the watershed," and creates a freshwater system that supports multiple critical salmon life stages. As described more fully in Section III.B.4 below, mining would alter groundwater-surface water hydrology, nutrient processing, and export rates of resources and materials for aquatic ecosystems downstream. The "inherent complexity" of the region's salmon-supporting hydrology means that hydrological models used to estimate exposures are "inevitably simplifications." It is therefore extremely difficult to identify and control the potential range of impacts from mining, creating "one of the greatest sources of uncertainty for the water quality risks."

<u>EPA Response:</u> Comment noted; no change required.

3.5 Bristol Bay is unique, not for having developed into a deeply interconnected ecosystem, but rather for the exceptional fact that this hydrology is still fully functional and has not been disturbed by human activity. Overall physical habitat complexity in the Bristol Bay watershed is higher than in many other systems supporting sockeye salmon populations. For example, of 1,509 North Pacific Rim watersheds, the Kvichak River ranks third in physical habitat complexity. Closely tied to this physical complexity is the biological interconnectedness of Bristol Bay; salmon life-history variability fortifies ecological productivity and stability for the region as a whole. These facts inspired requests by the public and the peer-review panel for EPA to "[s]trengthen the assessment with additional information to characterize the interconnectedness of groundwater and surface water and its importance to fish habitat in the watersheds." The requested analysis now forms part of EPA's revised Assessment and dramatically strengthens the call for 404(c) action.

<u>EPA Response:</u> Comment noted; no change required.

3.6 The physical environment in Alaska is projected to transform dramatically due to enhanced variability of climate conditions in the coming decades and centuries. For this reason, and particularly because a mine in Bristol Bay would require post-closure management in perpetuity, the peer-review panel strongly urged EPA to more fully consider the broad range of impacts from climate change. EPA has done so and documents in its revised Assessment how severely climate change could impact and undermine even the “best” mine site structures, operations and maintenance, and, in turn, the salmon-dependent ecosystems as well as the communities and wildlife that rely on these ecosystems.

Projected increases in temperature and precipitation from climate change in the Bristol Bay region are expected to alter substantially the physical environment. Across the Bristol Bay watershed, average temperature is projected to increase by approximately 4°C by the end of the century, with winter temperature increasing the most. Precipitation is expected to rise by 30% across the watershed, for a total increase of approximately 250 mm annually. Annual water surpluses are expected to increase 144 mm and 165 mm in the Nushagak and Kvichak River watersheds, respectively, in the Bristol Bay watershed.

Climate change will likely result in modified snowpack and timing of snowmelt, a greater chance for rain-on-snow events, and an increase in flooding. On their own, these climate alterations will impact salmon fishery and populations. Without the additional stress of development impacts, however, salmon may adapt, as they have to the already higher Alaskan temperatures. If climate change is instead layered onto an ecosystem already bearing the burden of (even the smallest) mine scenario, such resilience is doubtful. For example, asynchrony in spawning timing helps buffer Bristol Bay salmon populations from climatic events. The decline in physical and hydrological complexity that would result from mining, described in more detail in Section III.B.4 below, would therefore reduce salmon resistance to the effects of climate change and further compound the mine’s unacceptable adverse effects.

In addition, climate change may make the design of a compliant and safe facility that follows operational best practices extremely difficult. The uncertainties already inherent in developing a mine in a known climate have the potential to be dramatically magnified by changing climate conditions. Risk-inducing uncertainty includes: (1) the stability of tailings impoundments and other facilities in response to more variable and intense climate events; (2) modeling potential flows for transport of contaminants away from the mining site during both catastrophic and non-catastrophic releases; and (3) assessing the additional stress a more variable and intense hydrologic system will have on ecosystems already stressed by normal operational degradation of water quality and quantity. In the face of such uncertainty, development of a mine in Bristol Bay capable of withstanding the long-term stability challenges of a changing environment is, at best, unlikely.

EPA Response: Comment noted; no change required. Potential interactions between climate change and large-scale mining are addressed in Box 14-2, but a complete evaluation of the risks posed by large-scale mining in the face of a changing climate is beyond the scope of this assessment.

Earthworks (Doc. #5556)

3.7 With as many as five new chapters, EPA clearly responds to peer review questions and concerns on issues relative to the mine scenario, risk assessment, understanding the hydrologic nature of the watershed, cumulative impacts for other mines and development and long term impact of climate change. By doing so, EPA provides a more thorough understanding of Bristol Bay's complex water system and notes that impacts from water use and water treatment could have dramatic impacts on wetlands, fish spawning, and fish rearing habitat. Finally, EPA clearly shows that in short and long term, climate change will magnify these impacts, particularly when considering water and waste management in perpetuity post-mine closure.

EPA Response: Comment noted; no change required.

T. Quinn, Ph.D. (Doc. #7629)

3.8 My concerns are based on 1) the value of the fishery resources (the largest salmon run in the world), 2) the dependence of salmon on high-quality habitat and water, and freedom from human interference, 3) the highly sensitive nature of the region's geology in terms of limited buffering capacity, 4) the porosity of the soil and complexity of groundwater connections between basins, 5) the dependence of the human and ecological community on the well-being of the salmon, 6) the necessity of storing a vast quantity of toxic material in perpetuity in an unreliable, earthen dam over porous substrate (…)

EPA Response: Comment noted; no change required.

S. Sorset (Doc. #5887)

3.9 Has there been any assessment of potential effects of mining operations on non-renewable archaeological resources? Has there been any survey of these areas within the area of potential effect for archaeological resources to make an adverse effect determination?

EPA Response: Comment noted. We acknowledge that there are culturally important sites throughout the region (as evidenced by Chapter 22 of the PLP's Environmental Baseline Document), but our assessment does not include an identification or evaluation of those sites.

The Pebble Limited Partnership (Doc. #5536)

3.10 Original Draft Location: *Page:* 15, *Report Section Identification*: Appendix A, Section 2.1, Page 15, Excerpt*:* [blank].

Original Comment from State of Alaska: Snowpack is predominant source of water and there is a water surplus in the Nushagak-Big River Hills physiographic region, which is a "wet" climate class. Thus, downstream "dewatering" is less likely to be an issue. If permafrost moves up into stored waste rock, then less groundwater flow through it. Handling of snowpack and snow melt is important to impact assessment.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Pg 3-1 The same language remains, indicating that the analysis is based on the questionable assumption that dewatering is an issue in a watershed with a wet climate classification.

<u>EPA Response:</u> Analysis of flow modification is described in Chapter 7, where we describe the importance of the flow regime and risks associated with deviations from the flow regime to which local aquatic life may be adapted. Although the region may indeed be "wet", alterations to streamflow regime can have serious implications for aquatic life, even in systems where water is abundant. We concur that snowpack and snowmelt are important considerations for understanding regional hydrology. If permafrost expanded into waste rock it could reduce groundwater flow, but permafrost in the area is discontinuous so it is unclear whether or not permafrost would expand.

3.11 Missing Information Affects the Quality of the Assessment: The report is lacking critical information on regional hydrogeology, local hydrogeology, groundwater and surface water interaction. There are hundreds of references to groundwater in the report, and it is repeatedly listed as a key factor in fish habitat and other wildlife habitat functions. Appendix H refers to nearly 1,200 borings being made in the Pebble deposit, yet, hydrogeology within the pit and Tailings Storage Facilities (TSFs) is not described in the document. The Pebble EBD presents extensive regional and local studies conducted over multiple years which focus on water and geological resources in the watershed area. It appears that the Assessment did not utilize the environmental data presented in the EBD to attempt to address significant data gaps. This lack of any presentation of actual or likely groundwater conditions within the hypothetical mine scenario is a critical omission because of the repeatedly stated importance of groundwater.

<u>EPA Response:</u> Surface water hydrology data from the Pebble Environmental Baseline Document (EBD) were extensively used to model flows in the three streams draining the Pebble site. Hydrology within the pit and tailings storage facilities (TSFs) are not described by the EBD or by the assessment, because these structures do not exist. The hydrology of the pit was assessed by estimating a cone of depression within which all groundwater would be captured. This is a conservative assumption because some groundwater is likely to escape. Groundwater hydrology below the TSFs was addressed by assuming a reasonable flow rate under the dam given the permeability data provided. Given the complexity of the geohydrology of the site and the complex effects mining would have on geohydrology, we judged that numerically simulating groundwater flow on the site during mining based on the borehole data was beyond the scope of the assessment and would not necessarily result in less uncertainty than the assumptions used in the assessment.

3.12 Original *Draft Location*: Page*:* 2.21, *Section:* Section 2.3.2, page 2-21, paragraph 5, *Excerpt:* [blank].

Original Comment from Environ: Nushagak River is defined with "high base flow" **–** that is incorrect, according to Figure 2-7B.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Pg 3-14, first paragraph; the original language concerning high base flows remains unchanged, as does new Figure 3-10 pg. 3-17. Furthermore, no additional language has been added in this paragraph to discuss the apparent discrepancy noted by the commentator. The comment has therefore not been addressed.

<u>EPA Response:</u> This section discusses the flow regime of regional rivers and focuses on the comparison between peak flows and base flows for individual rivers. The lower Nushagak and Kvichak Rivers, for instance, exhibit a more moderated flow regime (higher base flows, lower peak flows) than more variable river systems. The figure referenced in the comment (Figure 3-10 in the revised and final assessment) illustrates that the difference between peak flow and base flow is lower for the Nushagak and Kvichak Rivers compared to other regional rivers.

3.13 Page*:* 3-28, *Section:* 3.5 Water Chemistry.

Excerpt: The watersheds in the Pebble deposit area (Figure 2-5) are neutral to slightly acidic, with low conductivity, hardness, dissolved solids, suspended solids, and dissolved organic carbon (Table 3-4).

Technical Comment by ERM: Water chemistry data is only referenced from the PLP 2011 Environmental Baseline Document. No chemical data are presented, and the only data are referred to as “elevated”, again with the PLP reference. Much of the Assessment is focused on ecological effects of chemistry and the accurate baseline is not presented in this document. Additionally, there is no comprehensive baseline data set presented for the Bristol Bay Watershed, only the Mine project area. Predicting impacts without due consideration of baseline conditions will result in non representative impacts being predicted.

Citations: PLP 2011 EBD.

General Subject Area: Water Chemistry Baseline.

Comment Category: Incomplete data set.

<u>EPA Response:</u> There is no comprehensive baseline water quality dataset for the entire Nushagak and Kvichak River watersheds. Background water chemistry for the three streams draining the Pebble deposit is included in Chapter 8 (e.g., see Table 8-10). This material was included in both Chapter 3 (Section 3.5) and Chapter 8 of the revised assessment; for clarity and to eliminate redundancy, it has been removed from Chapter 3 of the final assessment.

3.14 *Page:* 3-31, *Section:* 3.6 Water Temperature.

Excerpt: Water temperature data (PLP 2011: Appendix 15.1E, Attachment 1) indicate significant spatial variability in thermal regimes.

Technical Comment from ERM: Baseline water temperature data are only referenced from the 2011 PLPEBD. No new data are presented, and broader BBWA-wide data are not presented.

Citations: PLP 2011 EBD.

General Subject Area: Water Temperature Baseline.

Comment Category: Incomplete data set.

<u>EPA Response:</u> PLP EBD data were cited to illustrate the concept that water temperature regimes can be spatially variable. No change required.

3.15 Original Draft Location: *Page:* 4.38, *Section:* Section 4.4, p.4-38, Box 4-3, *Excerpt:* [blank].

Original Comment from Environ: The overall intent of this box is not clear and seemingly contradictory. The summary in box 4-3 describes local faults (near Lake Clark and in the Iliamna Lake) and the known activity on those faults, indicating that activity on major faults has been minimal and that smaller faults in the area have "very limited capability to produce damaging earthquakes". However, the next paragraph discusses, in general terms, unpredictable "floating earthquakes" and stress induced earthquakes. Then, the conclusion highlights that in the Bristol Bay area there is a significant amount of uncertainty in (1) interpreting seismicity (i.e., the general frequency and distribution of earthquakes) and (2) identifying fault locations and extents.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Discussion is now part of the text but remains essentially unchanged. It continues to be contradictory. The risk of earthquakes in the project area is not accurately depicted.

<u>EPA Response:</u> The text in Box 4-3 is included in Section 3.6 of the revised assessment. This text describes the existing conditions in the Pebble area and the uncertainty associated with estimating seismic hazards based on current data. Floating earthquakes and stress induced earthquakes would likely be smaller than those produced by large faults.

3.16 Original Draft Location: Page: 4.38, Section: Box 4-3.

Excerpt: Interpreting the seismicity in the Bristol Bay area is difficult because of the remoteness of the area for study, lack of historical records on seismicity, and complex bedrock geology that is overlain by multiple episodes of glacial activity. Thus, there is a high degree of uncertainty in determining the location and extent of faults, their capability to produce earthquakes, whether these or other geologic features have been the source of past earthquakes, and whether they have a realistic potential for producing future earthquakes.

Original Comment from Knight Piesold: The summary discounts the previously stated studies, and illustrates a seeming tendency to discount the science that doesn't suit the biased perspective that is promoted in many areas of the EPA document.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Pg 3.35 paragraph 3 - The same statements have been retained.

<u>EPA Response:</u> The statement does not dismiss the previously cited reports, but qualifies the confidence that a reader should place in the conclusions of those reports. No change required.

3.17 Original *Draft Location*: *Page:* 4.44, *Section:* Section 4.4.2.1, p. 4-44 (PDF p.133), *Excerpt:* [blank].

Original Comment from Environ: This table is very short, and based on the data in Figure 4-11 (p. 4-42 [PDF p.131]), does not include the 5.1 to 6.0 magnitude earthquakes to the north and south of the Pebble Deposit location.

Based on the context in which this table is cited through section 4, the purpose of this table seems to be to show the range of earthquakes that can occur in Alaska as well as in the Lake Clark area. Although there is a note at the bottom of the table indicating that smaller earthquakes do occur in the Lake Clark area (near the Pebble Deposit site), it may be useful to list a few of these earthquake events through time to make this point more clear. Otherwise, this table only shows large earthquakes relatively far away from the site, which is misleading. It would also be helpful to include the 5.1 to 6 magnitude earthquakes to the north and south of the Pebble Deposit location.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The same table remains in Chapter 3, and therefore continues to contribute to fundamental bias in the analysis.

<u>EPA Response:</u> The table provides information on the distance to and depth of large earthquakes in Alaska, as well as the largest recorded earthquakes near the Pebble deposit area (within approximately 60 km). The magnitude 5.1 to 6 earthquakes referenced in the comment were more than 100 km from the Pebble site. No change required.

3.18 *Original Draft Location*: *Page:* 4.44, *Section:* Report Section Identification: Chapter 4.4.2.1, *Excerpt:* [blank].

Original Comment from State of Alaska: Comment: In Table 4-7, EPA lists examples of earthquakes in Alaska ranging from a magnitude 3.0, located 122 km from the project, to the Great Alaska Earthquake of 1964, a magnitude 9.2 located 469 km from the project. The nearest earthquake listed is a magnitude 4.3, located 30km from the project. A note on the table states, "…earthquakes in the range of magnitudes 2.5 to 3.6 occur regularly in the Lake Clark area…)". The earthquakes listed by EPA in relation to the Pebble deposit are technically insignificant. National guidelines for incident reporting for dams do not require reporting for earthquakes less than 5.0 within 24 km of the project site, or for earthquakes greater than 8.5 more than 102 km from the site.

Recommended Change: Comment Reference: Section 9 of "Guidelines for Reporting the Performance of Dams", National Performance of Dams Program, Stanford University, 1994.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Table 3.5 The table retains the same earthquakes as the previous one without additional discussion. The comment has not been addressed.

<u>EPA Response:</u> These earthquakes provide the seismic context for the area of the mine facilities. No change required.

3.19 Original Draft Location: *Page:* 2.25, *Section:* Report Section Identification: 2.3.5 Ecosystem Integrity, *Excerpt:* [blank].

Original Comment from State of Alaska: Comment: The document states " the primary human manipulation of the Bristol Bay ecosystem is the marine harvest of approximately 70% of salmon returning to spawn" This level of harvest of a salmon resource suggests there is substantial opportunity to mitigate minor or temporary impacts from other human activities. The document goes into lengthy details of a perceived impact from a hypothetical mine using numerous assumptions but ignores the current impact to the salmon resource from the excessive by-catch by the marine commercial fishing industry. The document fails to adequately address the already significant impact to the salmon resource by human activities and that the marine harvest could be manipulated to increase uses for subsistence users.

Recommended Change: Recommended Change: The document could address the substantial opportunity to manage and mitigate minor or temporary losses in salmon resources by actively managing the marine harvest to increase the availability of the resources to subsistence users as is already being done to account for excessive by-catch and other impacts.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: pg 3-36 first full paragraph – the language in this paragraph remains the same with no acknowledgement of the comment. Comment has not been addressed.

<u>EPA Response:</u> The possibility of mitigating potential mining impacts via management of salmon harvests is mentioned in Box 7-2, and discussed in greater detail in Appendix J. No change is needed in the problem formulation section of the assessment (Chapters 1 through 6).

3.20 Original Draft Location: *Page:* 1.2, *Section:* Section 1, page 1-2, paragraph 3, 5th sentence, *Excerpt:* [blank].

Original Comment from Environ: The report states that a comparative analysis of a watershed that currently supports both surface mine operations and salmon fisheries was conducted using the Fraser River in British Columbia. However, the O'Neal and Woody report concludes that: "Given their distinct physical and biological nature, as well as vastly higher levels of urbanization and industrialization in the Fraser River basin relative to the Bristol Bay basin, recent comparisons between the two watershed are suspect." There are several additional reasons why a comparison of the two watersheds and impacts on fisheries are not useful. The Fraser River basin is impacted by large populations centers (Vancouver and Victoria); and the basin is much larger than Bristol Bay (238,000 km^2 and 92,000 km^2, respectively). The Fraser River basin is impacted by a high degree of industrialization, including forestry, agriculture, two large hydroelectric projects, in addition to mining. The basin's water quality is extremely impacted with over 200 contaminants documented in the basin. Clearly the cumulative impacts of development in the Fraser River basin far exceed the types and number of impacts conceivably projected for the Bristol Bay basin.

Recommended Change: Comment reference: Feddema, J. J. 2005. A revised Thornthwaite-type global climate classification. Physical Geography 26:442-466.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Comment still stands. Comparison with the Fraser River is inappropriate for several reasons.

EPA Response: We agree, which is why we state that the Fraser River is a poor analogue for mining in the Bristol Bay watershed (Box 8-4).

E. S. Gottlieb (Doc. #0200)

3.21 From my perspective mining practices HAVE THE POTENTIAL to greatly perturb the functionality of the ecosystem in the event of failure(s) of mining infrastructure. Because the risk of natural events (e.g., earthquakes, mass wasting events) that would contribute to failure(s) of said infrastructure is difficult to assess and cannot be altered, a proactive risk management strategy for allowing mining to operate within the watersheds would be one that does not allow the possibility of TSF failures. Bottom line, if the mining industry wants the resource in Pebble, they need to develop new technologies that do not significantly alter the land surface.

EPA Response: Comment noted; no change required.

3.22 For millennia, the salmon ecosystem in Bristol Bay has been functionally resilient to naturally occurring landscape changes and climate variability that have affected the region. The area is at a convergent margin and is rainy. Earthquakes and heavy storms, both of which individually and jointly can contribute to mass wasting events that increase sediment load in watersheds, have been a part of this natural range of variability which characterizes the ecosystem.

The siting of a large mining operation in the area would create an environment that is drastically different than what has existed in the past. In the event of a natural episode of mass wasting that incorporated one or multiple TSF's it seems highly likely that the effects on water chemistry and turbidity would greatly exceed the natural range of variability. Thus the risk, although low frequency in nature, likely involves extreme consequences for the system, which is UNACCEPTABLE.

EPA Response: Comment noted; no change required.

Bristol Bay Native Corporation (Doc. #5438)

3.23 In response to peer review requests, the Revised Assessment better characterizes and discusses seasonal hydrologic processes, seasonal flow variations, and how global climate change will influence these hydrologic processes and rates. The Revised Assessment then properly utilizes modeling to evaluate the expected impacts of combined pressures from seasonal climate and flow variability and mine development on the fragile watershed ecosystem. While EPA admits its modeling technique is limited, it notes that climate change and seasonal variation impacts during salmon migration events will likely intensify any effects caused by large-scale mining. BBNC agrees with this additional analysis, as limited as it admittedly is, as a means of acknowledging, if not fully quantifying, additional and compounding impacts from large-scale mining on the Bristol Bay Watershed.

EPA Response: Comment noted; no change required.

3.24 The Revised Assessment is improved in that it includes more scientific information concerning Bristol Bay fisheries and aquatic habitat. The following are a few examples. The Revised Assessment contains:

- Considerably more discussion of the importance of the upper Bristol Bay watershed stream reaches as rearing habitat for several species of commercially important and subsistence fishes (…)

EPA Response: Comment noted; no change required.

National Parks Conservation Association (Doc. #5558)

3.25 Hydrologic connections between the Pebble Mine prospect and the Chulitna and Lake Clark watersheds remain unclear. Please study the area's groundwater and surface water hydrology.

EPA Response: Comment noted. Detailed study of the hydrologic connections between the Pebble deposit and the Chulitna and Lake Clark watersheds is outside the scope of the current assessment.

Alaska Conservation Foundation (Doc. #6803)

3.26 In addition to impacts from development, the peer review panel strongly urged EPA to more fully consider the broad range of impacts from climate change, particularly in light of post-mine closure management in perpetuity. Climate change projection show an average temperature increase of 4 degrees C by the end of the century, with precipitation increasing by 30% annually and a total of nearly 270 mm of precipitation (3-44). On their own these changes will impact the salmon fishery and populations. Without development impacts salmon might adapt to changing conditions. However, adding climate change to mine assessment scenarios raises critical questions concerning water management and treatment, tailings storage risks, pipeline and road or culvert failures beyond the life of the mine post closure in perpetuity.

EPA Response: Comment noted; no change required.

Alaska Department of Natural Resources (Doc. #5487)

3.27 While EPA acknowledges the uncertainties, there is no way to interpret how they affect the conclusions. Given that the entire Bristol Bay area has not been extensively monitored or mapped, the base information on which to build models is speculative. Attributes for over 65,000 stream and river reaches in the Nushagak and Kvichak River watersheds were estimated from a USGS database, including such fundamental attributes as flow, gradients, and extent of lowlands which in turn are the basis for fish habitat suitability. It appears that EPA has modified standard methods of determining some key physiographic and hydrologic attributes based on the limitations of the data and then proceeds to use the information to determine habitat suitability. Habitat suitability is a surrogate for populations of salmon since EPA acknowledges the limitations of population data.

EPA Response: Lacking an existing classification of stream and river characteristics in the study watersheds, we provide these summaries to better inform the reader of the region's geomorphic and hydrologic context. We acknowledge that this information provides a coarse estimate of habitat suitability and would be significantly strengthened by more detailed Intrinsic Potential modeling or other verified habitat modeling approaches. Nonetheless, this coarse-scale analysis provides a useful context to better inform readers unfamiliar with the landscape, and was included to respond to comments on the original draft assessment from peer reviewers and the public.

3.28 (…) the revised Assessment uses temperature data collected by PLP to support conclusions that stream temperatures are moderated by cooler groundwater inflow, and inappropriately assesses regional environmental risk and impact through inference of a site-specific model of pit drawdown.

EPA Response: PLP data are cited to illustrate the potential for surface water temperature moderation from groundwater inflow, which can include warmer winter temperature moderating effects. The pit drawdown is used to estimate changes to the water balance of the mine infrastructure, including water demands and water releases. The implications of the water balance are propagated downstream until moderated by unaltered flows from tributaries, groundwater and other sources.

3.29 The revised Assessment also discusses the additional potential impacts from climate change. EPA is still grappling with how to incorporate climate change into the NEPA process, much less in a speculative ecological risk assessment.

EPA Response: Comment noted; no change required.

S. L. O'Neal (Doc. #5528)

3.30 P. 3-24: "Salmon also use small streams in the Bristol Bay region for spawning and rearing, but use of these habitats may be constrained by shallow depths, insufficient flow to allow passage, the unavailability of open water in winter, or other limitations related to stream size."

In fact, headwater habitats are heavily exploited particularly by coho salmon (75% of headwater streams evaluated) and resident fishes including Dolly Varden (96% of headwaters). [Woody and O'Neal 2010]

EPA Response: We acknowledge that salmon and resident fish use very small streams in the study area and emphasize the ecological importance of these headwater habitats for both direct and indirect contributions to fish populations. However, this does not mean that there are no limitations to use.

3.31 P. 3-25: "Of the Pacific salmon species, coho salmon are most likely to use small streams for spawning and rearing, and have been observed in many of the smaller streams near the Pebble and other deposits."

Replace 'many' with either 'most' or 75%.

EPA Response: **Given the high density of very small streams and the uncertainty associated with any survey that is not a complete census of all streams, we feel it is premature to assign a specific proportion to this estimate.**

3.32 P. 3-26: "This threshold was used to identify two classes:

- Less than 5% flatland in lowland, indicating reaches are constrained and not floodplain prone.
- At least 5% flatland in lowland, indicating reaches are unconstrained and floodplain prone."

Include citations for the 5% cutoff defining floodplains.

EPA Response: **There is no published precedent for this criterion. This value was selected based upon visual inspection of cutoff values that best distinguished constrained and unconstrained valley settings, as interpreted from aerial photos and maps.**

3.33 P. 3-28: "However, as would be expected for a metalliferous site, levels of sulfate and some metals (copper, molybdenum, nickel, and zinc) are elevated, particularly in the South Fork Koktuli River."

Define "elevated" and/or include actual values.

EPA Response: **See response to Comment 3.13.**

3.34 P. 3-36: "No hatchery fish are reared or released in the Bristol Bay watershed, whereas approximately 5 billion hatchery-reared juvenile salmon are released annually across the North Pacific (Irvine et al. 2009)."

As stated in general comments above, it is worthwhile to note here that hatchery fish impose significant negative impacts on wild fish. [Rand et al. 2012a and 2012b]

EPA Response: **Clarification of this point has been added to the last paragraph of Section 3.7 in the final assessment.**

Iliamna Village Council (Doc. #5784)

3.35 An important additional feature of the Bristol Bay region is its closeness to several geologic faults that are the potential for the occurrence of major and minor earthquakes in the future. The proposed mine is close to the Lake Clark Fault, a 135-mile long tectonic zone, and 125 miles north of the site of the most powerful earthquake in the history of North America (in 1964).

EPA Response: **Doc. #5837 rescinded this comment; no change required.**

Northern Dynasty Minerals Ltd. (Doc. #3650)

3.36 Geosyntec Section: 6.2

2012 Geosyntec Comment: The seismic analysis provided in the 2012 Assessment is biased by unsupported hypothetical faults rather than relying on the substantial geological, geophysical and seismological evidence of the seismic environment in the vicinity of the Pebble Project.

How 2013 Assessment Responds to Comment: Box 4-3 of the 2012 Assessment has become Section 3.6, Seismicity, in the 2013 Assessment, with the language largely unchanged.

3-35 "Although there is no evidence that the Lake Clark Fault extends closer than 16 km to the Pebble deposit, and there is no evidence of a continuous link between the Lake Clark Fault and the northeast-trending faults at the mine site, mapping the extent of subsurface faults over long, remote distances is difficult and has a high level of uncertainty."

3-35 "Large earthquakes have return periods of hundreds to thousands of years, so there may be no recorded or anecdotal evidence of the largest earthquakes on which to base future predictions."

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. The statements in the 2013 Assessment do not serve to quantify risks, but rather to raise alarm and bias the assessment. Certainly mapping faults and interpreting the geologic record is challenging. That is why the project should be designed based on appropriate design techniques and based on the best available knowledge of seismology, geology, and engineering.

<u>EPA Response:</u> The assessment accurately describes the state of knowledge and the uncertainties concerning the locations of faults. No change required.

3.37 Geosyntec Section: 6.2

2012 Geosyntec Comment: While the seismic discussion in the three boxes (Box 4-3, 4-5 and 4- 6) in the 2012 Assessment is extensive, the references within the main text of the report are limited and very general. It appears that while the text in the boxes is intended to alarm the reader, the authors of the 2012 Assessment are not certain how to incorporate the actual seismic risk into their analyses, and hence they choose not to.

How 2013 Assessment Responds to Comment: Other than moving Box 4-3 into the main body of the text (Section 3.6), the 2013 Assessment does not make any new attempts to incorporate the actual seismic risk into their analyses.

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. The authors of the 2013 Assessment are not certain how to incorporate the actual seismic risk into their analyses, and hence they choose not to.

<u>EPA Response:</u> See response to Comment 3.36.

<u>C. Borbridge (Doc. #5066)</u>

3.38 Given the potential impact in the future, more comment is needed on the seismic activity on the proposed mining area. Very minimal study was performed by the Pebble group. More study is needed on the seismic activity in the proposed mining district and the effects of seismic events on earthen dams that are built with mining tailings. This is especially critical when people sometimes describe the effect of a significant earthquake as "liquefying" the ground. What effect would a significant earthquake have on what is essentially a massive earthen structure.

EPA Response: Comment noted; no change required.

Musicians United to Protect Bristol Bay (Doc. #5542)

3.39 To say Alaska is earthquake prone would be a serious understatement. The 1964 "Great Alaskan Earthquake," with a magnitude of 9.2, was the most powerful recorded earthquake in North American history, and the second most powerful ever recorded in the world. There were 123 known dead, and stunning damage across south central Alaska.

Last week, I was in the town of Seldovia on Alaska's Katchemak Bay. Before the 1964 earthquake, Seldovia was a prosperous cannery town with some 2,000 permanent residents. When the earthquake hit, the ground level rose permanently six feet, and the resulting higher tides wiped out virtually every waterfront business, including the canneries.

Today, one resident told me, Seldovia is dying. The permanent population has dropped to under 250 people. The school, which once had almost that many students, now has only 40.

If the sockeye salmon fishery on Bristol Bay is destroyed, this is what the future of that area may well look like.

Seldovia is less than 150 air miles from the proposed site of the Pebble Mine. The 1964 "Great American Earthquake" caused serious damage as far away as Seattle and Portland.

To even consider building one – let alone three – tailings ponds with up to 10 billion gallons of highly toxic sludge in an earthquake zone verges on shear madness.

EPA Response: Comment noted; no change required.

Ground Truth Trekking (Doc. #3928)

3.40 Published geological evidence (Haeussler & Salturs, 2004) strongly suggests the Lake Clark Fault passes less than 16km from the prospect.

Section 3.6 states: "Recent studies by USGS reinterpreted the position of the Lake Clark Fault further to the northwest, potentially bringing it as close as 16 km to the Pebble deposit (Haeussler and Saltus 2004). Haeussler and Saltus (2004) acknowledge that the fault could extend closer than 16 km, but data are not available to support this interpretation."

This mischaracterizes Haeussler and Saltus's 2004 publication. Haeussler & Saltus actually present evidence that the Lake Clark Fault likely continues towards the prospect area, and comes much closer than 16 km.

Their mapping traces the Lake Clark Fault to a location near the west end of Lake Clark, using aeromagnetic data which at the time of the publication did not extend further west. Their mapping (see Figure 1) shows the fault in-line with the Pebble deposit, with substantial (26 km) offset at the limit of mapping. Given this large offset, the fault is very likely to continue further southwest. The fault may curve and thus not intersect the mine prospect directly, or it may transition into some other, currently undocumented fault system that has a different orientation. Absent additional evidence, the most geologically probable scenario (a straight-line extension of known fault trace) puts the fault close to the proposed mine site, likely within 5 km. Any of these scenarios brings the fault closer than 16 km.

The argument that there is no evidence for the fault coming closer was advanced in the Pebble Baseline Document, but is in total discord with established geological knowledge, and is not valid. The geological reasoning presented to support that argument was also in discord with established geology, and lacked supporting evidence of any substance.

The possibility that the Lake Clark Fault may run much closer than 16 km to the site would have substantial implications for the potential strength of shaking should there be an earthquake. From Box 9.2 of the Watershed Assessment:

"Ghaffari et al. (2011) state that an MCE of magnitude 7.5 with 0.44g to 0.47g maximum ground acceleration was used in the stability calculations for the tailings dam design."

The ground acceleration values quoted here assume there is some distance between the fault generating the earthquake and the mine facility. If in fact the fault is very near the mine site, within a few kilometers then the shaking could be twice as strong as is used by Ghaffari et al.

We have several recommendations to improve the consideration of seismic hazards in the Watershed Assessment:

- Request that the USGS clarify the evidence for the location of the Lake Clark Fault, emphasizing a reasonable extrapolation of existing data. Both the original authors of the 2004 study (Peter Haeussler, Richard Saltus) remain active at the USGS.
- Restate the characterization of the Lake Clark Fault to clearly indicate it likely passes closer than 16 km from the mine site.
- Request further analysis using aeromagnetic data that has become available since 2004 to attempt to extend the mapped trace of the Lake Clark Fault. There is now public aeromagnetic data for the area, but it has not been interpreted by tectonics experts.

EPA Response: We acknowledge that the Lake Clark fault could extend closer than 16 km from the Pebble deposit based on the evidence presented by Haeussler and Saltus (2004). Given the limitations of the data and, as the comment indicates, the uncertainties in predicting the attitude of the fault, further extrapolation of the fault location and extent is not warranted.

3.41 "No [peer reviewed] evidence of Earthquakes in the last 1.8 MY" is technically true and also misleading.

The assessment states that there is no evidence of Earthquakes in the last 1.8 million years along the Lake Clark Fault. This is technically accurate, but misleading.

There is no currently peer reviewed evidence suggesting earthquakes on the LCF in the last 1.8 million years. [Footnote: There is non-peer reviewed work suggesting possible seismic activity along the north shore of Lake Iliamna within the last 10,000 years. This work is currently being prepared for peer review. (http://www.groundtruthtrekking.org/static/uploads/files/120907%20Preliminary%20Field%20Report.pdf8XlDm4/120907%20Preliminary%20Field%20Report.pdf] However, glaciation has destroyed most geomorphic evidence younger than roughly 11,000 years old. Even if there was an abundance of Quaternary earthquakes between 11,000 BCE and 1.8 million years BCE, we would not expect to see evidence of them. This was pointed out by Dr. Peter Haeussler at the recent Keystone dialogue. [Footnote: Relevant comments at roughly 43 minutes: http://www.youtube.com/watch?v=T9tD35mqab8]

A more accurate characterization of the state-of-knowledge might be:

"There is no currently published evidence of earthquakes within the Holocene Era (last 10,000 years) in the area. Glaciations have erased most surface evidence previous to this period. The seismic history of the area back to 1.8 million years has not been determined, and likely cannot be, due to lack of evidence. Although displacement of up to 26 km has been identified on the Lake Clark fault since the Eocene, (Haeussler & Saltus), the degree of seismicity associated with this motion is unknown. The activity level of the fault from 10,000 years ago to 1.8 million years ago is likely impossible to determine."

<u>EPA Response:</u> The comment provides accurate supporting evidence for the statement made in the assessment. This point has been further explained in the final assessment text.

<u>J. L. Hallock, Jr. (Doc. #2889)</u>

3.42 I think the Draft Assessment is thorough and well done for the most part – providing a generally sound basis for analyzing potential mine development in the region. I do think some of the risks and consequences listed in Table ES-4 may be optimistic in some cases.

However, the almost complete lack of discussion of how seismicity and volcanism might interact with the scenarios for mining facilities to affect the risk for impact is quite surprising. The Pebble Deposit is located in a zone of active seismicity and volcanism - very close to the limit of damage from the Great Alaskan Earthquake of 1964, and closer still to the Aleutian Arc of historically active volcanoes (Mt. Redoubt, Mt. Katmai/Novarupta caldera region, Mt. Iliamna, Augustine, Mt. Spurr and Crater Peak). In fact, this is one of the most seismically active areas on the globe. Mt Redoubt has erupted twice since 1990, and Crater Peak has erupted regularly 15 times in the last 500 years – including 1953. The 1912 eruption of Novarupta was the largest eruption of the 20th century, and surpassed the Krakatoa event of the late 1800s.

Several geologic faults occur in the vicinity of the Pebble Deposit – the Lake Clark Fault, the Castle Mountain Fault, the Bruin Bay Fault, and potentially others (note the 7.9 Denali quake of 2002 was supposedly located on a previously unknown fault). It appears the fault system in the area has not been extensively evaluated. The most significant seismic feature of the general area is the Aleutian Trench subduction zone (Alaska-Aleutian Megathrust) – on which the 1964 quake was centered. According to records of the Alaska Earthquake Information Center, 100s (or more) of at least small earthquakes occur relatively close to the Pebble Deposit each year– with a number over 5-6 ML (AEIC 2013). The Uniform Building Code map of seismic hazards shows that part of the area of assessment is in a zone of moderate risk of earthquakes, and part is in a zone of high risk (Combellick 1985). Over the 20-80 year life of the active mine and the perpetual period of tailings storage and leachate collection and treatment subsequent, the probability of several earthquakes occurring close enough to the mine area to cause appreciable shaking should be considered essentially one.

The Great Alaskan Earthquake of 1964 was the second most powerful earthquake ever recorded – at 9.2 ML. Its associated zone of deformation was enormous – extending close to the area of the Pebble Deposit, possibly including the eastern portion of Iliamna Lake. That quake had an estimated recurrence interval of approximately 800-1200 years (Plafker 1969). The next quake of that magnitude could potentially occur closer to abandoned mine facilities and tailings impoundments. Alaska reported has a magnitude 8 earthquake every 13 years or so – and many are associated with this same megathrust system. Even if the acid producing rocks are removed at some point (to where would that tremendous volume of material be moved and disposed?), the remaining fine tailings would still subject spawning and rearing areas to siltation in the event of a dam breach.

To compound these matters, the unconsolidated soils and surficial geology that predominate in much of the area near the Pebble Deposit imply that any seismic waves moving through the area will increase in amplitude and duration (essentially due to being slowed down) – causing much greater shaking during an earthquake. While the existing topography in many parts of the area watershed is largely flat or rolling hills and thus does not have many areas prone to landslides, any structures built on top of the unconsolidated material would be at significant risk. The tailings impoundment dams would be 90 and 209 meters tall, and probably constructed largely of earthen material. This is basic earthquake science – areas of similarly unconsolidated geology in California and elsewhere have been prone to the most damage during earthquakes (e.g., Loma Prieta). This is also what was observed during the Great 1964 earthquake (Plafker 1969). Such unconsolidated material is not only subject to greater movement and instability when subject to seismic waves, it is more prone to liquefaction (especially if moist or wet…) during this movement – often causing solid objects placed on top of or anchored within it to sink or settle. The entire area where the access roads and pipelines would be built just north of Iliamna Lake is made up of unconsolidated glacial lacustrine and alluvial deposits.

The combination of significant seismic risk over time in combination with extensive unconsolidated surficial geology seems to be a significant aspect of the existing environment if one wishes to construct very large tailings impoundments, water treatment systems and pipelines containing contaminated or hazardous material.

If at all possible, the potential risks posed to mine facilities posed by seismic and volcanic hazards – both virtually certain to occur during the active life of the mine and thereafter – should be dealt with more directly in the final Assessment. The draft assessment mentions earthquakes occasionally, but the discussion of probability of failure of facilities is based apparently only on the historical record of historical similar mines in a variety of areas. I suggest that the probability of failure of certain facilities be revised to account for this, if at all possible. In particular, the listed probability of failure of a tailings dam of 1 in 2,500 to 1 in 250,000 years seems to be a woeful underestimate for such a seismically active area with unconsolidated geology. At the very least – there should be more discussion on the risk of volcanic and seismic events during the course of active mine operation and subsequent permanent tailings storage, monitoring, and water collection and treatment in this, the existing environment. Statements by industry groups that the use of best engineering practices will greatly reduce the risk of failure must be caveated by the fact that none of the "similar" mines have tailings impoundments approaching the height of those proposed at

Pebble (90 to 209 meters), and none are in areas with this level of seismicity. Has anyone built a tailings impoundment of even 90 meters in height in a seismically active zone and followed its performance over a period of 200 years?

I do not think it is adequate for a document summarizing the existing environment and risks to it, to simply state that the risks of earthquakes have not been fully explored. If the probabilities of failure listed cannot be revised to include seismic risks, then a much larger caveat should be included. Perhaps the best estimates of earthquake hazards over time could be listed separately. I think it would be reasonable to assume that the probabilities provided in the Draft Assessment are potentially large underestimates of the real probabilities when seismic and volcanic risks are included.

EPA Response: The tailings dam failure scenarios presented in the assessment could be caused by a number of mechanisms, including a seismic event. This point has been clarified in Chapter 9 of the final assessment.

Dr. J. D. Copp (Doc. #4321)

3.43 Flaw #1: Ignoring Reservoir Induced Seismicity

The Zipingpu disaster illustrates the factors contributing to Reservoir Induced Seismicity:

- Dam height over one hundred metres
- Dam stores at least 1 billion cubic metres
- Dam is located in a fault zone.

The International Commission on Large Dams states that RIS is possible in reservoirs deeper than 100 meters (328 feet). Zipingpu is 500 feet high. The largest tailings dam at Pebble Mine is 740 feet and will hit the 100 meter depth when it's less than half full. Like Zipingpu, Pebble Mine tailings dams will store more than one million cubic meters. And again like Zipingpu, Pebble Mine tailings dams are located in an active fault zone.

A large earthquake can cause liquefaction, where solid soil transforms into mush. The March 11, 2011, earthquake in Japan, for example, was accompanied by extensive liquefaction. Alaska, like Japan, lies on the Ring of Fire and experiences 5,000 quakes per year. That plus Reservoir Induced Seismicity to increase the probability of collapse of one or more Pebble Mine earthen tailings dams.

Reservoir Induced Seismicity is a real phenomenon and well-represented in the geo-physical literature. A simple Google search on "Reservoir Induced Seismicity" generates over fifty pages. Dozens of cases have been documented. For example, filling the 300-m deep Nurek Reservoir in Tadjikistan induced 1,800 earthquakes over a nine year period.

Given the size of the impoundments proposed for Pebble Mine and given the heightened seismicity of the region, Reservoir Induced Seismicity is clearly a significant risk factor. Ignoring it artificially distorts the assessment of risks posed by the Pebble Mine.

EPA Response: We agree that reservoir-induced seismicity occurs, and address the issue in Section 3.6 of the revised assessment. It is one of many factors that must be considered in the seismic risk analysis for design of the impoundments. At the Pebble

deposit, seismic risk would be driven by the potential for earthquakes generated by large regional fault systems, which would be larger than those generated by the reservoirs.

<u>L. Trasky (Doc. #5050)</u>

3.44 The Pebble claims are located in a seismically active area and there is some evidence that it is located on a fault. It is possible even likely that a very large earthquake in the next thousand years could cause the saturated tailings to liquefy and slump into Talarik Creek or the Koktuli River.

<u>EPA Response:</u> Comment noted; no change required.

<u>V. Wilson, III (Doc. #5529)</u>

3.45 While the Pebble Partnership, in their baseline scientific documents claim that the Lake Clark Fault Line near the Pebble Prospect is currently inactive, I would like to point out the many strong earthquakes that have occurred where they were previously thought to be of low-risk, and where fault-lines were thought to have been inactive. According to the Washington Post's March 2012 story (at http://www.washingtonpost.com/national/health-science/seismic-hazards-japan-earthquake-and-other-tectonic-surprises-challenge-scientific-assumptions/2012/03/09/gIQAoV291R_story_1.html) there are a number of prominent seismologists and geophysicists that note how strong devastating earthquakes, such as the 2008 earthquake in China's Sichuan Province and 2004's Indian Ocean earthquakes, were not necessarily thought to have been in high earthquake prone-area's. If there was to be a strong earthquake at the Pebble Mine area which Pebble claim's to be of low-risk at this point, it could potentially have catastrophic consequences for the mine infrastructure and thus fisheries, wildlife and indigenous cultures.

<u>EPA Response:</u> Comment noted; no change required.

<u>E. Ginsburg (Doc. #9633)</u>

3.46 The EPA report is a conservative estimate, and paints a bleak picture of the readily predicted effects of mining in the watershed. But one of my parents' most significant experiences while in Anchorage was the 1964 earthquake, currently ranked by the USGS as the second largest in the world since 1900. The State of Alaska reports (http://seismic.alaska.gov/seismic_hazards_earthquake_risk.html) that the state can expect an earthquake of magnitude 8 or larger every 13 years, on average.

<u>EPA Response:</u> Comment noted; no change required.

<u>World Wildlife Fund, Arctic Field Program (Doc. #5537)</u>

3.47 Another improvement in this second draft Assessment is consideration of potential impacts from climate change. The Bristol Bay Assessment's peer review panel strongly urged EPA to more fully consider the broad range of impacts from climate change. Climate change projections show an average temperature increase of 4 degrees C by the end of the century, with precipitation increasing by 30% annually and a total of nearly 270 mm of precipitation (page 3-44 of the Assessment). A variety of detrimental impacts to salmon populations are anticipated. A report on how climate change may impact Alaska salmon populations shows the response to climate change will differ among species, depending on their life cycle in freshwater. Climate change may alter ocean entry timing for salmon, cause decreases in summer stream flows and result in higher water temperatures. Rapid changes in climatic conditions may not extirpate salmon, but they will impose greater stress on many stocks that are adapted to present climatic conditions.[Bryant 2009]. The report concludes that "[The] survival of sustainable populations will depend on the existing genetic diversity within and among stocks, conservative harvest management, and habitat conservation." In other words, the diversity of salmonid populations is a critical feature contributing to their resilience to climate change stressors. Construction of a massive mine and accompanying infrastructure at the headwaters of the Nushagak and Kvichak watershed would significantly impact the quality and quantity of available salmon spawning and rearing habitat, thereby diminishing the very diversity that is critical for salmon to better withstand the stressors of climate change.

<u>EPA Response:</u> Comment noted; no change required.

3.48 Other anthropogenically induced environmental changes may pose significant threats to Bristol Bay salmon stocks and ecosystem. Ocean acidification, or the oceanic uptake of anthropogenic carbon dioxide, is altering the seawater chemistry of the world's oceans with consequences for marine biota. While the potential impacts of ocean acidification are not clearly understood, ongoing research has identified a wide variety of detrimental impacts to marine species and systems.

<u>EPA Response:</u> We agree that ocean acidification could affect marine species including Pacific salmon, but this assessment focuses on freshwater habitats. Consideration of ocean acidification and potential effects on salmon populations is outside the scope of the assessment as defined in Chapter 2.

<u>Moore Geosciences, LLC (Doc. #2911)</u>

3.49 The revised assessment has added a section on climate change and appropriately modeled and estimated potential changes in temperature and precipitation in the region. The new climate modeling results show that climate change is expected to be substantial in the region, especially temperature, precipitation and snow melt timing. This makes designing a safe facility (waste water treatment or tailings impoundments) extremely difficult.

There are three areas in the assessment where consideration of climate change has potential to substantially increase the estimated risks associated with large-scale mining development. The first is in the stability of tailings impoundments and other facilities in response to more variable and intense climate events. The second is in modeling potential flows for transport of contaminants away from the mining site during both catastrophic and non-catastrophic releases. The third is in assessing the additional stress a more variable and intense hydrologic system will have on ecosystems stressed by normal operational degradation of water quality and quantity. It is likely that changes in evapotranspiration and runoff will modify plant cover, erosion, flow regimes, flooding and sediment transport (Goudie 2006). This will in turn affect ecosystem function and carrying capacity. Similarly, changes in freshwater delivery, nutrients and sediments resulting from increased hydrologic activity and mine modifications may have profound effects on Bristol Bay itself (Scavia et al. 2002). To assess the full extent of potential risk, therefore, it is important that regional climate change as shown in the revised assessment be included in all aspects of analyzing the potential effects of long-term mining development in the Bristol Bay watershed. Climate change must also be considered in any development of best management practices for operations.

EPA Response: See response to Comment 3.6.

Stratus Consulting (Doc. #5433)

3.50 Previous comment, 2012 Watershed Assessment: "EPA should consider a more rigorous treatment of hydrologic extremes and uncertainties in its final Watershed Assessment, including at least a discussion of climate change and how a changing climate could alter historical flow regimes during mine operations."

2013 Revised Watershed Assessment: EPA spends substantially more time discussing climate variability and change in this draft, including an explicit discussion of climate change projections for Bristol Bay in Section 3.8. EPA acknowledges that climate change could have a range of potential impacts on streamflows and salmon habitat, including changes in migration times, decreased access to spawning locations, and changes in sedimentation patterns that could influence quality of spawning habitat. Using the Pacific Northwest as an analogue, EPA notes that these climate change impacts are likely to exacerbate any effects that might be caused by mining.

EPA Response: Comment noted; no change required.

D. Schindler (Doc. #7906)

3.51 The revised watershed assessment now discusses the potential for impacts of climate change that will likely compound effects from development. These components of the assessment are somewhat vague – but they have to be. Our ability to forecast the effects of climate change on freshwater ecosystems is distinctly poor. However, we do know that properly functioning habitat does provide resilience to climate change. Thus, climate change is likely to exacerbate any impacts that watershed development and mining will have on salmon ecosystems. The risks to salmon and aquatic habitats from mining are probably underestimated when you consider the climate-changed future that lies in store for western Alaska.

EPA Response: Comment noted; no change required.

Chapter 4: Type of Development

Iliamna Village Council (Doc. #5784)

4.1 The Pebble deposit is of the type called porphyry, meaning it is composed of metal sulfides dispersed a regional rock host. It is the largest of many such deposits located in the Nushagak and Kvichak watersheds, and at least 7 other similar deposits in the area have been the subject of at least minimal exploration and development. Several other, non-porphyry gold claims have also been made in the area of the two watersheds. The Pebble, however, is by far the largest. All of these deposits are low-grade ore, meaning the host ore contains only a small percentage (generally less than 10%) of the metal (copper, gold, molybdenum, zinc, etc.) sulfide and an even smaller content of actual copper, gold or other commercial metals.

EPA Response: Doc. #5837 rescinded this comment; no change required.

4.2 (…) A consequence is that huge quantities of waste rock are a direct result of mining low-grade porphyry deposits. This waste rock consists of the overburden that must be removed before the low-grade ore body can be mined, plus the large percentage of the actual ore that must be removed before a metal sulfide concentrate can be obtained.

EPA Response: Doc. #5837 rescinded this comment; no change required.

4.3 At the Pebble site, metal sulfide concentrate would be obtained at the mine site by a two step grinding and separation process. The ore is first crushed in the mine pit, then transported by truck or conveyer belt to the separation mills at t he surface. Here the ore would be ground to a fine powder (<0.2 mm in size, about the same size as the thickness of a human hair). This powder would be suspended in a water slurry and chemicals (similar to a soap or detergent) added to selectively allow either the metal sulfides or the host rocks to form a foam that can be separated from the other type of component. At the proposed Pebble mine, this first step would concentrate a porphyry component, rich in the metals of interest, copper, gold and molybdenum from the rest of the ore. The non-porphyry portion of the ore would then be removed to a tailings disposal pond.

EPA Response: Doc. #5837 rescinded this comment; no change required.

4.4 The porphyry-rich portion would then be taken to a second grinding mill, and ground into an even finer powder (about ten times smaller, less than 0.025 mm in diameter). A second flotation process, using different chemicals, but based on the same principles, would then separate then portion of the porphyry concentrate rich in copper, gold and molybdenum from the rest of the sulfide-rich fraction of the ore. This second waste portion would also be discarded in the tailings disposal facility (dam). A final (at least at the mine site) separation process isolates the copper and gold-rich sulfides from the molybdenum rich portion. The copper-gold concentrate would be maintained in a slurry and shipped via pipeline to the port on Cook's Bay. The molybdenum-rich concentrate would be dried at the site, bagged and shipped via truck to the port. The cooper/gold and molybdenum concentrates are then shipped by sea to a smelter. There the metals are chemically obtained from the sulfides, using high temperatures and carbon in the form of coal or charcoal with the emission of sulfur dioxide.

EPA Response: Doc. #5837 rescinded this comment; no change required.

D. Schindler (Doc. #7906)

4.5 4) The ore bodies are rich in a wide variety of heavy metals that are toxic to salmon and other aquatic wildlife, and will be found in higher concentrations in waters associated with many mining activities.

EPA Response: Comment noted; no change required.

4.6 (…) However, we do know a lot about some of the core threats that mining in Bristol Bay represents. 1) The ore bodies are S-rich and poorly buffered; they *will* produce acid-mine drainage. This is not debatable. 2) The ore bodies are large and will produce enormous amounts of waste that need to be stored and maintained for a very long time. Even in the absence of catastrophic disturbances such as earthquakes and floods, retention of these wastes is still prone to error and cannot be guaranteed over reasonably long time scales.

EPA Response: Comment noted; no change required.

The Pebble Limited Partnership (Doc. #5536 and #5752)

4.7 *Original Comment from the State of Alaska (Page 4.4; Report Section Identification 4):* Considerable narrative is presented on the hypothetical chemistry of the porphyry copper deposits, discussing how the acid generation potential (AP), the net neutralization potential (NP) and the neutralizing potential ratio (NPP) are calculated and what they mean. On page 4-5, it is stated that "In general, the rocks associated with porphyry copper deposits tend to straddle the boundary between being net acidic and net alkaline, as illustrated by Borden (2003) for the Bingham Canyon, Utah porphyry copper deposit (Figures 4-2 and 4-3).["] This is good information but the specific AP, NP and NPP of the Pebble Deposit are not discussed here. This is crucial information since it has bearing on potential environmental impacts during the mine and after the mine life in perpetuity. Good information on the humidity cell tests of the Tertiary and Pre-Tertiary waste rocks are included in Table 4 on page 15 of Appendix H. This information is more valuable than the extensive hypothetical discussion and should be incorporated into pages 4-4 through 4-7.

Addressed: No.

Comments: This comment is not reflected in the current review draft. Subsequently, the analysis in this section remains base upon hypothetical data and likely is not reflective of actual expected effects.

EPA Response: The purpose of this section was to inform the reader of the geochemistry of porphyry copper deposits in a general way, rather than specific to the Pebble deposit. Bingham Canyon is a well-studied deposit, and thus provides a good example of data from which to draw. The assessment has been reorganized to more clearly present what is background information (Chapter 4 in the revised assessment) versus what pertains to the evaluated scenarios (Chapter 6 in the revised assessment). The geochemistry of the Pebble deposit is described in Chapters 6 and 8.

4.8 *Original Comment from the State of Alaska (Page 4.11, Report Section Identification: Chapter 4.2.3):* EPA states, "…geomembrane technology has not been available long enough to know their service life…" and generally discounts the potential mitigation value of the product. In fact, the advent of geomembranes began in 1839 when Charles Goodyear vulcanized natural rubber with sulfur which led to the development of thermoset polymers. Polyvinyl chloride resin production began in 1939 and mass production of polyethylene compounds began in 1943. The U. S. Bureau of Reclamation began using geomembranes in the 1960s. The geosynthetics industry broadly shifted to thermoplastic polymers in the 1980s. HDPE and other formulations of polyethylene are routinely approved by EPA and other international regulatory agencies for use in solid and hazardous waste landfills around the world (which have indefinite design lives, also). (Reference: Designing with Geosynthetics, 5th Edition. Koerner, 2005 ISBN-10: 0131454153)

Addressed: No.

Comments: Current text still states on page 4-17 that "However, geomembrane technology has not been available long enough to know the service life of these liners", and still concludes that geomembranes liners can fail based on their review of (Koerner et al. 2011). Geomembrane liners are widely and successfully used in the mining and waste management industry, and in our experience, the incorporation of membranes into multi-component composite liner design approaches for tailings facilities is increasingly sophisticated. The probability of the failure of the geomembrane component of a liner system is greatly reduced with the level of care taken in the design and preparation of underlayment, the actual deployment and thermal welding of liner material, and in the testing regime used to ensure the integrity of the weld bonds. The reduction of the probability of liner failure or the significance of any areas of leakage by the routine application of appropriate QA/QC methodologies during liner construction has not been addressed in this Section. The text also presents seepage collection as an option "if seepage collection is expected or observed." Rockfill tailings dams are usually designed to seep as an operational safety measure, since lowering the phreatic pressure within the tailings mass tends to reduce physical stresses on the dam structure. It would be highly unusual to see a modern rock fill dam design that did not provide for some collection of seepage and pumpback to the tailings supernatant or reclaim[.]

<u>EPA Response:</u> Laboratory estimates on longevity of geomembrane liners, as well as the typical situations under which longer or shorter lifetimes would be expected, are presented in Section 4.2.3.4. No liners have existed in a field setting for hundreds of years, so there is no basis for comparing laboratory results to a real-life setting. No change required.

4.9 *Original Comment from the State of Alaska (Page 4.13, Report Section Identification: Chapter 4.3):* The mine scenarios assessed by the EPA are representative of a very, large scale mining with a particular set of mine development elements that are not representative of a large percentage of porphyry copper deposit mines. For example, an open pit mine is selected while there are a number of large scale mines of such deposits that mine by bulk underground methods such as block caving, sub-level caving vertical crater retreat and other underground methods. The volume of waste rock created by such underground mining methods is several orders of magnitude less than that assumed in the EPA mine scenarios.

Addressed: No.

Comments: While block caving is discussed in Chapter 4 as a potential extraction method for porphyry copper deposits, the current draft of the EPA document retains a focus on the same type of large-scale, open pit mine scenarios considered in the first draft. The reviewer's comment on the potential applicability of block caving methods and the associated potential environmental benefits is not addressed. The current draft of the EPA report only assumes three large open-pit scenarios – Pebble 0.2, Pebble 2.0, and Pebble 6.5 – that vary in relation to the theoretical amount of ore to be mined. Whether or not these scenarios would resemble the actual design of a mining project as presented in the State of Alaska's permitting process is a matter of conjecture. Failure to incorporate a range of realistic possibly scenarios biases the analysis.

<u>EPA Response:</u> Underground mining is discussed as a possibility in Section 4.2.3.1, although full evaluation of underground mining is outside the scope of this assessment. We assume block caving would be used only after open pit mining, as described in Ghaffari et al. (2011). Block caving would result in an extension of mine operations and disposal of additional tailings and waste rock, issues that are already addressed in the assessment. However, it also would introduce new issues related to the potential for ground slumping and groundwater contamination. It is true that underground mining methods would reduce the volume of waste rock that is placed on the surface of a mining site, but a given quality of material mined via underground methods would result in the same amount of tailings as that material mined via surface methods. A tradeoff in the amount of waste rock brought to the surface would be the issue of rock surfaces exposed to oxidation and groundwater in underground-mined regions.

4.10 *Original Comment from Environ (Page 4.21, Report Section Identification: Chapter 4.3.5, Page 4-21, Paragraph 2)*: The paragraph states that it was assumed that the TSF would be unlined other than on the upstream dam face, and there would be no impermeable barrier constructed between tailings and underlying groundwater. Generally, unlined TSF are not permitted if there is potential for significant degradation of the underlying groundwater.

Addressed: No.

Comments: The second version continues to state that “The TSF would be unlined other than on the upstream dam face, and there would be no impermeable barrier constructed between tailings and underlying groundwater.” Again, this is an unrealistic assumption for any tailings facility constructed in this watershed and subject to the permitting process currently required by the State of Alaska. These assumptions result in overestimates of potential project effects that permeate throughout the document.

<u>EPA Response:</u> The liner described in Ghaffari et al. (2011) is proposed only for the dam itself. Seepage through the dam itself would be collected near the toe of the dam. The surface of the dam constitutes a small percentage of the entire surface area of the proposed reservoir, most of which would not be lined. Seepage though the floor of the reservoir would contribute to groundwater recharge. A requirement to fully line the TSF foundation requires more information on the saturated hydraulic conductivities of the locations than was provided in Ghaffari et al. (2011).

The points raised in the comment would not change the outcome of our analysis. We assume that over the long timeframes that the tailings would be in place, seepage to groundwater would occur but that its downstream consequences would be negligible. Additional measures to obtain tailings seepage would not change this outcome, because the toxicity of the tailings leachate is estimated to be relatively low.

4.11 EPA acknowledges that modern mining and environmental regulations “serve to hold an operator accountable for potential future impacts, through establishment of financial assurance requirements and imposition of fines or compliance orders upon non-compliance with permit requirements …” Id. at 4-6. These modern regulatory regimes were developed during the 1970s and 1980s – EPA’s continued reliance throughout the draft Assessment on comparative data from earlier mining activities ignores this development.

<u>EPA Response:</u> None of the references to the effects of past mines in the assessment's analysis sections address the presence or absence of financial assurance, so the comment is not relevant to the quoted statement.

4.12 Phyllis K. Weber Scannell, a reviewer with extensive experience in mine permitting in Alaska, described some of the measures missing from the Assessment's scenario:

Chapter 4 provides a detailed description of a hypothetical mine design for a porphyry copper deposit in the Bristol Bay watershed. Some of the assumptions appear to be somewhat inconsistent with mines in Alaska. In particular, the descriptions of effects on stream flows from dewatering and water use do not account for recycling process water, bypassing clean water around the project, or treating and discharging collected water.

<u>EPA Response:</u> The issues mentioned were discussed in Sections 4.2.3 and 4.3.7 of the original draft assessment. They are now addressed in Chapter 6, which describes the mine scenarios, and in Chapter 4, which provides generic background on porphyry copper deposits and mining. Streamflow effects presented in Chapter 7 now reflect a complete water balance, including water capture and re-use, bypass, and discharge from the wastewater treatment facility, as suggested in the comment. Dr. Weber Scannell indicated in her follow-on review of the revised assessment t hat she was pleased with this additional information.

<u>Earthworks (Doc. #5556)</u>

4.13 With respect to the 2012 Copper Porphyry Report, none of the peer reviewers identified or challenged the accuracy of any of the data within the report. See the specific reviewers comments below:

David A. Atkins:

> "The report presents a useful summary of failures and incidents at 14 copper porphyry mines in the US. Results should serve as a cautionary note that these types of incidents occur with some frequency at mine sites in the past and present."
>
> "The report does make it clear that accidents and failures occur relatively frequently at mine sites, and this is the main lesson."

Dina Lopez:

> "The authors use an impressive list of references that includes government agencies and National Response Incident reports. In terms of the number of mines covered, and the references list, the report has convincing evidence of the high number of incidents and their impact."
>
> "As mentioned earlier, the report is only a compilation of the evidence of release of contaminants from porphyry copper mines to the environment. In that sense, the extensive references and well documented incidents show compelling evidence that this kind of contamination problem is common in the copper porphyry industry. The report does not intend anything else but to show that pipeline spills, and leaks from tailing ponds and waste rock piles occur in most of this kind of mines. In that sense, the objectives of the report are clearly achieved."

Robert Kleinman:

> "The report provides a quick summary of the environmental problems associated with ongoing copper porphyry mining in the U.S."
>
> "The only conclusion that should be carried forward from the Earthworks report is that environmental problems are commonly associated with copper porphyry mining."

Christian Wolkersdorfer:

> "The report is so far accurate as it compiles all incidents of the 14 copper porphyry deposits they investigated."
>
> "My general impression is that the report can be used as a basis to identify potential problems and to give recommendations of how to avoid them in future mining operations."

<u>EPA Response:</u> Comment noted; no change required.

4.14 Northern Dynasty also highlights specific peer review comments in response to Earthwork's 2012 report on U.S. copper porphyry mines, and mischaracterizes the report and its findings. Please review our response to their specific comments below:

1. No modern mine examples – most of the mines considered are old facilities with operations often initiating in the 1880s.

> *Response:* The comment seems to imply that the report omitted a large segment of current U.S. copper porphyry mines that have operated without failures, but that isn't the case. The 2012 U.S. Copper Porphyry Mines Report reviewed 14 out of 16 (87%) of the copper porphyry mines currently operating in the U.S., representing 89% of U.S. copper production in 2010, the most recent data available by the U.S.G.S.
>
> Furthermore, it's inappropriate to focus on when operations initiated. Many of today's mines originated with underground mines that were operated historically. The copper porphyry mines in the report are all operating mines with operating permits and discharge permits currently regulated by state and federal agencies.

<u>EPA Response:</u> Comment noted; no change required.

4.15 2. Issues presented relate to facilities designed and constructed before modern environmental regulation, and thus have little relevance to modern operations.

> *Response:* Once again, the mines in the report represent 14 out of 16 (87%) of the copper porphyry mines currently operating in the U.S., with operating permits and discharge permits currently administered by state and/or federal agencies. (…)

<u>EPA Response:</u> Comment noted; no change required.

4.16 The mines in this report are all currently operating mines with operating permits and discharge permits that ostensibly meet today's state and federal laws, yet problems continue to occur. For example, at the Chino Mine, enlargement of the precipitation plant reservoir was completed in 1985 to prevent overflows of leachate solution into Whitewater Creek. Above average precipitation however caused the new reservoir to overflow and discharge waters to Whitewater Creek on October 9 and 10, 1985; May 6, 1986 and October 6, 1986. Furthermore, Chino's tailings pond No. 7, which became active in 1988, has affected groundwater to the east, west and south of the impoundment.

EPA Response: Comment noted; no change required.

4.17 Many incidences have occurred as a result of operator error. For example, at the Ray Mine, a tailings liquid spill in 2012 occurred as a result of operator error during the application of new technology. According to the Notice of Violation, a delay in completion of the tailings distribution line in a tailings impoundment, where the company had initiating a new upstream construction method in 2011, resulted in a tailings liquid spill. The delay in completion of the tailings distribution line resulted in the uneven distribution of the tailings, which in turn cased the ponded water to migrate to the southeast and eventually fill the open trench and was ultimately released from the impoundment.

EPA Response: Comment noted; no change required.

4.18 3. No insight into the causes for the failures presented, leading the reader to erroneously conclude that copper mines cannot be operated on an environmentally sound basis.

> *Response:* The report simply demonstrates that environmental failures commonly occur at copper porphyry mines currently operating in the U.S., and therefore, the failure modes that were identified in the Bristol Bay watershed assessment are reasonable, and well-supported by the record of operating copper porphyry mines in the U.S.

4. It appears that at least one reviewer (i.e., Lopez), only reviewed an executive summary, not the complete report, thus raising significant questions about the thoroughness/appropriateness of the peer review process.

> *Response:* Three of the reviewers completed a full assessment of the report. In contrast, none of the PLP materials have been peer reviewed.

EPA Response: Comment noted; no change required.

4.19 5. Northern Dynasty also includes specific references from the peer review comments. Please note our response to each:

> *"…the report presents what appears to be a thorough list of incidents from 14 copper porphyry mines in the U.S. The conclusion that we can expect a similar or worse track record for a new mine is, however, not supported by the information presented." – David A. Atkins*

Our response: The report doesn't conclude that because of the record of failures at operating U.S. copper porphyry mines that all new mining operations will cause failures, but that the failure modes identified in the Bristol Bay watershed assessment with respect to risks to water quality are reasonable, and well supported by the record of failure at operating U.S. copper porphyry mines.

EPA Response: Comment noted; no change required.

4.20 "I find the report, by its nature, to be very biased. In reality, a similar report emphasizing problems and mistakes could probably be written for most human activities… Such reports, which attempt to paint the world black or white, inevitably come across as one- sided because they are. While it is appropriate to consider potential environmental issues and problems associated with mining when making a decision with respect to Bristol Bay, such decisions should be made based on the site-specific conditions, along with appropriate risk management analysis." – Robert Kleinmann

Our response: Northern Dynasty doesn't provide the reviewer's full quote, but inappropriately picks and chooses, omitting important elements of the reviewers comments. For example, the reviewer's actual quote is, "While not challenging the facts presented, I find the report, by its nature, to be biased." It's important to note that the reviewer finds no issue with the facts presented in the report. Instead, the reviewer considers the report biased because it doesn't include the economic benefits of mining. This is illustrated by the reviewer's examples, which Northern Dynasty also omitted in the quote above. In the actual review, Robert Kleinmann goes on to say, "For example, a similar report written about farming could display all of the negative aspects associated with land disturbance (erosion, loss of wetlands, loss of wildlife habitat, decreased soil fertility, downstream sedimentation), fertilization (downstream eutrophication), and excessive use (and spills) of pesticides and herbicides and righteously conclude that farming should be banned. Or alternatively, the mining industry could produce a similar report stating only the benefits of copper mining, including not only the socio-economic benefits but also the resulting benefits on the local, regional, and national economy and the fundamental importance of copper to our industrial activity and lifestyle.

What's important to note here is that the Bristol Bay watershed assessment is an ecological risk assessment, so it's appropriate for the copper porphyry report to focus only on the environmental track record of operating copper porphyry mines. This type of environmental review isn't unusual or biased. It's routinely done by academia, state and federal governmental agencies.

When considering the risk related to a mining operation, it is problematic to take predictions of site-specific mitigation at face value. There is ample evidence from mines that have completed the permit evaluation process, where environmental predictions and mitigation design have predicted compliance with permit limits, and yet these predictions and mitigation designs failed. Kuipers and Maest (2006) highlights the ongoing uncertainties associated with water quality predictions. That report evaluates 25 modern hardrock mines. During the permitting process, 100% of these mines were predicted to meet water quality standards, and yet 76% failed to do so. Mitigation measures predicted to prevent water quality exceedances failed at 64% of the mines. These percentages increase when focusing on mines, like the proposed Pebble Mine, with high potential for acid mine drainage and close proximity to surface and groundwater. A risk assessment for Pebble must carefully consider how successful predicting these failures have been in the past.

<u>EPA Response:</u> Comment noted; no change required.

<u>North Coast Rivers Alliance (Doc. #5061)</u>

4.21 In addition, the Assessment fails to discuss the dangers of acid mine drainage. When sulfide deposits are exposed to the elements, they react with water and oxygen to produce sulfuric acid. This acid effluent seeps into the surrounding environment, contaminating soil and groundwater. Once acid mine drainage starts, it is virtually impossible to stop, and experience has shown us just how dangerous it is. For example, prior to a massive cleanup effort, acid drainage from the Iron Mine near Redding in Northern California flowed out of the site, killing virtually all aquatic life in the creeks draining the area. After storms, contaminated water reached the Spring Creek and Keswick Reservoirs, and altered the chemistry of the Sacramento River, placing productive salmon fisheries at risk. With no way to prevent the formation of acid mine drainage, water treatment must occur on site, and Iron Mountain will continue to produce acid drainage until the millions of tons of sulfide deposits in the mountain are gone – 2,500 to 3,000 years from now. The vastly greater sulfide deposits that the Pebble Mine would expose to the elements would produce deadly acid mine drainage for tens of thousands of years, permanently destroying not only Bristol Bay's world class salmonid fisheries, but all fish and wildlife dependent on the rivers that drain into the bay.

<u>EPA Response:</u> Iron Mountain was mined from the mid-1800s to the early 1960s. Mitigation measures were absent during mining and reclamation activities were not performed when mining ceased, which meant there were large amounts of acid-generating waste materials (waste rock and tailings, both in piles) exposed to weathering over long periods, as well as the open pit and underground mine workings. In our scenarios, we have included the use of mitigation measures within each phase of mining to reduce the potential for acidic drainage creation, as would be expected of any modern mine to be developed. Such measures have become required standard practice to minimize potential for repeating the problems evident at Iron Mountain.

<u>K. Zamzow, Ph.D. (Doc. #5054)</u>

4.22 Comments on Ore Chemistry and Ore Processing Chemicals. 4.2.2 Chemistry and associated risks of copper porphyry deposits:

1. There was no mention in this section of precipitation of metals downstream in neutral pH waters.

Precipitation of aluminum, iron, and manganese are mentioned later and could be referenced here.

<u>EPA Response:</u> This point has been clarified in the final assessment.

4.23 2. It would help to clarify that the paragraph below refers to porphyry copper deposits worldwide, and that Pebble likely follows a similar sequence of zonation; I have not seen a discussion of the zones of alteration of this deposit.

> *"In general, the rocks associated with porphyry copper deposits tend to straddle the boundary between being net acidic and net alkaline… Moving outward from the core to the ore shell and pyrite shell, pyrite abundance increases and NNP values become progressively more negative."*

<u>EPA Response:</u> In Section 4.2 we are discussing porphyry copper deposits in general, not the Pebble deposit specifically; no change required.

4.24 3. I appreciate the clear, accurate description of the process of weathering, acid drainage and neutralization.

This section could be clarified if you note that components in both ore and host rock are released when in contact with acid, and not just the mineral of economic interest. When mentioning the minerals released under alkaline conditions, molybdenum should be mentioned along with selenium and arsenic, given the concentrations of moly in the area and the toxicity of molybdenum to fish eggs.

<u>EPA Response:</u> The statement "Mining processes expose rocks and their associated minerals…" includes both the ore and the host rock. However, the focus of our discussion is waste materials, since those would remain an environmental hazard, whereas the ore would be processed and resultant tailings would not have the same characteristics as the original material. The "e.g., copper minerals" provided was an example of minerals that could be released and was not intended to represent the only mineral that could be released. Molybdenum, selenium, and arsenic are other elements that could be released, but the purpose of this chapter was to provide background in a general sense (i.e., it is not specific to the Pebble deposit).

4.25 4. The report suggests that material with neutralizing potential ratio (NPR) of 1-4 should undergo further kinetic and geochemical testing, reasoning: "This further testing and assessment are necessary because if neutralizing minerals react before acid-generating minerals, the neutralizing effect may not be realized."

The NPR is appropriately used as a screening tool, and it is reasonable to have material with NPR between 1 and 4 undergo further testing as a critical component of waste rock management. In addition, kinetic testing needs to be continued for decades before and during the operation of the mine.

Long term kinetic testing could determine if concentrations stabilize over time. The humidity cell test (HCT) results showed extreme standard deviation from the mean in some analyte concentrations (Appendix H Table 4). Some of this is due to the early erratic concentrations in the first flushing periods; this is analogous to snowmelt or rain flushing accumulated oxidized material out of waste rock piles after cold or dry periods and could occur seasonally at the Pebble site. It is important to consider the flushing concentrations as well as the means.\

<u>EPA Response:</u> The comment supports the call in the assessment for more testing. Comment noted; no change required.

4.26 5. This section should mention that the sulfide components of the rock also cause the release of sulfate, a component of total dissolved solids (TDS).

As mentioned in a later section, controlling TDS has become a significant issue at the Red Dog mine, which is having difficulty attaining even the 1,500 mg/LTDS concentration allowed under their water discharge permit, due in part to the high TDS in runoff from waste rock.

<u>EPA Response:</u> The sentence has been revised to explicitly state that sulfate, protons, and free metal ions are released from oxidation of sulfide minerals.

4.27 6. It would be worthwhile to note that the acid generated through the acid rock drainage process is much more acidic and in no way comparable to the type of "acidity" that naturally occurs in wetlands and peat environments.

> It is the extreme excess of acidity that depauperates stream life more than the drop in pH, and causes streams to be unable to buffer changes in pH (natural or anthropogenic). Should a "pulse'" of acidity flush into a stream -an event that could occur if a WWTP temporarily failed – the recovery of the stream is based in part on catchment alkalinity. The South Fork and North Fork Koktuli have little alkalinity and are likely to have a difficult time rebounding from a pulse of acidity.

<u>EPA Response:</u> The point of this comment with respect to wetlands and peat is unclear, since waters at the site are not naturally acidic. The major source of risk to aquatic biota during the scenario's WWTP failure would be copper, not acidity. Although the low alkalinity would not neutralize a major pulse of acidic water, there is no reason to expect that an acidic residue would remain, so recovery of pH should be relatively fast.

4.28 4.2.3 Overview of the mining process

1. Could you add a brief explanation as to why dry stack tailings is inappropriate for acid-generating material? Would dry stack be an option if a pyrite concentrate were produced, removing much of the sulfide-rich material?
2. Although accurate, the phrase "Waste rock is stored separately from tailings" might be better phrased as "Waste rock is boulder to rubble-sized material that is placed in large, terraced stockpiles while tailings are a fine slurry material remaining after processing and require a different manner of storage."

<u>EPA Response:</u> Text has been revised to address these points. If the material is non-acid generating, there is no acid-production potential (removal of pyrite is necessary, although acidity can be caused from things other than pyrite as well) and dry stacking could be appropriate.

4.29 BOX 4-4: Block caving and subsidence

In the sentence "This could lead to oxidation of the sulfide minerals exposed during mining operations and, depending on the hydrogeology, the potential generation of groundwater with elevated metals content from the mined area" –

> It would be accurate to change the wording to "the potential generation of groundwater with elevated acid and metals". Mine workings water chemistry is likely to consist of acid, sulfate, and metals (based on Pebble East leachate chemistry) and represents a potentially severe long-term risk.

<u>EPA Response:</u> This change has been made in the final assessment.

<u>Alaska State Legislature – Representatives A. Josephson (Doc. #5320) and L. Gara (Doc. #5618)</u>

4.30 This is the wrong place for a foreign-operated copper and gold strip mine that will rely on flotation chemicals that kill fish. In order to separate the various minerals found at the site, various chemical reagents must be added to a solution to enhance the floatability of the valuable mineral particles. A frother reagent, typically Methyl Isobutyl Carbinol (MIBC) or Pine Oil, must be added to the solution to create a froth and allow minerals to be captured. MIBC is not diluted but pumped directly from bulk containers to the point of addition using metering pumps. Collecting agents must be used to make bubbles in the froth attract the minerals. Collectors are organic molecules or ions and are often ethyl, butyl, propyl, and amyl xanthates. Potassium Amyl Xanthate is one common collecting agent.

EPA Response: Comment noted. Box 4-5 has been expanded in the final assessment.

4.31 Depressors are inorganic compounds used to prevent the flotation of undesirable particles. Cyanide is one common depressor. Activators help make difficult to separate minerals more floatable. Copper sulfate is one common depressor. Flocculants are polymers used to separate solids from water. Surfactants are products that carry out the same role as washing detergents. Lime is used to raise the pH of the processing solution to the desired level. Acid might also be used at the end of the water treatment process to lower a pH range following the use of lime.

EPA Response: See response to Comment 4.30.

Bristol Bay Native Corporation (Doc. #5438)

4.32 Indeed, in its Revised Assessment, EPA clarifies that the mine scenarios “draw on plans developed for Northern Dynasty Minerals, consultation with experts, and baseline data collected by the Pebble Limited Partnership to characterize the likely mine site, mining activities, and surrounding environment” and that the mine scenarios “realistically represent the type of development plan that can be anticipated for a porphyry copper deposit in the Bristol Bay watershed.” Additionally, in response to concerns raised by peer reviewers, the Revised Assessment properly clarifies that the scenarios are based on worldwide industry standards for porphyry copper mining and incorporate modern conventional mining practices. Furthermore, the Revised Assessment conservatively assumes that only modern mining technologies and practices will be utilized in Bristol Bay and that these technologies and practices are in place and working properly at all times. These are extremely careful assumptions for a risk assessment.

EPA Response: Comment noted; no change required.

Center for Science in Public Participation (Doc. #5657)

4.33 Box 4-1. Reducing Mining’s Impacts

Recommendation: You might want to reference the GARD Guide (Global Acid Rock Drainage Guide, International Network for Acid Prevention, http://www.gardguide.com).

The GARD Guide is generally accepted as the state-of-the-art summary of the best practices and technology to address ARD issues, and is designed to be continuously updated to reflect changing practices.

EPA Response: Although the GARD Guide has utility, its best use is similar to that of Wikipedia—that is, finding a base of information from which to extend one’s search for original references to information provided. The disclaimer posted on the Guide’s

website provides its own guidance as to the use of material from the site: "…None of the information contained herein should be relied on in preparation or assessment of any information by any person or entity. Should any person or entity decide to utilize the information in this report for any purposes, they do so at their own risk and consequence…" [http://www.gardguide.com/index.php/Disclaimer]. Therefore, although the GARD Guide was consulted, information was followed up to obtain (and cite) the original sources.

4.34 4.2.3.4 Tailings Storage

"Full liners beneath TSFs are not always used and may not be practicable for large impoundments; however," (p. 4-17)

Liners are certainly technically viable for any size tailings impoundment.

Recommendation: Clarify by saying "Full liners … may not economical …" or "… economically practicable…"

<u>EPA Response:</u> This change has been made in the final assessment.

<u>Ground Truth Trekking (Doc. #3928)</u>

4.35 For reasons of fiduciary responsibility, the primary mine operator will be obligated to avoid liability for such activities, and the probability that the mine will become the ward of the state or of a less capable firm.

Although this possibility is implicit in the Watershed Assessment, we suggest making it explicit. For reasons giving below, it is a likely scenario, and will deeply impact long-term maintenance of the Tailings Containment Facility, the pit, and other facilities.

History has abundantly demonstrated that mining firms frequently enter bankruptcy before, or soon after, mine closure. Reclamation bonds have not historically proven an effective counter to this. They have frequently been inadequate for long-term closure and/or long term maintenance. Analysis (Chambers, 2005) suggests the current bonds for large Alaska mines are systemically inadequate even for the closure of mines.

Promises made, unless contractually binding, quantified, and enforceable, are lower in precedence than the fiduciary obligation of corporate managers to their shareholders, under the principle of shareholder primacy. Contractual obligations are only robust against immediate concerns of firm profit and fiduciary obligation, as long as they remain valid. If such contractual obligations expire or are voided, they no longer apply. As mentioned above, contractual obligations can currently be shed by a variety of legal means, and failing to do so could be taken by shareholders as neglect of fiduciary obligation, and therefore as cause to sue the management of the mine operator in question.

Given the body of corporate case law on shareholder primacy (starting with Ford vs. Dodge Bros.), and the assumption that the mine operators will be competently and professionally managed, strong consideration must be given to the eventuality that, at the time that profitable operations cease, the mine will be become a ward of the state, or otherwise be transferred to a firm incapable of funding reclamation, and that the primary beneficiaries of the profitable operation will be shielded from further liability.

For the reasons above, the conservatism principle of accounting & finance should be applied ("assume the less optimistic scenario") in preference to the going-concern principle ("assume all business continues as usual").

The ability of the state, or of a lesser firm, to maintain the facilities should be explicitly considered in the Watershed Assessment, on the assumption that the mine operator will be insolvent or will divest itself of the obligation to reclaim and maintain the mine site once valuable resource is no longer being extracted. It is highly possible, if not plausible, that the mine will become a ward of the state. The feasibility of late-stage reclamation and long-term maintenance should be considered in this light, along with the technical unknowns.

<u>EPA Response:</u> Section 6.3.5 discusses premature closure and issues related to financial liabilities and Box 4-3 outlines requirements. Failure to have sufficient funds could result in a situation similar to premature closure, depending on the stage in which a company "walked away." This type of situation is presented qualitatively in the assessment. It is true that, if the mining company failed to complete closure or long-term operation and maintenance, the State would likely be left to complete the work with inadequate financial means.

<u>N. Dawson (Doc. #2915)</u>

4.36 The report does NOT take into consideration the additional, long-term development and effects from those developments that will be necessary to operate a large scale mining development in a remote part of Alaska. These developments include, but are not limited to, employee housing, transportation infrastructure, shipping traffic potential dredging activities required to have a large vessel landing available, and the large scale electricity-generating power plants that would be necessary to operate the mines and the port.

<u>EPA Response:</u> We acknowledge in Chapter 2 (and throughout the assessment) that there are many potential sources of risk associated with large-scale mining that were considered outside the scope of the assessment. The relative magnitude of some of these sources is discussed briefly in Box 6-1.

<u>L. Trasky (Doc. #5050)</u>

4.37 The state land use management and regulatory system is strongly biased toward the development of mines etc. over protection of fisheries resources. For example the Alaska Department of Natural Resources (ADNR) changed the primary use of state lands in the Bristol Bay Area Plan from fish and wildlife habitat and harvest to mining to promote the development of the Pebble mine. This is further supported by the fact that the Governor Parnell introduced bills in the current legislative session to eliminate public notice for many types of ADNR actions related to mining and to prohibit non governmental agencies and persons from applying for rights to retain water in stream for fish and wildlife. The Alaska Coastal Management Program which provided standards for coastal development assembled and distributed draft state permits and provided an opportunity for local governments to review state and federal and state veto projects which would adversely affect their interests was first moved to the Department of Natural Resources and then eliminated entirely. The entire state permitting process is now coordinated by ADNR. The ADNR Large Mine Permitting Process is very efficient at expediting permitting for mines, but really has no process for denying mines. The States fish habitat protection statutes which are administered by ADF&G sound good but have no enforceable standards. They contain provisions such as "if the Commissioner finds it necessary (to protect fish habitat), and the commissioner must provide for the "proper protection of fish and wildlife". Most importantly the fish habitat protection statutes have no requirement for public notice, and no appeal process for anyone but the applicant!

EPA Response: Comment noted; no change required. The purpose of the assessment is not to evaluate the effectiveness of the State of Alaska's regulatory processes, but to determine potential effects of a large-scale porphyry copper mine on the region's salmon resources. In the event that a mine plan is submitted, EPA will provide oversight in programs where it does have regulatory authority.

4.38 2. Your analysis did not consider that once the mine plan is approved and permit are issued that stipulations and conditions to protect fish and fish habitat can be relaxed administratively by the State through amendments. This is facilitated by the states assumption of the Clean Water Act Program and the Governors bill in the current legislature to assume management of the Corps 404 program. The Governor has also introduced House Bill 77 which largely eliminates public oversight and involvement in large mine activities through the issuance of general permits for many activities on state land. This bill passed the State House and is up for a vote in the State Senate this fall. The bill would also change existing in-stream flow statutes to prohibit private citizens and organizations from applying for in stream flow reservations to protect fish and wildlife and habitat and would void the hundreds of applications currently pending. One Senate Senator who read the Governors bill said that, "This is one of the most sweeping and one of the worst bills I've seen come before the legislature. "The commissioner of ADNR, if this bill passes, has the ability to override any law in the state, practically, if he wants to do something on state land. There's no public notice required, there's no appeal process required, there's no best interest finding required, we're taking away appeal rights. This is just a sweeping change of natural resource law (Anchorage Daily News May 19, 2013)."

EPA Response: See response to Comment 4.37.

4.39 3. Once the mine is opened and substantial mining occurs there is no way to practically or politically shut it down, even if the mine turns out to be uneconomic or causes serious pollution. Without constant pumping, maintenance and treatment[,] the open pit and underground workings will quickly begin to fill with water and oxidation of the exposed sulfides will generate heavy metal contaminated water. This water will eventually overflow the pit and begin to contaminate surface and ground water. Neither the state nor federal government will want to assume the cost of remediating the pollution so the mine will be allowed to continue to operate and fisheries will suffer. There is also the possibility that the mine may prove to be uneconomic at some point in the future in which case the federal government would have to treat the mine as a superfund site such as the Grouse Creek Mine in Idaho or the Summitville Mine in Colorado.

EPA Response: See response to Comment 4.37. However, it is worth noting that mines have been shut down and reopened in the past due to economic fluctuations without catastrophic environmental consequences (e.g., Greens Creek Mine in the mid-1990s).

4.40 6. Important environmental threats may have been overlooked in the EPA analysis for the proposed Pebble Mine. For example the EIS for the Red Dog mine did not consider that the sulfide ore that would be mined would be acid generating! It also failed to anticipate that lead zinc concentrate blowing from the mine, uncovered trucks, and storage piles at the dock would contaminate thousands of acres of private land and National Monument with toxic levels of lead and zinc. The Red Dog EIS concluded that the mine, which has been identified by EPA as the biggest industrial polluter in the U.S., would have no significant impact on the environment! The EIS also anticipated that the tailings piles would remain permanently frozen negating the need for expensive tailings storage and treatment facilities. Unfortunately this has not occurred because of global warming or inadequate engineering. Similarly a few months before the Exxon Valdez oil spill the Alaska Department of Environmental Conservation and the U.S. Coast Guard reviewed the Alyeska oil spill contingency plan for Prince William Sound and found that Alyeska had the type and amount of equipment to contain and clean up the largest tanker spill! When the spill occurred it became evident that Alyeska did not have enough equipment and much of that was inoperable. A post spill analysis revealed that Alyeska's booms and skimmers were not effective in over 3 foot waves, 15 knot winds or 1 knot currents, conditions which occur over 65 percent of the time in Prince William Sound!

<u>EPA Response:</u> The EIS for Red Dog Mine was completed in 1984. Although geochemical predictions will never be perfect, they have improved over the last 30 years. As stated in Chapter 2, this assessment is not a thorough evaluation of all potential effects of large-scale mining in the Bristol Bay watershed, and many potential impacts are considered outside the scope of the assessment. Our assumptions regarding the mine scenarios evaluated are clearly stated throughout the assessment, allowing the reader to make judgments about any threats they feel are not adequately addressed.

<u>S. L. O'Neal (Doc. #5528)</u>

4.41 Although dust from the road is considered, dust generated from mining remains an omission from the revised Assessment that warrants consideration.

<u>EPA Response:</u> Dust from mining is considered in Section 6.4.2.5.

4.42 Box 4-3: The box provides a useful explanation of financial assurance, however an associated review of the history of financial assurance is warranted (i.e., Clark Fork River, others).

<u>EPA Response:</u> We provide a brief overview of regulatory and financial assurance issues in Boxes 4-2 and 4-3 of the assessment, but full evaluation of how these processes have worked in the past is beyond the scope of this assessment.

4.43 Box 4-4: Citation needed re: underground mining subsidence is needed.

<u>EPA Response:</u> This box has been revised in the final assessment and citations are now provided.

4.44 P. 4-16: "The majority of existing tailings dams are less than 30 m in height but the largest exceed 150 m." Needs citation

<u>EPA Response:</u> Citation is provided in the final assessment.

W. J. Richardson (Doc. #0633)

4.45 Porphyry bodies produce copious amounts of acid mine drainage once the ore has been exposed. The buffering capacity of the surrounding area is ruled obsolete once encapsulation of those materials by oxides has occurred. Another problem inherent in this region is trapped acidic waters with heavy metals that will flow off of the site during spring thaw, referred to as a 'Pulse Event', which will coincide with the Sockeye Spring Run. Even if the toxins and acids can be remediated to below toxic levels, the chemical signature of the water will be so drastically altered that the Sockeye fry will not signature the river for return spawnings.

EPA Response: Comment noted; no change required.

Chapter 5: Endpoints

Alaska Department of Natural Resources (Doc. #5487)

5.1 EPA's 1998 guidance describes ecological endpoints and defines them based on ecological relevance, as well as susceptibility and relevance to management goals. Levels of ecological organization are described (individuals, populations, communities, ecosystems, landscapes) and multiple ecosystem processes. [See USEPA, 1998. Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F. April, Washington, DC; Environmental Protection Agency, Office of Research and Development, at Section 3.3, Selecting Assessment Endpoints page 28] [See State of Alaska HIA website, http://www.epi.alaska.gov/hia/] While obviously important, the endpoint for viability of Native culture does not appear to conform to the environmental and ecosystem endpoints described in the 1998 guidance. EPA may well be addressing the fact that local communities requested the Assessment, prompting the only new field research that informed the Assessment. However, a societal component to an ecological assessment seems unrelated to the accepted methodologies of risk assessment. Other methodologies have been developed since 1998 to assess the impacts of large development projects on residents, health, culture and reliance on subsistence foods such as Health Impact Assessments (HIAs). HIAs have been done or are in progress for large projects in Alaska and the information from them can be used to inform NEPA reviews.

EPA Response: Potential endpoints for ecological risk assessments include ecosystem services, which encompass the support of subsistence cultures.

5.2 The first draft of the Assessment described the endpoint as "Alaskan Native cultures [human welfare as affected by fisheries]" at page 3-2. The revised Assessment broadens the endpoint and describes it as "viability of Alaska Native cultures." While the state acknowledges the importance of salmon and fishing to Alaska Natives in the Bristol Bay area, there are many other pressures on Native culture in Alaska that are not attributable to mining or any other economic activity or infrastructure development. In fact, the lack of economic opportunity is a primary cause of population loss in some villages as new generations of Alaskans are seeking opportunities elsewhere.

EPA Response: The language in the final assessment has been changed to "health and welfare." The assessment is clear that the scope is an evaluation of salmon-mediated effects on Alaska Native culture. We recognize that Alaska Native culture faces

numerous pressures, but the purpose of this assessment was to evaluate only potential impacts of large-scale mining on salmon resources and resulting effects on Alaska Native culture.

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

5.3 The Revised Assessment rightfully notes that "[f]or Alaska Natives today, subsistence is more than the harvesting, processing, sharing, and trading of land and sea mammals, fish, and plants. Subsistence holistically subsumes cultural, social, and spiritual values that are the essence of Alaska Native cultures."

<u>EPA Response:</u> Comment noted; no change required.

5.4 *BBNC's 2012 Comments and Technical Submissions:* Socio-Economic Impacts to Local Communities. The Draft Assessment "does not adequately discuss the very important socioeconomic impacts to local communities that would likely result from the potential environmental impacts of the development of the hypothetical mine scenario." (BBNC Part I Comments, at 5)

Revised Bristol Bay Watershed Assessment: EPA notes that socioeconomic impacts to local communities is only a secondary and indirect effects endpoint for consideration in the assessment. (Revised Assessment at 5-1).

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC notes that the Revised Assessment does not analyze the multiple inevitable impacts to Alaska Native cultures and ways of life if large-scale hardrock mining development proceeds in Bristol Bay. BBNC recognizes that EPA has limited the scope of its assessment to "fish-mediated" impacts on Alaska Natives, and notes that this limited scope makes the assessment very conservative in nature.

<u>EPA Response:</u> Comment noted; no change required.

5.5 The Revised Assessment is improved in that it includes more scientific information concerning Bristol Bay fisheries and aquatic habitat. The following are a few examples. (…)

- A better discussion of the importance of maintaining small and diverse fish populations, both salmonid and non-salmonid, and expanded consideration of the genetic "portfolio effect" to buffer against genetic drift and protect biological complexity and stability of the fishery.
- More analysis of other important Bristol Bay fish species (such as rainbow trout, char, and Dolly Varden), and an improved analysis of the importance of these fish species to the health of the watershed, to sportfishing, and as subsistence food.

<u>EPA Response:</u> Comment noted; no change required.

5.6 Particularly important is EPA's acknowledgment that the losses of streams and wetlands would affect genetically unique populations of salmon, undermining the stability of the overall Bristol Bay fishery that depends on the genetic diversity of individual populations (the "portfolio effect").

EPA Response: Comment noted; no change required.

5.7 BBNC Recommendation: "EPA should add a greater explanation of the key terms 'quality,' 'diversity,' and 'portfolio effect,' as they are used with respect to fish." (BBNC Part I Comments, at 3)

The Assessment was revised considerably to include more information about the biological complexity of salmon stocks and the portfolio effect. (Revised Assessment, sections 5.2.4 and 13.4.1).

BBNC welcomes these revisions and EPA's acknowledgment that the losses of streams and wetlands would affect genetically unique populations of salmon, undermining the stability of the overall Bristol Bay fishery that depends on the genetic diversity of individual populations.

EPA Response: Comment noted; no change required.

5.8 BBNC Recommendation: "There is substantial literature documenting the adverse impacts of mining and energy development on small indigenous communities, such as increased inflation, overwhelming demands on existing services, and increases in social problems like domestic violence. The Assessment would benefit from greater attention to this literature and a more thorough and prominent discussion of these threats." (BBNC Part I Comments, at 5) BBNC submitted detailed technical comments from Don Callaway, containing a thorough evaluation of the socioeconomic environment near the Pebble Deposit. (BBNC Part I Comments, Attach. E)

EPA's Revised Assessment includes no references to the socioeconomic evaluation provided by Don Callaway and submitted as part of BBNC's 2012 comments.

BBNC notes that the Revised Assessment is very conservative in assessing subsistence and socioeconomic impacts. Indeed, the Revised Assessment merely focuses on subsistence foods and lifestyle indirectly as an endpoint for evaluating the impact of salmon loss, rather than including a separate endpoint for analysis of the impacts on local communities from the mine itself.

EPA Response: We agree that the assessment is conservative because it only evaluates salmon-mediated effects on Alaska Native culture (Chapter 12), and not potential direct effects on Alaska Native culture or the health and welfare of local communities. Chapter 12 does include some case studies, but the focus remains on loss of subsistence resources and not on the direct economic and social effects of large-scale mining.

The Pebble Limited Partnership (Doc. #5535)

5.9 The Assessment states that it has three endpoints:

1. the abundance, productivity, or diversity of the region's Pacific salmon and other fish populations;
2. the abundance, productivity, or diversity of the region's wildlife populations; and
3. the viability of Alaska Native cultures. Each of these endpoints meets the criteria of ecological relevance, management relevance, and potential susceptibility to stressors associated with large-scale mining.

The unfortunate fact is that the Assessment does not really quantify impacts or risks to any of these endpoints.

__EPA Response:__ **Throughout the assessment, we have clarified that the primary endpoint of interest is salmonid fish resources, with secondary endpoints concerning fish-mediated effects on wildlife and Alaska Native culture. Where possible, detailed information on stressors and endpoints at project-relevant scales (i.e., the mine site watersheds, the mine footprints, and the transportation corridor) are presented in the risk analysis sections (e.g., fish distribution maps in Chapter 7). We summarize the risks associated with habitat loss and modification at various scales and in response to multiple types of impacts from mining activities (e.g., see the conceptual models in Chapter 7). For the pathways considered, we included peer-reviewed literature and information from the EBD and State of Alaska reports to summarize and synthesize likely types of effects given the habitat alterations and losses that would result from large-scale mining in this region.**

5.10 The Assessment does not discuss mining effects on the abundance, productivity or diversity of the region's salmon or other fish populations, but rather simply reports on the estimated impacts to stream channels and wetlands. For example, regarding sockeye salmon, the average annual inshore run of sockeye salmon (the key fish species identified in the Assessment) in Bristol Bay was 37.5 million fish between 1990 and 2009 (pg 5-11).

__EPA Response:__ **See response to Comment 5.9.**

__**The Pebble Limited Partnership (Doc. #5536)**__

5.11 Original Draft Location: Page 3.2, Report Section Identification: 3.3; Excerpt: [blank]

Original Comment from State of Alaska: The endpoints 2, 3, and 4 are essentially glossed over, while endpoint 1 is not well related or scaled to represent the likely site-specific impacts of the Pebble mine. The conclusions of this document is used to directly assess impacts of the mine without an in depth consideration and quantification of site-specific actions and impacts.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Endpoints have been collapsed into three (Section 5.1), but Endpoint 1 (fish) uses habitat as a surrogate to address a lack of data on fish abundance, productivity, diversity'. This link is tenuous, and the underlying analysis does not make clear the relationship.

__EPA Response:__ **See response to Comment 5.9**

5.12 In fact, the Assessment does not quantify impacts or risks to any of these endpoints. The Assessment does not discuss mining effects on the abundance, productivity, or diversity of the region's salmon or other fish populations, but rather simply reports on the estimated impacts to stream channels and wetlands. It then states that risks to the region's wildlife and Alaska Native cultures is related to impacts to salmon, but it never quantifies the impacts to salmon, and therefore it cannot reach any meaningful conclusions regarding the potential risks to wildlife or Alaska Native cultures.

EPA Response: See response to Comment 5.9.

5.13 The Assessment appears to be using the term "sustainable fishing" rhetorically based on the fact that the Bristol Bay fishery has supported the industry and subsistence cultures for many years. Criteria for measuring whether this can be maintained with various projects on the landscape appear not to have been presented in the Assessment.

EPA Response: The purpose of the assessment is to evaluate potential effects of large-scale mining on the region's salmon resources, not to determine criteria for measuring whether "sustainable fishing" can be maintained under different types and combinations of development. No change required.

5.14 *Page* 5-11, *Section*: 5.2.2.1 Salmon

Excerpt: Sockeye is by far the most abundant salmon species in the Bristol Bay watershed (Table 5-3) (Salomone et al. 2011). Bristol Bay is home to the largest sockeye salmon fishery in the world, with 46% of the average global abundance of wild sockeye salmon between 1956 and 2005 (Figure 5-9A) (Ruggerone et al. 2010). Between 1990 and 2009, the average annual inshore run of sockeye salmon in Bristol Bay was approximately 37.5 million fish (ranging from a low of 16.8 million in 2002 to a high of 60.7 million in 1995) (Salomone et al. 2011). Annual commercial harvest of sockeye over this period averaged 25.7 million fish (Table 5-3), and 78% of the average annual subsistence salmon harvest (140,767 salmon) over this period were sockeye (Dye and Schwanke 2009, Salomone et al. 2011). Escapement goals – that is, the number of individuals allowed to escape the fishery and spawn, to ensure long-term sustainability of the stock – vary by species and stock. For example, the current sockeye escapement goal for the Kvichak River ranged from 2 to 10 million fish (Box 5-2). Annual sport harvest of sockeye in recent years has ranged from approximately 8,000 to 23,000 fish (Dye and Schwanke 2009).

Technical Comment from ERM: The Assessment describes the Bristol Bay Sockeye Salmon fishery as the largest in the world (46% of world populations of Sockeye). It is unclear from the Assessment what percentage of sockeye production come directly from the Koktuli's South and North Forks, or the Upper Tularik. Furthermore it is unclear if within this region the values presented in the report are annual or interannual variation. ERM's analysis indicate that the number of sockeye produced by the North Koktuli (as well as the South fork and Upper Talarik Creek) in comparison to the total district inshore run for the Nushagak and Naknek-Kvichak systems is very low. When compared to overall Bristol Bay production the proportion attributable to sockeye production by the three drainages is near zero. This is not to suggest that these fish are not important but only that they represent a negligible fraction of overall production, and are negligible in comparison to the annual Bristol Bay commercial harvest (25 to 30 million sockeye commercially harvested annually).

Citations: Morstad et al., 2010, as cited by PLP EBD 2011; Baker et al., 2009, as cited by PLP EBD 2011; *General Subject Area*: Sockeye Salmon Fish and Fish Habitat; *Comment Category:* Incompl[e]te use of data and incomplete analysis.

<u>EPA Response:</u> As stated in the assessment, Chapter 5 presents background information on the assessment endpoints across the Bristol Bay watershed and within the Nushagak and Kvichak River drainages. Information on salmon populations in the South Fork Koktuli River, North Fork Koktuli River, and Upper Talarik Creek are provided in Chapter 7.

The analysis referenced in this comment uses index counts as population estimates, which is invalid for reasons specified in Section 7.1.2. Also see NDM 2005 (Draft Environmental Baseline Studies 2004 Progress Report, Chapter 11) where the methods and results for spawner index counts are described, with the following caveat (p. 11-9): "Please note that aerial spawning-survey results are an index of overall spawning abundance in the project area and are not intended to serve as escapement estimates."

5.15 *Page* 5-11, *Section*: 5.2.2.1 Salmon

Excerpt: Chinook salmon are an important subsistence food for residents of the Nushagak River watershed. Chinook returns to the Nushagak River are consistently greater than 100,000 fish per year, and have exceeded 200,000 fish per year in 11 years between 1966 and 2010. This frequently places the Nushagak at or near the size of the world's largest Chinook runs, which is notable given the Nushagak River's small watershed area compared to other Chinook-producing rivers such as the Yukon, Kuskokwim, Fraser, and Columbia.

Technical Comment from ERM: Among the three local drainages where direct impacts will occur, the NFK supports the largest run of Chinook salmon (followed by the SFK), and indeed Chinook were the most abundant of any salmon in the NFK in 2004 and 2005. That changed in 2006 when the run decreased by an order of magnitude confirming that a high interannual variability exists in these stream systems. Between 2004 and 2008 the Nushagak River Chinook salmon escapement estimate ranged from 53,344 in 2007 to 163,506 in 2005 and had a 5-year average of 106,131 (Baker et al. 2009; as cited by PLP EBD 2011). In contrast, the NFK Chinook salmon mean index counts (used as an index of escapement) ranged from 157 in 2008 to 1,838 in 2004 and averaged 891 for the 5-year study period (PLP EBD 2011; Table 15.1; Figure 15.1-27). The North and South Forks of the Koktuli River (tributaries of the Mulchatna River, a major Nushagak River tributary) are relatively minor contributors to overall Nushagak river Chinook salmon production. There are many Mulchatna and Nushagak River tributaries that likely produce much greater numbers of Chinook salmon (although further analysis is needed to confirm this and relevant data is limited for some stream systems and sub-tributaries). These include the Wood River, Kokwok River, Mulchatna River, Nuyakuk River, Tikchik River and the King Salmon River (Nushagak Tributaries) and the Stuyahock and Chilikadrotna River (Muchatna Tributaries).

Citation: No reference provided; *General Subject Area*: Chinook Salmon Fish and Fish Habitat; *Comment Category:* Data not supported by reference. Incomplete use of data and incompl[e]te analysis.

<u>EPA Response:</u> See response to Comment 5.14.

5.16 Original Draft Location: Page 5.1, Report Section Identification: 5.1 Fish Distribution, Excerpt: [blank]

Original Comment from State of Alaska: In regard to standard risk assessment format, descriptive sections such as 5.1 Fish Distribution are usually part of Problem Formulation. As commented above, and again related to risk assessment format, the actual Problem Formulation section is too general and sections 2, 3, and portions of 4, 5, and 6 provide more specific analysis that could be made part of problem formulation. The purpose being to focus the conceptual models and risk assessment on critical issues. This does get done to some extent, but just not in the problem formulation. The Bristol Bay Watershed Assessment as a whole does not follow a typical risk assessment format. Rather, individual sections are each generally formatted each as their own risk assessments.

Recommended Change: Section 5-1 applies to multiple sections of the report and should be moved to the Problem Formulation section of the report, to augment the very general information currently provided. Alternatively, make a specific problem formulation part of each of Sections 5 and 6, keeping a general conceptual model in Section 3 related to potential impacts, and then refine that broad conceptual model with a conceptual exposure model that better fits the scenarios in each of Sections. Problem Formulation is supposed to focus the assessment on the most important endpoints requiring assessment or investigation. As it is written there is this long laundry list of potential endpoints scattered throughout Sections 2, 3, and 4. The Risk Assessment portions need focus.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Although Problem Formulation was expanded into 5 chapters, which included an expanded discussion of fish distribution and abundance in Section 5.2: “Endpoint 1: Salmon and Other Fishes,” the same information from Section 5.1 was moved to Risk Analysis and Characterization, and is now Section 7.1: “Abundance and Distribution of Fishes in the Mine Scenario Watersheds.” This section still appears to contain the same discussion on the interpretation of available fish distribution data, which is overlaid on the revised version of the mine scenarios. The risk analysis does not meet EPA standards. The comment stands.

EPA Response: In Chapter 5 (part of the problem formulation portion of the assessment), we provide an overview of the assessment’s primary and secondary endpoints in the Bristol Bay watershed as a whole, focusing on the two watersheds—the Nushagak and the Kvichak—that drain the Pebble deposit area. In Chapter 7, where we begin to evaluate how mining would impact these endpoints, we focus in on the specific streams draining the site. It would be inappropriate to include specific data used in analyses, such as fish occurrences at the Pebble site, in the problem formulation portion of the assessment. Further, it would make it more difficult for the reader to understand the analyses. This is appropriate, and there is nothing about this organization of information that does not meet EPA standards.

5.17 Original Draft Location: Page 5.75, Report Section Identification: 5.6 Fish Distribution, Excerpt: [blank]

Original Comment from State of Alaska: The text states that any negative impact on fish could lead to negative impact on the health and welfare of Alaska Natives. Yet, of the 40,000,000 (high range) fish returning to the Bristol Bay region, it was stated earlier that approximately 150,000 are taken for subsistence. The assessment assumes that “any” impact to fish populations would necessarily result in a proportional impact to Alaska Native subsistence fish use although the relative taking of subsistence fish is small relative to the taking of commercial fish.

Recommended Change: Present a more detailed or at least report more precisely the numbers of salmon used for subsistence versus the total number of fish, and discuss the balance that could be adjusted between escapement, commercial, and subsistence fish harvest, particularly if a more detailed economic analysis shows the mine is more economically valuable than slight losses to the commercial fish industry.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The following statement was added to the document "The magnitude of salmon-mediated effects on wildlife, subsistence resources, and indigenous cultures cannot be quantified at this time, and is uncertain." (page 12-16). No expanded analysis was provided. The only value placed on subsistence fishing is an annual harvest of 2.6 million lbs per year (page 5-24), and on average, 50% is Pacific salmon (page 5-34). Additionally, page 5-35 and 5-36 presents % harvest by species for subsistence fisheries in Bristol Bay watershed. The comment stands. The analysis overestimates the impacts on subsistence use.

EPA Response: The comparison of subsistence with commercial fisheries is not within the scope of this assessment. Likewise, the assessment is not an economic cost-benefit analysis of mining and the fishery. Although the subsistence fishery is small relative to the commercial fishery, it sustains a way of life for local residents and is integral to the social and spiritual aspects of the region's Alaska Native cultures. The scope of the assessment is limited to potential risks to salmon from large-scale mining and resulting salmon-mediated effects to indigenous culture and wildlife. The scope does not include an economic cost-benefit analysis of mining, commercial fishing, and subsistence fishing.

The statement from the revised assessment cited in the comment is part of a discussion of uncertainties, and it does go on to provide an expanded analysis which states "…the magnitude of overall impact to wildlife, subsistence resources, and indigenous cultures depends on many factors, including the location of the effects, the temporal scale of the effects, cultural resilience, the degree and consequences of cultural adaptation, and the availability of alternative subsistence resources." We do not see how this analysis of uncertainties "overestimates the impacts on subsistence use."

5.18 (…) [T]he Assessment establishes as an endpoint to assess the abundance, productivity, or diversity of the region's Pacific salmon and other fish populations. However, the Assessment fails to actually analyze this endpoint qualitatively. Instead, it simply talks about impacts to fish habitat and wetlands.

For example, regarding sockeye salmon, the average annual inshore run of sockeye salmon (the key fish species identified in the Assessment) in Bristol Bay was 37.5 million fish between 1990 and 2009 (p. 5-11). Based on the highest index spawner count over the 5 year survey period, approximately 90,200 sockeye salmon were estimated in the Mine Scenario watersheds, (which include the South and North Fork Koktuli Rivers and the Upper Talarik

Creek, Table 7-1 on p. 7-13). Accepting that this estimate may underestimate the actual population, these fish represent about 0.25% of just the returning sockeye salmon in the Bristol Bay watershed, and certainly a much lower percentage of the total population. Although this is a crude estimate, it provides an order of magnitude sense of the potential project effect on fish populations, which the Assessment fails to provide.

EPA Response: See response to Comment 5.14.

5.19 The Assessment relies on Alaska Department of Fish and Game analysis on yield to establish sustainable levels. These data are obtained from observer reports of escapement. It is unclear in the Assessment what defines sustainable harvests. Furthermore, it is not clear what level of industrial fishing is necessary, if any, to influence the sustainability of salmon stocks. Furthermore, the commercial sockeye fishery in Bristol Bay is sustained because of regulations limiting the commercial harvest allowing a sufficient number of adults to spawn, to protect future harvests. In the absence of those regulations, commercial fishing would likely proceed at an accelerated rate congruent with market demand and likely resulting in overharvest. The Assessment fails to point out that the Bristol Bay sockeye industry has sustained itself because of these regulatory limits. Like the commercial fishing industry, a mine of the caliber discussed in the Assessment would certainly go through a robust regulatory review process whereby management conditions would be established in a fashion that makes the mine development compatible with other resource uses.

EPA Response: Commercial fishing regulations are discussed in Box 5-2.

5.20 Page/Section: Section 5

Excerpt: The Assessment indicates throughout that overall salmon populations are expected to be reduced due to water loss and direct impacts.

Technical Comment by ERM: Data indicating significance/non-significance are not currently available since population studies on the local drainages have not been conducted, and only abundance studies have been reported. The Assessment fails to substantiate statements on reduced salmon populations with references supporting their position. Furthermore, the Assessment fails to distinguish between spatial scales when making these statements. Anadromous stream lengths in the three watersheds (South and North Forks of Koktuli and the Upper Talarik) comprise less than 0.3 % of the total anadromous stream length in the Nushagak and Kvichak river systems and still less for the six combined hydrologic units comprising Bristol Bay. In addition, adult sockeye return estimates for these three watersheds are less than 0.2% of the total commercial harvest in Bristol Bay. In fact, the interannual variation in Bristol Bay commercial harvest is greater than the annual return estimates for the Koktuli Rivers and the Upper Talarik. In summary, the existing data sets indicate reductions in salmon populations will likely not be measurable at the Bristol Bay Scale.

Citations: No reference provided.

General Subject Area: Fish and Fish Habitat.

Comment Category: Scale of impact.

EPA Response: Text on the relevant geographic scales has been added to Chapter 7 to illustrate the relative proportion of AWC stream length lost within the North Fork

Koktuli, South Fork Koktuli, and Upper Talarik Creek watersheds under the mine scenario footprints. For response to comment on the proportion of salmon populations affected, see response to Comment 5.14.

5.21 *Original Draft Location*: Page 2.17, Section 2.2.4, Excerpt: Table 2.6

Original Comment from Environ: The only justification for the values of each economic sector states "see Appendix E for additional information on these values." There are many calculations and value estimates throughout Appendix E. In order to be able to verify calculations specific references to specific locations in Appendix E need to stated.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Section 5.2.3, Pages 5-23 and 5-24. This section is almost identical to previous Section 2.2.4. adding no additional information as recommended. Page 1.2 states "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." And page ES-9 states "The economic effects of mining are not assessed." Comment was acknowledged but not addressed. Therefore the original comment still stands.

<u>EPA Response:</u> This information is included as Table 5-4 in the revised assessment. The table heading now directs readers to Appendix E (Table 3 of the Executive Summary and Section 4) for additional information on the reported values.

5.22 *Original Draft Location*: Page 2.24, Section 2.3.4, Excerpt 1st paragraph

Original Comment from Environ: The logic presented in these two paragraphs is flawed since it assumes that all the returning fish escape into the rivers to spawn. Per Figure 6-1, the average escapement into the entire study area averages 16,142 fish, not 30 to 40 million. At an average size of 2.32 kg per fish (Burgner 1991), this is equivalent to approximately 37,500 kg of fish. Only a small percent of that weight is nitrogen and phosphorus (typically 11 to 12 percent nitrogen). So the total import must be less than 4,000 kg of nitrogen and smaller amount of phosphorus, not the estimated 20 million kg reported in the referenced paragraphs. Also worthy of note, Moore and Schindler (2004) indicate that on average, smolts export 12% of the phosphorus and 16% of the nitrogen that their parents bring in, so the nutrients available to other biota are smaller than the total nutrients imported by the parents.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Essentially, the same analysis is presented in Section 5.2.5 of the second review draft as was presented in Section 2.3.4 of the first review draft. The comment was not addressed. The assumption that all returning fish escape into the river grossly over-estimates the impacts of a project on nutrient availability.

<u>EPA Response:</u> No change required, as the text accurately reflects the findings of the cited works, does not contain logical inconsistencies, and does not make any argument regarding import vs. export of marine-derived nutrients.

5.23 *Original Draft Location*: Page 5.16, Section 5.2.1.2 and Appendix C, Excerpt [blank]

Original Comment from Environ: The assessment states that the loss of upstream waters (p 5-21, P 1) would "greatly reduce inputs of organic material, nutrients, water, and macro invertebrates to reaches downstream ….". They also state that 65% of the nitrogen flux is attributed to headwater contributions. They then go on in Appendix C (p 16-18) to state the tremendous importance of Marine-derived Nutrients to the Bristol Bay Watersheds coming in from salmon swimming upstream.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Marine derived nutrients are a primary source of nutrients in the river, as is indicated in the Appendices. The main body of the text needs to reflect this. The document seems to assume that headwaters are a driving source of nutrients and no nutrient budget has been developed. The analysis likely overestimates the effects of reductions in nutrients from headwater streams.

<u>EPA Response:</u> These statements are not contradictory. Headwater streams provide important inputs to downstream waters, including the many streams that do not have documented anadromous fish populations. Where anadromous fish occur, marine derived nutrients can play an important role, but this does not negate the contributions of headwater nutrient sources, particularly for streams without large runs of salmon. Text has been added to Chapters 5 and 7 citing research that demonstrates the relative proportion of marine-derived nutrients in freshwater taxa in the region and relative contributions of other subsidies.

5.24 Original Draft Location: Page 2.16, Report Section Identification: Section 2.2.3, Excerpt [blank]

Original Comment from State of Alaska: Draft Comment: The logic presented in these two paragraphs is flawed since it assumes that all the returning fish escape into the rivers to spawn. Per Figure 6-1, the average escapement into the entire study area averages 16,142 fish, not 30 to 40 million. At an average size of 2.32 kg per fish (Burgner 1991), this is equivalent to approximately 37,500 kg of fish. Only Draft Comment: Text states that the Mulchatna caribou herd spends a considerable amount of time in other watersheds. Approximately how much time does the Mulchatna caribou herd spend in the Nushagak and Kvichak River watersheds?

Recommended Change: Specify how much time the Mulchatna caribou herd spends in the Nushagak and Kvichak River watersheds as compared to other watersheds in the Bristol Bay watershed. This information might be presented as a fractional use estimate.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Identical text.

<u>EPA Response:</u> The relevance of the comment about salmon escapement to Section 2.2.3 is not clear, but in any case Figure 6-1 (which does not appear in the final assessment) illustrates Chinook salmon counts among Nushagak drainages. It is not an estimate of total salmon escapement by all species. Regarding caribou, we are not aware of data (and none were suggested in the comment) that would allow a quantitative fractional use estimate to be completed. The Barren Ground Caribou section of the USFWS report discusses historical data, which indicate that population size, as well as range, have varied over time.

<u>The Pebble Limited Partnership (Doc. #5752)</u>

5.25 The central question that motivated this assessment is: how would mining affect the long term viability and abundance of salmon and other fish resources in the Bristol Bay watershed? EPA avoids analysis of this core issue, apparently because there are no data to suggest that mining cannot co-exist with other commercial, recreational and cultural uses of the resources within the overall watershed. In fact, as discussed below, the only quantitative data in EPA's assessment with respect to fish population indicate that mining would have minimal or no impact on the overall Bristol Bay fishery.

<u>EPA Response:</u> The assessment does not attempt to predict salmon population responses to the identified scenarios. Rather, as carefully outlined in the various chapters and associated conceptual frameworks, the assessment provides an evaluation of the risks associated with various mining activities, including both inevitable and potential habitat modifications. The weight of evidence presented in these chapters includes peer-reviewed scientific literature of salmon habitat requirements, population dynamics, physiological responses to various stressors, field data, and other sources of information.

5.26 The Risk Posed By The Mine To The Bristol Bay Fishery Is Minimal. The Assessment does not demonstrate that the area affected by the Pebble mine would have a significant impact on salmon in the Bristol Bay fishery. In fact, it demonstrates the reverse.

A. Even absent compensatory mitigation, at most a small fraction of 1% of the sockeye salmon in the Bristol Bay fishery would be affected by a Pebble Mine.

Using the sockeye salmon populations and even accepting what are likely to be overstated fish populations from the Assessment, the number of sockeye salmon in streams affected by the mine site is (i) less than one-fourth of one percent of the total inshore run of sockeye salmon in the Bristol Bay area and (ii) less than one-half of one percent of the annual commercial harvest of sockeye salmon. According to the Assessment, the average annual inshore run of sockeye salmon is roughly 37.5 million and the annual commercial harvest is 25.7 million. Assessment at 5-11. Using the highest number from the "highest reported index spawner counts" in the Assessment, about 90,000 fish occupy the "mine scenario watersheds." See id., Tbls. 5.3 and 7.1. Thus, even using the Assessment's numbers, the sockeye salmon in the "mine scenario watersheds" represent approximately [0].24% of the total inshore run of sockeye salmon in Bristol Bay and approximately [0].35% of the annual commercial harvest from Bristol Bay. Even setting aside mitigation measures, the Pebble mine would have negligible impact on salmon habitat in Bristol Bay.

<u>EPA Response:</u> This comment makes two important assumptions. First, it assumes that index counts provide escapement estimate, which is an invalid assumption (see response to Comment 5.14. Second, it assumes that if low numbers of fish are documented for a site, the habitat is somehow of low or lesser importance. This is an invalid assumption for several reasons:

- **Sampling in the study area is difficult. Information on fish distributions in the study area must rely on intermittent site visits during periods when the area and streams are accessible and suitable for effective sampling. Given the logistical challenges of sampling fish environment, it is reasonable to conclude that the current databases provide an incomplete description of the full distribution and abundance of fish in the study area, and may well be an underestimate.**
- **Some habitats are seasonally important. Fish may be absent from a site during portions of the year, but present in high abundances at other times. Low abundance at one point in time does not necessarily equate to low abundances at another point in time, nor does it mean that the habitat is not important.**
- **Sites with low abundances during years with low adult escapement may have high abundances during years with higher survival or escapement, allowing populations to respond to favorable conditions.**
- **Sites with low apparent abundances of target species (e.g., salmon) may provide habitat for other fish species, macroinvertebrates, or other components of the food web essential for ecosystem function.**
- **Sites with low abundance may provide important services to downstream waters, including regulation of water quality or flows or supplies of materials.**

<u>EPA Response:</u> Given these factors, it is not valid to conclude that streams with low abundances observed under a particular sampling regime are somehow unimportant. They can in fact be very important, as is well-known and documented within the ecological and fisheries literature detailed in the assessment.

<u>Center for Biological Diversity (Doc. #2922)</u>

5.27 If the proposed Pebble Project goes forward, construction and operations of the mine site and transportation infrastructure for the mine would have major and population-level impacts on Iliamna Lake seal. These impacts include (1) major adverse impacts to quality and quantity of anadromous and freshwater fish in the lake; (2) severe and long-term impacts on habitat quality especially water quality; (3) toxic effects resulting in direct mortality and decreased survival and reproductive rates from mine contaminants; (4) increased pressure and competition for fish and wildlife resources because of increased human access to the area; and (5) increased stress levels and disturbance from higher human activity and industrial activity levels in the area, especially low-flying aircraft. (…) EPA's Bristol Bay Assessment failed to analyze impacts to the Iliamna Lake seal, despite stating their interest in analyzing salmon-dependent species and species that would be directly impacted by Pebble Project.

EPA Response: As detailed in Chapter 2, this assessment does not consider all species that would be directly impacted by a mine at the Pebble deposit. Throughout the assessment, we have clarified that the primary endpoint of interest is salmonid fish resources, with secondary endpoints concerning fish-mediated effects on wildlife and Alaska Native cultures. On-going research on Iliamna Lake seals is now mentioned in Section 5.3.

World Wildlife Fund, Arctic Field Program (Doc. #5537)

5.28 Acquire a full understanding of the ecological linkages between species, including endangered ones. In particular, the Assessment should address the potential impacts of large scale mining in Bristol Bay that could cause significant impacts on other species of fish, marine mammals and birds as a result from reduced salmon runs and pollution on the region's freshwater system and marine estuaries. Regardless of a potential ESA designation, adverse impacts to Bristol Bay salmon populations will have a reverberating impact throughout the marine food web, including for the endangered Cook Inlet beluga whale and Lake Iliamna seal.

EPA Response: See response to Comment 5.27.

5.29 Include an assessment of recent king salmon stock concerns in Western Alaska. The Nushagak River was the only major western Alaska River in 2012 that met its king salmon escapement goal. Other traditional king salmon strongholds, including the Yukon and Kuskokwim Rivers, did not meet their king salmon escapement goals. There is scientific agreement that king salmon stocks throughout Alaska have been in decline for the past few years, so it is important for the EPA to include the fact that king salmon runs are being stressed throughout Alaska by something other than large-scale mining in the Bristol Bay region. Large-scale mining in the region can further exacerbate and stress Bristol Bay's king salmon populations.

EPA Response: Recent and persistent regional and statewide declines in Chinook productivity and harvest are a definite concern (ADF&G Chinook Salmon Research Team 2013, p. 8). The long-term variability of annual run-strength of Nushagak River Chinook salmon stocks does not appear to deviate much from other key Alaska Chinook salmon producing streams (ADF&G Chinook Salmon Research Team 2013, p. 51-56), thus we do not highlight it here.

5.30 Update the Assessment's section on the economic values to acknowledge the most recent analysis of the economic values of the salmon fishery, as quantified by University of Alaska Institute of Social Research (ISER) in its May 2013 report titled "The Economic Importance of the Bristol Bay Salmon Industry." ISER's findings showed that the fishery is worth a total of over $1.5 billion and provides 12,000 fishing and processing jobs during the summer salmon fishing season. Measured as year-round jobs, and adding jobs created in other industries, the Bristol Bay salmon fishery created the equivalent of almost 10,000 year-round American jobs across the country. These numbers are impressive indicators of an economic resource that would be jeopardized by construction of a mine in the watershed. Other analyses, such as a 2011 study by WWF, demonstrate the global significance of the Bristol Bay fishery. Graphic's included in the 2011 WWF study titled "The Value of Commercial

Fisheries Near Bristol Bay, Alaska" illustrate the geographical distribution of Bristol Bay salmon sold in the global market by just one salmon processor, with its salmon product reaching four out of the seven continents, and as far as Japan, South Africa and the United Kingdom. The report includes the residency of Bristol Bay salmon permit holders to demonstrate the national, statewide and regional importance of the Bristol Bay's fisheries. Bristol Bay provides jobs and economic benefits for Alaska Native tribal members, as well as American's from all walks of life.

EPA Response: Comment noted; no change required. We are aware of the report cited in the comment, but have not included it in the assessment because it is outside the scope of the assessment.

5.31 Consider the ongoing National Marine Fisheries Service study of the potential mining impacts on freshwater seals of Lake Iliamna in the final Watershed Assessment. This study will help guide future EPA actions. These seals are currently under review by the National Oceanic and Atmospheric Administration for potential listing as a protected species under the Endangered Species Act. These marine mammals are an important part of the Bristol Bay ecosystem, as well as for Alaska Native cultures for subsistence purposes. The 404(b) (1) Guidelines of the Clean Water Act prohibit the authorization of discharges where they would jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify its designated critical habitat. These same provisions should be considered for the endangered Cook Inlet beluga whales which could be adversely impacted by Pebble's potential infrastructure and activities in Cook Inlet.

EPA Response: See response to Comment 5.27.

Alaska Chapter of the Wildlife Society (Doc. #7415)

5.32 Salmon are the foundation of the region's food web, and a major food source for terrestrial predators such as brown bears, bald eagles, and in some areas wolves. Marine nutrients delivered by salmon directly or indirectly affect freshwater and terrestrial habitats for a variety of species. Significant reduction in the salmonid food base would likely result in a cascade of changes to multiple species across trophic levels and habitats.

EPA Response: Comment noted; no change required.

Thirteen Members, United States Congress (Doc. #7353 and #7355)

5.33 We write to express our strong support for protecting the thousands of American jobs and substantial economic opportunities in Bristol Bay, Alaska. Bristol Bay is home to one of North America's last great wild salmon fisheries, with nearly 40 million salmon returning to the region each year. Those fish support the jobs of commercial fishermen and women who earn a living fishing, processing and distributing these salmon throughout the world, as well as a healthy tourism economy. Unfortunately, the waters and wetlands that sustain this economic engine are threatened by a proposal to turn the habitat where these fish spawn into an industrialized hard rock mining zone.

EPA Response: Comment noted; no change required.

5.34 A recent report issued by the Institute of Economic and Social Research – University of Alaska (ICSR) found that Bristol Bay plays a critical role in the regional economy of the Pacific Northwest. Specifically, it demonstrates that the value of Bristol Bay based commercial Fishing activities accounts for an impressive $1.5 billion in annual output value, including $500 million in direct income. Additionally, the impact across Washington and Oregon sustains $618 million in indirect economic activity, mostly through seafood processing. This results in more than 4,000 jobs for Alaskans and nearly 6,000 jobs in Washington, Oregon and California. Clearly, the health of Bristol Bay plays a very significant role in maintaining the economic vitality of a region that relies heavily on the entire commercial fishing industry.

We represent states with strong commercial fishing industries. The fishermen and women in our states depend on the well-being of our nation's fisheries so the businesses they run can continue to thrive. Unfortunately, the proposed Pebble Mine has created a cloud of uncertainty. With the looming threat of a massive open pit mine that could destroy their fishery, these businesses lack the certainty required to grow their operations. That's why over 100 commercial fishing organizations from across the country have written in opposition to the Bristol Bay mining permit and asking for a comprehensive review of the mine's impact.

<u>EPA Response:</u> Comment noted; no change required.

5.35 In New England, which has a long and proud history of commercial fishing, the importance of maintaining abundant and healthy fisheries is certainly appreciated and understood. We have seen firsthand the impact that a potential loss of an industry can have on a local community. New England fishermen and their communities, like their counterparts in Alaska, are dependent on the health of local fisheries to sustain their businesses and their families.

Additionally, a number of New England fishermen reportedly hold commercial fishing permits in Bristol Bay and many crew members make their way to Bristol Bay to work during the region's fishing season. We understand that these fishermen are concerned about the future of Bristol Bay's abundant fisheries. Several fishing organizations, including the Gloucester Fishermen's Wives Association, the Maine Lobsterman's Association, and the Maine Coast Fishermen's Association have communicated to us their support and concern for the fishermen of Alaska. We take seriously their views on this important issue and respectfully encourage the EPA to complete and publicly release a final Watershed Assessment for Bristol Bay prior to the start of Alaska's salmon fishery season this summer.

<u>EPA Response:</u> Comment noted; no change required.

<u>Northern Dynasty Minerals Ltd. (Doc. #3650)</u>

5.36 In EPA's hypothetical mine area, no salmon spawning has ever been documented upstream of Frying Pan Lake (FPL), only a few juvenile coho salmon have been found upstream of FPL, supporting juvenile coho to move upstream from spawning location. However, fish density and distribution data show that these fish are confined to the main stem SFK up to about tributary stream SFK 1.370. Fish habitat data from the EBD would show that this portion of the SFK main stem is only about 2 m in width.

The AWC erroneously reports juvenile sockeye salmon rearing in FPL. This distribution is not supported by the known locations of sockeye spawning, the ages of fish represented in the AWC, the number of juveniles reported (3 or 4 depending on the source), and the behavior of juvenile "river type" sockeye after emergence. Data for the UT shows a relatively large spawning population of coho salmon, a few Chinook, and some sockeye in certain years. However, EPA assumed that the upper portion of UT was important for Chinook and sockeye and that sufficient habitat is not available downstream of any cut off areas to accommodate a few occasional and additional spawners. This is also true in the SFK downstream of the ephemeral reach and in the NFK.

EPA Response: This comment assumes that if low numbers of fish are documented for a site, the habitat is somehow of low or lesser importance. This is an invalid assumption for several reasons (see response to Comment 5.26).

Regarding the sockeye salmon observed in Frying Pan Lake documented by a PLP contractor, we acknowledge that the counts are low but, as stated above, this does not invalidate the conclusion that these waters provide rearing habitat. Juvenile sockeye salmon are known to migrate upstream from spawning locations, thus these individuals may have moved into Frying Pan Lake from known downstream spawning locations. We are not aware of any genetic analyses that have determined the juvenile sockeye in Frying Pan Lake were river type. There may be both river and lake type sockeye in the Koktuli system.

5.37 a) Woody and O'Neal, 2010 – "Fish Surveys in Headwater Streams of the Nushagak and Kvichak Drainages Bristol Bay, Alaska"

Summary

- No clearly stated conclusions are identified.
- Science in the report was not emphasized nor articulated in very much detail.
- Does not determine mine impacts as stated in the "disjointed and advocacy-laced Preface".
- Limited in scope and too general in nature to contribute to quantitative assessment of development impacts.

Specific References.

> *"The Preface states that the purpose of these surveys (conducted in 2008), and by assumption the purpose of the overall report (which adds data for 2009 and 2010), was to determine if these streams and their habitat could be affected by mining activity associated with the proposed Pebble Mine. I did not see that purpose reflected in the body of the report. There was no discussion of impact assessment methodology or documentation of an environmental assessment, which would be needed to attain the stated purpose. Rather, this report is merely a data compilation of species collected by trapping, electroshocking, and aerial survey, and it presents habitat parameters for streams surveyed." – William J. Wilson (pg.4)*

"This report does not determine mine impacts as stated in the Preface." – William J. Wilson (pg.4) "The conclusions of the report are meagerly supported by the evidence provided." – William J. Wilson (pg.5)

"A sampling data summary is provided as an insert to Appendix I that shows the number of reaches sampled and their total lineal length, but a mathematical error adds confusion (reaches sampled in the three years were 4, 34, and 20 totaling 58, not 68). How does this number, 58, relate to the 97 sites mentioned on page 16?" – William J. Wilson (pg.5)

"The methods state that study sites were selected near or adjacent to mine claims for streams with <10% gradient, but it is not immediately clear if all of these potentially affected sites were surveyed or only a subset since the maps included in the report show the study areas at a fairly coarse scale." – Michael R. Donaldson (pg.7)

"A weakness is the assessment of physical habitat at study sites, which could have been more thorough (e.g., through more extensive data collection at multiple transects across each study reach). A more detailed data set might lend itself to more extensive characterization of the relationship between salmon abundance and physical habitat, which could potentially be used to estimate salmon abundance at unsurveyed sites." – James M. Helfield (pg.7)

"The study is not close to optimally designed, nor are the methods, results, discussion, and conclusions well presented in an organized, sequential way." – Dennis L. Scarnecchia (pg.8)

"It was not clear if there was a systematic sample design for identifying exactly which streams were sampled, and why they were chosen over other possible streams (other than gradient). Although this study appears to be preliminary in nature, presumably to be followed by more detailed studies, it would have been useful to know why particular streams were chosen or not chosen in a landscape context, for example, based on their location, accessibility, or proximity to proposed mining, etc." – Dennis L. Scarnecchia (pg.8)

"It would have been useful to clearly identify how the electrofishing settings matched the objective/goal of the study, for example, to make sure that if fish were in a section, that they were sampled." – Dennis L. Scarnecchia (pg.8)

"Although habitat was assessed, there was little indication as to what the hypotheses of the investigators were regarding the relations between habitat measures and fish presence or absence. As it was written, it was not clear exactly why most of the habitat information was collected, other than to show they were within very general acceptable ranges for species in question." – Dennis L. Scarnecchia (pg.9)

"Although presence/absence seemed to be the objective of the sampling, it would have been useful to give an indication of relative abundance of captured fish stream by stream, not just as a whole, as was done. Too little emphasis was put on the results of the fish sampling, which was the theme of the paper. It would have also been useful in a discussion section to show how the catches of anadromous fish and resident fish related to specific habitat conditions; this was not done." – Dennis L. Scarnecchia (pg.9) "The conclusion section as a whole presented a challenge as written because it is not a conclusion section." – Dennis L. Scarnecchia (pg.9)

"No conclusions are identified." – Dennis L. Scarnecchia (pg.9)

"Weaknesses of this report include a disjointed and advocacy-laced Preface, which unfortunately sets the scene for a report that bears little resemblance to that Preface. Another concern is the lack of quantitative information on number of fish collected, by species, in each reach/site, in each year, by each sampling method. For example, page 16 states that of the 97 sites surveyed, 72 contained anadromous salmon, but was that one or two fish per site, or hundreds per site?" – William J. Wilson (pg.10) "The report mentions "the continuing dramatic decline" of [salmon] in the Fraser River in British Columbia; this impression of dramatic decline in the Fraser is out of date and should be revised." – Williams J. Wilson (pg.10)

"Figure 6 states that hatcheries can cause detrimental genetic and ecological changes in wild salmon populations; hatchery effects on salmon are not the subject of, nor discussed in, the narrative of this report, and this statement is irrelevant." – William J. Wilson (pg.11)

"A statement on page 23 requires considerable explanation and referencing: "As illustrated by this…stud[y], headwaters comprise a significant proportion of essential…habitat for salmon…" This report provides no justification or supporting data or analyses for this statement. Significance has statistical meaning and requires a statement of confidence; terms, "significant" and "essential", have specific scientific and/or regulatory meaning that require referencing." – William J. Wilson (pg.11)

"The report does not provide the quantitative data needed to characterize the relative importance of the areas surveyed to the overall production of fish in the Nushagak and Kvichak River systems, and in turn, to fish production in the larger Bristol Bay watershed. Lack of specific information on species collected in sites/reaches that are within the mine footprint, or downstream of presumed development sites, limits the application of this report's results to the EPA assessment." – William J. Wilson (pg. 13)

EPA Response: The criticisms of Woody and O'Neal (2010) listed above describe limitations of the sampling design, lack of additional data that would have been useful, and other critiques of the conclusions drawn. Woody and O'Neal (2010) is cited once in Chapter 5 to illustrate the occurrence of coho salmon high in headwater streams in the proposed mining area. The fact that fish were captured and identified correctly in these areas is not in dispute. This is the sole fact cited in Chapter 5, thus these critiques are not relevant to the manner in which this citation is used in the assessment.

IUCN SSC Salmonid Specialist Group (Doc. #5435)

5.38 Our sockeye salmon assessment (the original version was released in 2008, and an amendment to this was completed in 2011) is the culmination of a great deal of work, and was made possible by a number of contributors and collaborators across the North Pacific. Although sockeye as a species is not considered to be at risk globally, many populations have experienced declines, including populations in the Kvichak River in Bristol Bay. Bristol Bay is widely regarded as the most abundant and diverse assemblage of sockeye populations in the world. Conservation of core areas like this is the most reliable way to ensure viability of the global species. Restoration is much more difficult, expensive, and less effective if healthy populations are allowed to decline. There is much talk these days about sustainable fisheries. This concept depends directly on the health and well-being of individual populations as it is the collective of these populations which provides the stability to the larger population aggregate and the fisheries that depend on them.

EPA Response: Comment noted; no change required.

Natural Resources Defense Council (Doc. #5436 and #5378)

5.39 Pacific salmon are gone from 40% of their historical breeding ranges in the western United States. Where populations remain, their numbers tend to be significantly impaired or dominated by hatchery fish. This status of Pacific salmon throughout the United States underscores the "value of the Bristol Bay watershed as a salmon sanctuary or refuge," and highlights the Bristol Bay watershed as a "significant resource of global conservation value." Allowing its degradation should be out of the question.

EPA Response: Comment noted; no change required.

5.40 The 2013 Assessment also admits that total spawning escapement has never been documented for rivers in the mine claims and that many headwater tributaries have not been surveyed, rendering estimates of salmon abundance and range as minimal and not realistic estimates on which to calculate potential impacts. The impacts from the entirety of the infrastructure and personnel needed to implement the project, which could be significant, are also not included.

EPA Response: Comment noted; no change required.

5.41 This inherent intricacy of groundwater-surface water exchanges makes regulating or controlling such interactions during large-scale landscape development extraordinarily difficult. These complex interactions simply cannot be boiled down to a one-to-one calculation. NDM asks EPA and the public to believe that a mine occupying only a small percentage of the Nushagak-Mulchatna and Kvichak drainages "could not meaningfully impact ecological resources" over the "broad" Bristol Bay area. As noted by the peer review panel, however, the relationship between habitat and salmon production is "nonlinear." Even "5% of the habitat could be critical and thus responsible for 20% or more of salmon recruitment."

EPA Response: Comment noted; no change required.

Trout Unlimited (Doc. #5527)

5.42 Salmon are without a doubt the keystone species of the region, however rainbow trout, arctic char, grayling and northern pike are particularly important to recreation, as well as subsistence, in the region. The region's rivers boast some of the most sought after rainbow trout and arctic char fishing in the world. The Nushagak River is one of the largest producers of Chinook salmon in the world with an average over 100,00 fish annually, with runs exceeding 200,000 eleven times between 1966 and 2010. It deserved the additional recognition this draft gave.

EPA Response: Comment noted; no change required.

V. Wilson III (Doc. #5529)

5.43 Include an assessment of recent king salmon stock concerns in Western Alaska. The Nushagak River was the only major western Alaska River in 2012 that met its king salmon escapement goal. Other traditional king salmon strongholds, including the Yukon and Kuskokwim Rivers, did not meet their king salmon escapement goals. There is scientific agreement that king salmon stocks throughout Alaska have been in decline for the past few years, so it is important for the EPA to include the fact that king salmon runs are being stressed throughout Alaska by something other than large-scale mining in the Bristol Bay region. Large-scale mining in the region can further exacerbate and stress Bristol Bay's king salmon populations.

EPA Response: See response to Comment 5.29.

H. Neumann (Doc. #0238)

5.44 Salmon are the keystone species of the Bristol Bay region. Without the annual runs the land and waters of the region would be immensely poorer in the plant and animal diversity. (Wilson, et al., 1995; Hartman and Burggner, 1972)

EPA Response: Comment noted; no change required.

C. Borbridge (Doc. #5066)

5.45 More needs to be learned about the importance of genetic diversity of salmon stocks. A healthy diversity of salmon producing streams is important to a salmon producing river A healthy diversity of salmon producing rivers is important to a salmon producing fishery such as Bristol Bay. Does an impact on an area of salmon producing streams impact the overall health of a fishery beyond a specific number of salmon lost. If it can take 1,000's of years of natural selection and adaptation to produce the salmon stocks in various streams, how much is lost by possibly losing them in a few years. What may be lost even if there is an attempt to somehow "replace" the numbers lost with perhaps greater numbers elsewhere?

EPA Response: Comment noted; no change required.

Earthworks (Doc. #5556)

5.46 Bristol Bay watershed supports the largest sockeye salmon fishery in the world, with approximately 46% of the average global abundance of wild sockeye salmon. Furthermore, the Chinook runs in the Nushagak River are frequently at or near the world's largest. Both species are critically important to the health and survival of other species in the region, and both species are particularly sensitive to the kinds of impacts associated with large-scale metallic sulfide mining generally – and Pebble Mine specifically.

EPA Response: Comment noted; no change required.

5.47 It is important to recognize that about one third of sockeye salmon population diversity is considered endangered or extinct – Bristol Bay sockeye salmon likely represent the most abundant diverse sockeye salmon populations left in the U.S.

EPA Response: Comment noted; no change required.

5.48 The characterization of ecological resources provides a compelling case for the local, regional and global significance of the Bristol Bay fishery, and its ecological, economic and cultural significance.

<u>EPA Response:</u> Comment noted; no change required.

<u>S. L. O'Neal (Doc. #5528)</u>

5.49 Table 5-1. Fish species reported in the Nushagak and Kvichak watersheds

- Abundance information should include references (either Local Ecological Knowledge and/or ADFG Anadromous Waters Catalog)
- Although 'uncommon' is not defined, tributaries to Iliamna Lake commonly support coho.
- "Juveniles abundant and widespread in upland flowing waters of Nushagak River watershed and some Kvichak River tributaries downstream of Iliamna Lake…" Should read: "some Kvichak River tributaries to and downstream of Ilimana Lake" for Chinook, coho, and chum.
- Arctic char and Dolly Varden are exceedingly difficult to distinguish in the region (Penny Crane, USFWS, Anchorage, AK)

P. 5-8: As discussed above in general comments, a more thorough discussion of the lack of hatchery influence in the region is warranted here.

P. 5-9: The list of 'sport and subsistence fish species' should include whitefish and pike in paragraph one of section 5.2.1.2 P.

5-10: "Both anadromous and non-anadromous Dolly Varden are found in the Bristol Bay watershed, and both life-history forms can exhibit complex and extensive migratory behavior." Penny Crane (USFWS, Anchorage, AK) has more specific data regarding Dolly Varden anadromy in Bristol Bay.

<u>EPA Response:</u> The heading for Table 5-1 now directs readers to Table 1 in Appendix B for additional information on references and the abundance and life history of each species.

The coho salmon relative abundance entry in Table 5-1 has been reworded to read: "Juveniles abundant/widespread in Nushagak drainage upland flowing waters and in some Kvichak River tributaries downstream of Iliamna Lake; present in some Iliamna Lake tributaries; not recorded in the Lake Clark drainage."

It is true that juvenile Arctic char and juvenile Dolly Varden are difficult to distinguish anywhere, but adults are less so; no change required to Table 5-1.

A sentence explaining why the lack of hatchery fish is important has been added to Section 5.2.1.1. This issue is also discussed in greater detail in Appendix J. Whitefish and pike have been added to the list of sport and subsistence fish species in Section 5.2.1.2.

5.50 In general, fish abundance is reported as either an average from 1956 to 2011 or 1990-2010. Consistency (i.e., one value or the other) is warranted throughout the document except when particular averages are required for comparison to other systems with limited data.

(…) If available, update figures, tables, and text referring to anadromous fish distribution with the 2013 ADFG Anadromous Waters Catalog. Several additions of anadromous distribution where made along the road corridor and in the Chulitna River.

EPA Response: The time periods over which different types of data are available vary, so to only use years for which all data types are available would unnecessarily restrict our analyses. Relevant time periods are reported in the assessment for each type of data used.

5.51 "Chinook salmon are an important subsistence food for resident of the Nushagak River watershed." That is true in the Kvichak as well, even if not as high a percentage of diet by volume which is more or less backed up in p. 5-33.

EPA Response: This point has been clarified in the final assessment.

Senator M. Cantwell et al., United States Senate (Doc. #5815)

5.52 Each year, nearly 40 million sockeye (*Oncorhynchus nerka*) return to Bristol Bay supporting North America's most productive salmon fishery. Bristol Bay is home to the largest sockeye fishery in the world and one of the largest Chinook (*Oncorhynchus tshawytschai* fisheries. The Bristol Bay watershed supports 35 species of fish including all North American salmon species: sockeye, Chinook, coho (*Oncorhynchus kisutchi),* pink (*Oncorhynchus gorbuscha*) and chum (*Oncorhynchus keta*).

EPA Response: Comment noted; no change required.

5.53 To better understand how our economies rely on Bristol Bay salmon, we want to bring a new report to your attention. The University of Alaska Institute of Social and Economic Research (ISER) recently released an economic report quantifying the economic value of the Bristol Bay commercial sockeye fisheries. ISER found that Bristol Bay's economic impact is critical to the regional economy of the Pacific Northwest and on our home states of Washington, Oregon and California. Specifically, the ISER Report demonstrates that the value of commercial fishing activities in the region account for $1.5 billion in output value, including $500 million in direct income. Additionally, Washington, Oregon and California benefit from $674 million in economic activity from Bristol Bay salmon fishing and processing. This economic activity fuels approximately 12,000 seasonal jobs and another 10,000 salmon related industry jobs across the United States, from Alaska to Maine. The Bristol Bay fishery generated the equivalent of nearly 4,400 full-time jobs for Alaskans as well as about 6,000 full-time jobs in Washington, Oregon and California.

EPA Response: See response to Comment 5.30.

5.54 If anyone doubts the devastating impacts of losing salmon fisheries, they need look no further than California. In 2008 and 2009, California's salmon fishing industry lost thousands of jobs, and millions of dollars, due to a catastrophic drop in salmon populations. Today, the state's fishing industry remains closely tied to the health of Bristol Bay, because Californians hold over 140 Bristol Bay fishing permits, the second highest number for any state after Alaska and Washington, and these permits enable over 550 jobs related to salmon fishing. These fishermen – as well as those from Alaska, Washington, and Oregon – cannot risk another salmon fishery collapse.

Our states have a strong maritime history of which our commercial fishing industries are a key part. In order to maintain these direct fishing and processing jobs, and the jobs supported by associated businesses like gear manufacturers, shipbuilders, suppliers and other maritime businesses, we must maintain healthy, sustainable fishery resources.

This new economic report clearly demonstrates that Bristol Bay is an integral component of the broader Alaska and Pacific Northwest seafood industry. Thousands of family wage jobs rely on Bristol Bay's world-class salmon runs. For these reasons, we request that the Administration act to protect Bristol Bay from any large-scale mining that would threaten our Nation's vibrant fishing economy. We support a valid, sound science based approach to ensuring that Bristol Bay salmon are safeguarded. To that end, we respectfully ask that you make staff from both the Council on Environmental Quality and the Department of Commerce available to our staff to discuss the implications of this economic report, and how these two agencies, specifically, are working with the EPA to protect our maritime economies.

<u>EPA Response:</u> See responses to Comments 2.34 and 5.30.

<u>The Nature Conservancy (Doc. #4315)</u>

5.55 Although the document has added a useful analysis concerning the quantity, quality, and diversity of aquatic habitats within the Nushagak River and Kvichak River watersheds, this analysis has not been thoroughly incorporated throughout the assessment to better understand spatially explicit impacts of the risk scenarios on aquatic habitats and their relative contributions to fish populations.

<u>EPA Response:</u> The habitat characterization analysis re-appears in Chapters 7 and 10, where we compare habitat characteristics of stream segments modified and lost to mining activities to the larger watershed contexts. We concur that additional analysis, once fish population productivity estimates are available for different habitat classes, would be extremely useful.

<u>Iliamna Village Council (Doc. #5488)</u>

5.56 Millions of acres of ANCSA surface and subsurface lands hold the keys to sustainable economic development of the area. Bristol Bay Region has one of the highest unemployment and poverty rates in Alaska. Basic infrastructure does not exist between the communities. Closure of Bristol Bay Watershed will stop the progress of ANCSA companies resolving the economic difficulties of the region.

<u>EPA Response:</u> The assessment is not an economic cost-benefit analysis of mining in the Bristol Bay watershed. No change required.

5.57 We cannot support a closure of ANCSA lands, thus harming the purpose of ANCSA to resolve social and economic needs of the Natives living in the villages. "ANCSA has enabled

Natives to participate in the subsequent expansion of Alaska's economy, encouraged to address serious health and welfare problems in Native villages, and sparked a resurgence of interest in the cultural heritage of the Native peoples of Alaska." Thanks to ANCSA subsurface resource development many social programs have been established for Native heritage and cultural preservation, death benefits, special Elder dividends, college scholarships, internships benefits, and jobs.

ANCSA was enacted for "the continued success of the settlement and to guarantee Natives continued participation in decisions affecting their rights and property." Closure of Bristol Bay Watershed will damage the rights of all Alaska Natives to determine resource development projects. The U.S. Government authorized ANCSA yet it is the same government that heeds the progress of ANCSA land management programs. There are numerous federal challenges that have stopped subsurface development on Native lands, such as oil exploration in the North Slope. This new chapter of the Bristol Bay Watershed Study will devalue such Native lands.

<u>EPA Response:</u> The assessment does not discuss or propose "closure" of ANCSA lands. No change required.

5.58 Bristol Bay supports the largest single spawning run of sockeye salmon in the world, and one of the largest single Chinook runs. These generate over $400 million in fisheries revenue each year and support more than 10,000 jobs. However, salmon runs in the Kvichak watershed, especially those involving Iliamna Lake, have been diminished in the recent past and much commercial, sport, and native fishing has been banned.

<u>EPA Response:</u> Comment noted; no change required.

5.59 Forced Closure will stop expansion of tourism projects in our communities. We want to link our communities to support tourism between our communities.

<u>EPA Response:</u> Comment noted; no change required.

5.60 The region also enjoys revenue from sport hunting for big game, especially moose. Sport fishing activities also generate considerable revenue and employment, though this has been virtually eliminated in the region of Iliamna Lake due to the decline in salmon runs (…).

<u>EPA Response:</u> Comment noted; no change required.

5.61 Lastly we want a government-to-government consultation before any decision is made of the Bristol Bay Watershed Study recommendations. lliamna is directly impacted by the Bristol Bay Watershed Study we have become a minority in the decision process that will have profound impact to our lives as Native Peoples. We deserve direct participation. Jurisdiction and procedure shall include the minority under federal law, and in this Bristol Bay Watershed Study our voice, has not been heard. Only the majority, those that do not live in the community are having their voices heard.

<u>EPA Response:</u> EPA has offered tribal consultation and coordination to 31 federally recognized tribal governments in the Bristol Bay region, including the Iliamna Village Council. This assessment is not a regulatory action and does not propose restrictions on development.

5.62 Bulk Fuel Facilities throughout the state of Alaska are owned by ANCSA corporations in their communities. Fuels are for used for heating homes and for subsistence hunting and fishing.

EPA Response: Comment noted; no change required.

Trillium Asset Management, LLC (Doc. #5111)

5.63 For widely diversified investors with long-term investment horizons such as ours (sometimes referred to as "Universal Owners"), the value of our portfolios is dependent in part on sustainable global economic growth. For that reason we are aware of the need for natural resource development to support economic growth as well as the development of clean technologies, which hold the promise of more sustainable economic growth. But we are also concerned that returns could be negatively affected by corporate behavior with negative social and environmental impacts. It is in our interest for our portfolio companies to reduce these risks and also protect our reputations from activities that may tarnish us through association. We therefore believe it is critically important for mining activity to occur only in ecologically and culturally appropriate areas.

We are concerned that if large-scale mining occurs in the Bristol Bay watershed and has the impacts described in the EPA's draft environmental assessment, that it could cast a cloud over mining projects in general – even responsible and safe ones. This has the potential of increasing mining costs generally and may put into question appropriate mining projects. Such occurrences could be destabilizing to the global mining and fishing industries and consequently not helpful for long-term economic growth.

EPA Response: Comment noted; no change required.

Pew Charitable Trusts et al. (Doc. #5655)

5.64 We commend the EPA for fulfilling its responsibilities under the Clean Water Act to determine the impact that large-scale mining could have on the Bristol Bay watershed and the economic future of its salmon fishery that generates an estimated 14,000 full and part-time jobs, valued at about $480 million annually.

EPA Response: Comment noted; no change required.

Center for Science in Public Participation (Doc. #5540)

5.65 The BBWA economics section values the commercial salmon fishery at approximately $300 million and 14,000 full and part-time jobs based on 2009 data. Recommendation: Consider including statistics from the more recent Gnapp et al. (2013), which valued the commercial salmon fishery at $1.5 billion dollars and 10,000 full time jobs.

EPA Response: See response to Comment 5.30.

K. Scribner (Doc. #7882)

5.66 I suggest we use 4,000 years as the amount to use as the surrogate for perpetuity, as this is the length of time the draft Assessment states that humans have depended upon Bristol Bay fishery resources. Note, too, that it is a very conservative number when compared to estimating the number of years contained in perpetuity. A recent study determined the annual value of the Bristol Bay salmon resource as $1.5 billion. Hence, 4,000 years x $1.5 billion/year = $6.0 trillion total. I submit that this value dwarfs the high-end valuation of mine resources of $600 billion, and requires no mitigation or waste management.

<u>EPA Response:</u> Comment noted; no change required.

<u>Weber Sustainability Consulting (Doc. #4319)</u>

5.67 The forests of Bristol Bay would be nutrient-starved were it not for salmon migrations. The importance of salmon as nutrient source to the forest and wetlands ecosystems of the Bristol Bay region has been noted, but underemphasized in our opinion. As bear, eagle and other predators carry many tons of salmon away from the rivers where they are caught, depositing carcasses or digested remains in the forest, they constitute the ecosystem's primary mechanism of nutrient distribution. If these watersheds are deprived of this mechanism, whether through means we have touched on here or those EPA has noted, then this will spell the functional end for most of the natural systems of this huge region.

<u>EPA Response:</u> The importance of marine-derived nutrients in the region is addressed in Chapters 5 and 7.

<u>The Wildlife Society (Doc. #5272)</u>

5.68 As the assessment notes, this is one of the world's best remaining salmon fisheries, which at an average run of 37.5 million fish, constitutes 46% of the world's sockeye salmon. The area is not only known for its fishery, but also supports high densities of water fowl, ptarmigan, brown bear, moose, and caribou that attract hunters from around the world. The assessment correctly identifies the importance of wild salmon to ecosystems in the Bristol Bay watershed. Salmon are a major food source for terrestrial predators such as brown bears, bald eagles, and in some areas wolves. Marine nutrients delivered by salmon directly or indirectly affect nutrient cycles in freshwater and terrestrial ecosystems for a variety of species. Significant reduction in the salmonid food base would likely result in a cascade of changes to multiple species across several trophic levels and habitats.

<u>EPA Response:</u> Comment noted; no change required.

<u>Dr. J. D. Copp (Doc. #4321)</u>

5.69 Beluga whales and migratory waterfowl and shorebirds have significant dependence on the Bristol Bay ecosystem. The large Beluga population on the Bay feeds extensively on Bristol Bay salmon. Massive numbers of the Pacific Flyway's migratory waterfowl and shorebirds rest and feed on Bristol Bay during their annual migration. In addition, six million seabirds nest on the Bay itself each year. The release of toxic materials from Pebble Mine, along with the massive infrastructure required for its development, are guaranteed to negatively impact all these animals. By ignoring the impacts to Belugas and migratory birds, the EPA document significantly under-reports the potential risks from Pebble Mine. Protection of these species is implemented by the [ ] and international Migratory Bird Treaties. While the Beluga population on the Bay is healthy, one could argue that the status of the species is far less so over the full extent of its range. Destruction of the 2,000 Belugas on Bristol Bay by Pebble

Mine would be a non-trivial event relative to the Endangered Species Act. Beyond that, the endangerment of migratory waterfowl, shorebirds, and seabirds, could (and should) invoke protection based upon the international Migratory Bird Treaties. This latter is a matter of interest not just to the Fish and Wildlife Service but the State Department as well. It was a mistake not to cover these matters better coverage in the latest EPA document.

EPA Response: See response to Comment 5.27.

Anonymous (Doc. #6267)

5.70 I feel more attention should be paid to what affects the proposed pebble mine would have on Marine environments. For example it is known that the endangered Western DPS Steller Sea lion prey on salmon and recent telemetry data shows adult female sea lions hanging out in areas of the Bering Sea and Gulf of Alaska where salmon in marine environments are known to reside. It is expected that sea lions prey on these salmon whole they are at sea in these areas. If the mine would affect a huge proportion of Sockeye salmon abundance, the downstream impacts could be devastating to those primary predators in marine environments. I feel the analysis should at least mention these potential impacts with a qualitative discussion on what the range of these impacts could be.

EPA Response: See response to Comment 5.27.

Curyung Tribal Council (Doc. #5754 and #5619)

5.71 Your report makes clear that we cannot wait any longer to protect Bristol Bay's renewable resources. The salmon and the environment, as well as native peoples, sport fishing industry, and commercial fishermen, and many others depend on that protection. Bristol Bay and its healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon. People from all over the world travel to Bristol Bay (or dream of traveling here) to fish for its world-class salmon and trout.

EPA Response: Comment noted; no change required.

Native Village of South Naknek (Doc. #9133)

5.72 Had you consulted with South Naknek, and I believe numerous other villages on the east side of the Kvichak River, you would have learned that our economies have been devastated, and that we welcome new economic opportunities into the region. You could have also learned that as the fishing industry economy collapses, there are fewer and fewer opportunities for the citizens of our villages, our members.

EPA Response: EPA invited 31 federally recognized tribal governments to participate in consultation and coordination process during the development of the Assessment. This included an invitation to the Native Village of South Naknek. The South Naknek Village Council appointed a representative to serve on the Interagency Technical Review Team early in the Assessment development process. EPA also has met with the Tribal President of the South Naknek Village Council and offered additional opportunities for the tribe to participate or request additional meetings with EPA.

Aleknagik Traditional Council (Doc. #2917)

5.73 As I said, the salmon is our staple food, and they start migrating from the Wood River systems, the Nushagak River systems, and the Kvichak River systems between early May to June every year to live as juvenile salmons in the Bays. I do not support any mining and oil development, as the toxic waste can seep through the fragile permafrost spongy tundra flora ruining our traditional edible berries, and lichen, which is also food source for caribou harvested by all Bristol Bay residents. The environmentalists need to consider climate changes which have caused unusual extreme storms, and heavy rains which have affected the freshwater lake streams where salmon spawning habitats are. The recent heavy rains have strong currents, which have caused flash floods washing some fragile salmon egg habitat areas. If the Pebble Mine, for example is developed, it will be an environmental threat to our tribal communities and all in-land watershed areas harming fragile tundra flora dependent as food for human and large land animals. To this day, our Alaska Native people travel to harvest their food resources throughout the Bristol Bay because it is our traditional way of life, and for our spiritual well being in having that special connection with Mother Earth. We want to continue to preserve our traditional way of life to freely harvest our marine mammals, all freshwater fish including salmon species in the freshwater tributaries, and in the marine ecosystem habitat areas into the millennia.

EPA Response: Comment noted; no change required.

Bristol Bay Native Association (Doc. #3106)

5.74 Salmon harvesting is essential to the continued cultural and economic viability of the region’s inhabitants and to the economic wellbeing of the State of Alaska (…).

EPA Response: Comment noted; no change required.

United Tribes of Bristol Bay (Doc. #5275)

5.75 The BBWA conclusively demonstrates that the development of the Pebble mine and associated mineral deposits will threaten the existence of the salmon-based subsistence culture practiced by the Yup’ik Eskimos and Dena’ina Indians of Bristol Bay.

One of the more important additions made to the BBWA is the synthesis of the environmental impact analysis with the established cultural and traditional knowledge of Bristol Bay’s tribal communities. The BBWA’s appendix contains a report from Boraas and Knott (Report) which details many of the traditional hunting, fishing, and religious practices of the tribal communities in the region. Most importantly, the Report describes with precision the threats posed to these traditional practices by changes in the surrounding environment – particularly changes resulting from mineral development. Because a full reiteration of the Report’s contents is unnecessary, UTBB will only highlight the Report’s key findings and discuss how those findings are incorporated into those chapters concerning mineral development Local Government Agencies/Elected Officials.

EPA Response: Comment noted; no change required.

5.76 The Report effectively details the unique nature of the salmon-based subsistence culture practiced by the Yup’ik Eskimos and Dena’ina Indians of Bristol Bay. The Yup’ik Eskimos and Dena'ina Indians of Bristol Bay represent two of the last remaining "salmon cultures" in the world. This salmon culture has gone unbroken for at least 4,000 years. This unbroken link is reflected today in the fact that Bristol Bay salmon consist of nearly 82% of the subsistence diet in the region. One of the strongest portions of the Report is the section detailing the subsistence way of life practiced by Bristol Bay's Yup'ik and Dena'ina residents. A prime example of the Report's thoroughness is its section discussing subsistence and employment. Neither state nor federal labor statistics identify subsistence practices as "employment," thus traditional employment reports show a high level of unemployed residents in the region. However, as the authors correctly point out, the subsistence way of life is already year-round, full time work. Those individuals practicing a subsistence way of life devote innumerable hours per year preparing nets, boats, smokehouses, and other equipment just in preparation for the summer salmon runs. The interviews of residents show that subsistence is viewed as a full time job, while wage employment is viewed more as a method to facilitate subsistence practices. This view of subsistence as full time employment also translates into prevailing views of material wealth. When asked by the authors how they define "wealth" or "riches," fifty out of fifty-three respondents defined it in terms of a full freezer or a good stockpile of subsistence foods. Bristol Bay's Yup'ik and Dena'ina residents consider themselves the richest people in the world.

<u>EPA Response:</u> Comment noted; no change required.

5.77 Beyond just subsistence harvests, salmon also serve an important cultural role. A major theme of the Report is that the Yup'ik and Dena'ina are "salmon people." As one respondent put it, "[s]almon more or less defines this area…. It is who we are; it defines us." This identification as "salmon people" permeates into nearly all aspects of the Yup'ik and Dena'ina culture. It is incorporated into their language, visual art, songs, and dance. This salmon-centric universe is also incorporated into Christian religious teachings. The Russian Orthodox Church – the predominate religion in the region – integrates several salmon ceremonies into church doctrine and instruction. Annual salmon-based Orthodox practices include the "First Salmon Ceremony" and the "Blessing of the Waters Ceremony." These examples are only a small sampling of the salmon-centric culture that exists in Bristol Bay, but they demonstrate the unique value that the five species of Pacific salmon have to the region's Native people. Salmon are more than just a food source. They are the foundation of an entire culture which has existed with little interruption for nearly 4,000 years. If the local interviews demonstrate anything, it is that the salmon-based culture described above is one that the Native people of Bristol Bay desire to keep.

<u>EPA Response:</u> Comment noted; no change required.

<u>Kachemak Bay Conservation Society (Doc. #1118)</u>

5.78 In the Bristol Bay region, salmon constitute approximately 52% of the subsistence harvest, and for some communities this proportion is substantially higher.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Community Action on Toxics (Doc. #5541)</u>

5.79 The cultures of Bristol Bay – Yup'ik and Dena'ina – are two of the last intact, sustainable, salmon-based cultures in the world. These cultures have maintained a connection to the lands and waters of Bristol Bay for thousands of years. The development of large scale mining could clearly impact the cultural life-ways dependent upon salmon and therefore have significant impacts on community and cultural health.

<u>EPA Response:</u> Comment noted; no change required.

Chapter 6: Mine Scenarios

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

6.1 The revised Assessment includes more data from the PLP Environmental Baseline Document (EBD), but EPA only used the PLP data in the absence of other data. EPA acknowledges that the 'potentially largest source of uncertainty in [water balance] calculations is the net balance of water from groundwater sources.' The modeling described in Box 6-2 of the Assessment (page 6-25), Mine Pit Drawdown Calculations, is inadequate to determine the impact of drawdown at a mine pit for the purpose of a risk analysis.

<u>EPA Response:</u> It is incorrect to state that we used EBD data only when other data were not available, and this misstatement has been corrected in the final assessment. Section 2.1.1 has been revised to more clearly explain the use of non-peer-reviewed data (including those in the EBD) in the assessment.

The original purpose of our pit drawdown calculations was to estimate how much water would come from the pit for the water balance. Our estimate closely matches the estimate reported in Ghaffari et al. (2011). Our cone of depression does not consider all of the details of local topography and geology, but provides a reasonable estimate of the dewatered area, which is in turn used to estimate the length of streams affected.

Although the assessment does say that the net balance of water from groundwater sources is "potentially the largest source of uncertainty in these calculations," the specific calculations listed are "estimates of the amount of water needed to support mining operations, the amount of water delivered to the site via precipitation, the amount of water lost due to evaporation, and the net balance of water to and from groundwater sources." The other three items are comparably easy to estimate.

6.2 Northern Dynasty filed the NI 43-101 as part of disclosure to potential investors and it is intended to be an economic analysis, not a comprehensive environmental planning document. It represents the view of only one of the two PLP partners at that time. It is not a mine plan and would not be a principal support document for state agencies to review for any proposed Pebble mine. The documents upon which the state agencies would base permitting decisions is the actual mine proposal, supporting documents and baseline information, a Clean Water Act Section 404 permit application, the environmental impact statement (EIS), developed by a federal lead agency under the guidelines of the National Environmental Policy Act (NEPA), and any other associated permit applications. The use of an investor document as EPA's principal technical description of proposed mining on the Pebble claims is scientifically and technically unjustifiable.

<u>EPA Response:</u> The scenarios evaluated in the assessment are based on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), which are described as "permittable" and assume the use of modern conventional mining methods, technologies, and mitigation measures and compliance with current regulatory standards. Thus, these scenarios are realistic estimates for the types of mines that would be developed in the region. Although the specific location of mine components and operational details may ultimately differ slightly from those used in the assessment scenarios, this would be also be true of any assessment conducted for any submitted mine plan.

<u>Alaska State Legislature – Representative M. Costello (Doc. #5814)</u>

6.3 I remain deeply concerned and discouraged by this assessment. This assessment should not have been conducted at all until the appropriate time during the state and federal permitting process of a specific project. The hypothetical mining scenario used by the EPA in this assessment fails to meet basic U.S. environmental and engineering standards. The State of Alaska would never permit this hypothetical mine and a company would be foolish to invest in its proposal. This assessment lays the groundwork to bar twenty-two thousand square miles of Alaska from mining development, based on an assessment of an implausible and untenable scenario.

<u>EPA Response:</u> See response to Comment 6.2.

<u>Iliamna Village Council (Doc. #5784)</u>

6.4 The USEPA report divides the likely permitting possibilities for the Pebble mine into three separate scenarios involving three different tonnages of extracted ore. The smallest involves removal and processing of 0.25 billion tons of ore, the second 2.0 billion tons of ore, and the third and largest involves 6.5 billion tons of ore. These three scenarios involve mine lifetimes of 20, 25 and 78 years respectively. Since it is, to me, unlikely that all of the infrastructure, equipment and construction will be accomplished for the smallest of these projected mine sizes, even though this would be quite profitable for the partnership companies, only the larger two have relevance with respect to potential benefits and disadvantages of the proposed mine. It is likely that permitting approval for the smallest of these projects would only be preliminary to approval of the larger two.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

6.5 Detailed discussion of these additional infrastructure needs would make this report unduly long and difficult, but it should be noted again that the cumulative footprint of a large-scale mine at the Pebble deposit likely would be much larger than the footprints evaluated the discussions above. Just in terms of physical area involved, the footprint and operational infrastructure for a 25-year mine at the Pebble deposit (similar to the Pebble 2.0 scenario) would cover approximately 50 square miles! In comparison, the limited number of components considered in this report (pit, waste rock piles, transportation corridor and tailings disposal facility) would cover only about 13 square miles under the Pebble 2.0 scenario. Some additional facts about the Pebble 2.0 mine scenario:

- Net power generation for such a mine would be approximately 378 megawatts. This is more than 100 times the maximum electrical load of the largest population center in the Bristol Bay watershed, the Dillingham/Aleknagik area.
- Dormitories for such a mine would house 2,150 people during construction and more than 1,000 people during mine operation, meaning that the mine site would rival Dillingham as the largest population center in the Bristol Bay watershed during construction and would remain the second largest population center during operation.
- The mine site itself, independent of the transportation corridor, is expected to contain more than 12 miles of main roads, as well as numerous pit and access roads, and would depend on a fleet of 50 to 100 vehicles, in addition to approximately 150 or more large, ore-hauling trucks. It should also be briefly noted that the construction and operation of the Pebble will provide infrastructure that could facilitate opening and operation of several other mining claims in the Nushagak and Kvichak watersheds. This would increase the area of environmental damage and the associated loss of salmon spawning habitat.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

6.6 The transportation corridor will also contain pipelines: one to carry the copper/gold concentrate slurry to the port, another to carry the water removed from this slurry back to the mine. Pipelines will also carry diesel fuel and natural gas to the mine site. Rupture or leakage from any of these pipelines, with the exception of the natural gas pipeline, could cause considerable additional damage to the streams in the vicinity, or more directly to Lake Iliamna. It is almost impossible to get an accurate estimate about the probable rate of truck accidents or pipeline failures. When these happen they will undoubtedly add to the already serious effects of the transportation corridor.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

6.7 Effects on water quality and salmon spawning habitat due to normal mining activities can come from a number of factors related to the actual operation of the mine. The most straightforward of these includes stream and river sections that will be physically eliminated due to the placement of the mine itself and associated mine features such as waste rock piles, the tailings disposal dam, electric power generating plant, milling and flotation pants, equipment storage and repair facilities, transportation corridors and pipeline routes. For the Pebble 2.0 plan, this would involve about 18 square miles of direct “footprint.” For the Pebble 2.0 mine plan, 56 miles of stream channel would be eliminated, blocked, or dewatered by the mine footprint, along with destruction of about 5 square miles of wetland area. These numbers are unavoidable losses, and do not include any chemical or biological changes that may or will be caused by mine operation and potential accidents or equipment failures.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

6.8 The tailings storage facility is a huge dam/reservoir designed to hold forever the very fine waste rock from the milling and flotation processes. As detailed above in the introduction

(The Pebble Deposit and Proposed Mine), this facility will be enormous. During the mine operation it will be continually fil[l]ed with slurries from the milling and flotation processes. As the solids settle, water will be pumped back into the mining operations for reuse. The best-case scenario here is that the overlying water layer will protect the fine tailings from exposure to oxygen, thereby preventing the release of acidity and metals. As the operation of the mine continues, the dam will be filling with increasing amounts of fine tailings with a relatively constant amount of water overlying the tailings. When the mine closes (in the Pebble 2.0 scenario, this will be after about 25 years of operation), the huge tailings dam will be filled with fine particles from the mining operations. There will also be an overlying layer of water. This water will be quite contaminated with metal ions and other chemicals from the years of re-use in the mining operations. This will work satisfactorily as long as nothing causes the dam to breach. The most likely cause of dam failure would be an earthquake or a major storm event that could overfill the dam and cause overflow of contaminated water into the surrounding countryside. Tailings dam failure during the lifetime of the mine is a very low probability event. However, if it occurs, it would be a major disaster for miles and miles of salmon habitat, wetlands, and Bristol Bay itself.

EPA Response: Doc. #5837 rescinded this comment; no change required.

6.9 Waste rock here refers to the overburden (rocks above the mineral deposit) of surface rock and ore containing small, un-economical concentrations of porphyry material. This rock will be piled near the mine pit. Rain and snowmelt will constantly percolate through these rock piles and either flow over the ground surface to wetlands and or streams, or percolate into regional groundwater. The waste rock from near the land surface does not contain significant porphyry material and is of little or no concern with respect to the generation of pollutants. The rock characteristics gradually change with the depth of origin to rocks that are marginal with respect to porphyry content that is economically viable.

All of these waste rocks are classified according to their potential to produce acid, and thus metal contaminants, upon exposure to atmospheric oxygen and water. Rocks that will not generate acid are classified as non-acid generating (NAG), and those that have the potential to generate acid are designated as potential acid-generating (PAG). The table presented above the amount of NAG and PAG rocks predicted to be present in the overburden that constitutes the waste rock in the Pebble 2.0 scenario.

It is probably prudent at this point to define what is meant by acid-generating. When sulfide minerals in porphyry rocks react with oxygen, one product is sulfuric acid. In the process of this oxidation, metals ions originally present as insoluble sulfides are converted to dissolved metal sulfates. In addition, acid generation lowers the pH of the receiving water, rendering most metals more soluble and potentially more toxic. However, if the rock under considerations also contains acid-neutralizing minerals such as limestone, the net effect of exposure to water and atmospheric oxygen will not produce acid or additional dissolved metals. Based on this geochemistry and laboratory tests of small samples, rocks are classified as NAG or PAG.

Two additional points are relevant. First, classification of rock samples as NAG or PAG are made using analyses of small samples that were selected to be representative of a large body of waste rock. If the sample selected was not completely representative of the larger body of rocks, which is likely, the classification may not apply to the entire body of rocks. The second point concerns the fact that, as rocks are exposed to the atmosphere, as in waste rock piles, NAG rocks can be converted by aging processes to PAG. Thus the designations in the table above as to the amount of NAG and PAG rocks in the waste rock are subject to possible change as the waste rock piles age. No investigations of aged waste rocks were reported in the USEPA document.

It would be extremely difficult to capture and treat the diffuse runoff and flow-through from the waste rock piles. Infiltration of this effluent into local waters is, in my opinion, inevitable. Thus, the waste rock present in the Pebble 2.0 scenario represents a huge potential and probable source of copper and other metal contamination. This contamination could be expected to enter the watersheds immediately adjacent to the mine site, potentially rendering additional miles of stream and river unacceptable for salmon spawning habitat.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

6.10 The three Pebble Mine scenarios considered in the Revised Assessment are based on the preliminary mine details put forth in the Wardrop report and incorporate information from scientific and industry literature from mines around the world. The Revised Assessment utilizes these scenarios to provide a better understanding of the potential range of risks and impacts associated with a particular scale of proposed action. Inclusion of the 0.25 billion ton scenario analysis – a mining scenario that is likely uneconomical to develop in such a remote area – allows EPA to include an extremely down-sized assessment of impacts to the Bristol Bay watershed.

<u>EPA Response:</u> Comment noted; no change required.

6.11 The Revised Assessment is improved in that it includes more scientific information concerning Bristol Bay fisheries and aquatic habitat. The following are a few examples. The Revised Assessment contains: (…) A better discussion of mine-induced changes to hydrologic connectivity between wetlands, groundwater, and surface water and the impacts of dewatering to aquatic habitats, including quantification of negative impacts on stream temperature and cold water refugia habitat in upper stream reaches.

<u>EPA Response:</u> Comment noted; no change required.

6.12 BBNC notes that the Revised Assessment devotes little attention to the feasibility and specifics of post-closure reclamation, which would be extremely difficult for a mine like the proposed Pebble mine. The assessment thus remains conservative in this regard as well.

<u>EPA Response:</u> The comment is correct. Post-closure reclamation is mentioned, but a detailed reclamation scenario was not developed or analyzed because it was considered outside the scope of this assessment.

6.13 BBNC thanks EPA for acknowledging its use of conservative cumulative impact assumptions and would like to point out that EPA's estimations of cumulative impacts on habitat from multiple mines remain conservative quantifications.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Miners Association (Doc. #2910)</u>

6.14 Fundamental Flaw: EPA's hypothetical mine does not represent any large mine. It doesn't represent Pebble. AMA cannot determine what the hypothetical mine is intended to represent. AMA research demonstrates that copper porphyry deposits are not representative of other deposits in the region, and that even copper porphyry deposits vary greatly. Further the hypothetical mine uses a non-representative geochemical make-up, uses a location that is not representative of Bristol Bay, and omits mitigation and prevention strategies likely to be used by other large mines in Bristol Bay. For those reasons, EPA's hypothetical mine cannot pretend to represent any large mine, they are all different. In addition, it cannot even represent any copper porphyry mine. The differences between them are too great. Therefore, the hypothetical mine cannot reasonably represent any mine except Pebble. But the hypothetical mine does not represent Pebble either. Pebble Limited Partnership has publically stated that they will not propose the mine that EPA is using as its hypothetical mine. The State of Alaska, AMA, and others have told EPA that its hypothetical mine fails to meet Alaska's permitting standards and would not be allowed. EPA's mine omits prevention and mitigation strategies that Pebble would likely propose and that the government would certainly require. It is not reasonable to forecast Pebble's impacts from a mine that Pebble won't propose, that the state would not permit if they did propose it, and that lacks strategies to prevent and mitigate impacts. The hypothetical mine does not represent the impacts from Pebble. If EPA's hypothetical mine does represent all large mines that could be proposed in Bristol Bay; if EPA's hypothetical mine does not represent any porphyry copper mine that could be proposed in Bristol Bay; and if EPA's hypothetical mine does not represent Pebble, then what does it represent? *The answer: the EPA's hypothetical mine represents <u>nothing</u>.* The impacts are not necessarily representative of any mine in the region, any porphyry copper mine, or Pebble. Therefore, predictions from the Bristol Bay Watershed Assessment are meaningless.

<u>EPA Response:</u> See response to Comment 6.2.

6.15 Error #1: status unclear. Copper Porphyry deposits are not representative of other mineral deposits in the Bristol Bay Watershed (2012 TR pages 3-5). The 2012 technical review documented the number and diversity of potential deposits in Bristol Bay. The EPA's 2013 draft is ambiguous about whether the hypothetical mine could represent the impacts of any large mine, any mine with disseminated ore, or Pebble. (As noted previously, in fact, it represents none). However, Error 1 in the AMA 2012 review describes why copper porphyry deposits are not representative of other mineral deposits in the Bristol Bay Watershed. We could find no response in the 2013 draft to this critique. We cannot determine the significance of this error, because we cannot determine whether the EPA draft asserts that the impacts from its hypothetical mine is intended to represent those from all potential mines, all copper porphyry mines, or just Pebble.

<u>EPA Response:</u> The assessment evaluates potential effects of porphyry copper mining at the Pebble deposit on the surrounding watersheds. Other deposits are considered in Chapter 13, but only in terms of potential mine footprints at those deposits. We acknowledge that the assessment of deposits other than Pebble is more uncertain. However, it is essential to recognize that Pebble is not the only deposit in the region that might be developed.

6.16 Error #2: partially addressed. EPA's hypothetical mine overestimates the size of likely mines in the Bristol Bay watershed. (2012 TR, pages 6-8.). AMA's review of EPA's 2012 hypothetical mine documented that is more than 5 times larger than the average open-pit mine in Alaska and British Columbia, and more than 4 times larger than the average copper mine in Alaska and British Columbia. It may or may not accurately represent the disturbance area of Pebble, but it is unlikely to accurately represent the disturbance area of any other large mine that may be proposed in the Bristol Bay watershed at some future date. We appreciate that EPA added a smaller alternative, though their write-up de-emphasized that alterative. The vast majority of impacts and discussion in the 2013 draft is focused on the larger alternatives. EPA's 2013 draft should be changed to emphasize that likely smaller size, at least for mines other than Pebble.

<u>EPA Response:</u> We agree that the scenarios, particularly the largest scenario, represent significantly larger mines than are currently found in Alaska and British Columbia. However, the Pebble deposit is significantly larger than all other deposits in the region, and the mine size scenarios are reasonable (and may even be conservative) given potential deposit size. In addition, these mine size scenarios are described by Northern Dynasty Minerals in Ghaffari et al. (2011), which also supports their plausibility. The assessment of risks from other deposits is based on the smallest mine size scenario, so the suggested change has been implemented.

6.17 Error #4: not addressed. EPA's hypothetical mine uses a non-representative geochemical make-up (2012 TR page, 9-11). There is no "typical" geochemical make-up for a metal ore that would be representative of all ores within the region. Therefore, the geochemistry of the Pebble deposit cannot be used to represent the geochemistry or geochemical risks of other deposits in the area. In addition, as the Assessment itself indicates, the geochemical risk is dependent on particular design parameters. Therefore, the geochemical risks of the hypothetical mine may not even represent Pebble, and definitely not represent other potential projects. We have mentioned previously that we cannot figure out what the hypothetical mine is supposed to represent. But if it is intended to represent any mine other than Pebble, using a non-representative geochemical make-up is a serious source of error. EPA completely ignored this critique in the 2013 draft.

<u>EPA Response:</u> See responses to Comments 6.2 and 6.15.

6.18 Error #5: not addressed. EPA's hypothetical mine omits mitigation and prevention strategies likely to be used by other large mines in Bristol Bay (2012 TR page 11). It is not possible to predict the design including mitigation and prevention techniques that will be used to protect the environment from mining of an ore deposit that has not yet been discovered. Given the large variety of techniques, it would be impossible for any as-yet undesigned mine to use exactly the set of mitigation/prevention strategies that EPA assumes in its hypothetical mine (although EPA used few strategies in its mine). Therefore the hypothetical mine cannot represent other mines in the Bristol Bay watershed. To the extent that EPA's hypothetical mine is intended to represent any mine other than Pebble, this is a significant source of error, yet EPA ignored this critique in their 2013 draft.

<u>EPA Response:</u> We disagree with this comment. The scenarios evaluated in the revised assessment assume the use of modern conventional mining methods and technologies,

largely as detailed by Northern Dynasty Minerals in Ghaffari et al. (2011). The assessment then evaluates unavoidable impacts that likely would result from the mine footprint and potential impacts that could result if specific components of the mine—despite modern conventional methods and technologies—were to fail.

6.19 Error #7: not addressed. EPA's hypothetical mine does not meet permitting standards. Therefore, it cannot represent realistic mine impacts for the watershed (2012 TR, page 13-14). AMA's 2012 technical review documented the reasons why the hypothetical mine does not meet Alaska's permitting standards and would not be authorized. Clearly, impacts from an unpermittable mine are not accurate. This error has been repeatedly pointed out, yet EPA's 2013 document ignores it.

<u>**EPA Response:**</u> **See response to Comment 6.2.**

6.20 Error #3: not addressed. EPA's hypothetical mine uses a non-representative location (2012 TR, page 8). A simple GIS analysis completed for AMA's 2012 technical review indicates that the location selected for the EPA hypothetical mine, including tailings and waste rock, is likely to impact significantly more anadromous fish stream habitat than other potential locations in the Bristol Bay watershed. Therefore, EPA's hypothetical mine cannot be used to estimate impacts for any potential mines in Bristol Bay, including Pebble if they should use different locations for tailings or waste rock. That is, if the hypothetical mine uses a non-representative location, then the impacts are incorrect. We could find no response to this critique in EPA's 2013 draft. EPA ignored this important source of error.

<u>**EPA Response:**</u> **We based the locations of the pit, tailings impoundments, and waste rock piles on the plan put forth by Northern Dynasty Minerals in Ghaffari et al. (2011) and their own analysis of the site. The pit is necessarily located on the ore deposit. We believe it unlikely that the waste rock would be hauled away from the vicinity of the pit. The tailings impoundments were placed at locations that provided suitable topography without incurring the cost of very long pipelines and extensive support facilities.**

6.21 Error #26: not addressed. Some locations are less risky than that of the hypothetical mine (2012 TR, page 28). The 2012 AMA review noted that some locations are less risky and have less consequence than those of EPA's hypothetical mine. Therefore, the impacts from dam failure in EPA's hypothetical mine do not represent the impacts of other locations. This means that the watershed assessment does not represent the potential impacts of other mines in the region, and does not represent the impacts of other locations that could be potentially chosen by Pebble. Despite the fact that this is a serious source of error and AMA pointed it out in its 2012 comments, EPA's 2013 draft failed to acknowledge this source of error or make any changes.

<u>**EPA Response:**</u> **We agree that some locations are less risky but also recognize that some locations are more risky. In the absence of detailed information on the locations of other deposits, the Pebble site serves as a surrogate for other sites.**

6.22 Error #11: partially addressed. The Assessment lacks a realistic water budget. AMA's 2012 technical review pointed out that EPA's 2012 draft lacked a realistic water budget. EPA did include a water budget in their 2013 draft. While the summary appears reasonable, the water budget is not in the detail that is typical of an actual mine proposal water budget. More importantly, it does not allow for innovative strategies that would reduce or mitigate for the water withdrawal, and therefore may not be representative of either Pebble or any other mine in the region. (See also 2012 TR, page 15-16)

EPA Response: The water balance developed for the assessment is sufficient to assess potential effects of the mine scenarios and is not meant to substitute for the water balance in a detailed mine plan. The water balance is based in large part on information presented by Northern Dynasty Minerals in Ghaffari et al. (2011).

6.23 Error #6: not addressed. EPA omits mitigation and prevention strategies that would eliminate or significantly reduce the impacts it predicts for its hypothetical mine (2012 TR, pages 11-13). The 2012 technical review references some design changes that would eliminate or reduce impacts that the Assessment predicts. These include dry tailings closure and moving the location of the product pipeline, among others. Indeed, some of the recommendations in EPA's own draft noted prevention/mitigation strategies that would eliminate or reduce some of the risks. Yet EPA failed to include those prevention/mitigation strategies, and only presented the risk without them. The 2013 draft also failed to include these. In addition, AMA's 2012 review showed that many as-yet- unknown prevention and mitigation strategies would likely be developed through the permitting process. Impacts predicted prior to the imposition of these strategies would not be accurate. This is a huge source of error in EPA's predictions and yet EPA continues to ignore this critique.

EPA Response: See response to Comment 6.2.

6.24 Error #25: not addressed. Assumption of a dam; assumption of a wet closure reclamation plan. (2012 TR, page 28). AMA noted mine designs that would eliminate the potential for dam failures, and noted that the 2012 Assessment acknowledged this possibility. EPA's 2012 and 2013 drafts fail to include the possibility of those potential designs in its assessment without explaining why.

EPA Response: Section 4.2.3.4 of the revised assessment discusses tailings storage, including dry stack tailings management. We presume that the team of engineers and scientists who prepared Ghaffari et al. (2011) considered many options for each facility and its components (including mining methods, process design options, waste rock management options, tailings management options, shipment of product) and selected the most favorable based on technical, economic, and environmental concerns. The assessment scenarios incorporate many of the design features proposed by Ghaffari et al. (2011) because those were among the most likely to be proposed by a mining company.

Resource Development Council for Alaska (Doc. #2912)

6.25 The revised assessment remains significantly flawed since it continues to refer to a hypothetical mine, and outdated mining techniques. Although the revised BBA has fewer references to old practices, the report still fails to incorporate current high tech and state-of-the-art mining practices and regulatory requirements.

EPA Response: See response to Comment 6.2.

<u>Northern Dynasty Minerals Ltd. (Doc. #3650)</u>

6.26 In both 2012 and 2013, the authors failed to consider that modern mining practices are designed to reduce the probability of failures of these engineered systems to some established standard of safety, and to minimize the consequences of any failure scenario with the use of modern monitoring systems, contingency planning as part of a mining operations plan, and the establishment of response systems and strategies to control quickly any releases of hazardous materials at the mine site. By omitting the application of modern mine operating best practices designed to reduce the probability of failures and to mitigate quickly the consequences of such failures, the BBWA is clearly biased towards influencing decisions on the fate of the project by implicitly assuming "worst case" outcomes for operation of most of the engineered systems at the future mine site are inevitable.

<u>EPA Response:</u> See response to Comment 6.2. The assessment does not state or suggest that worst-case outcomes are inevitable.

6.27 Geosyntec's 2012 comments remain unchanged. The assumption on the quality of mining practices (i.e., good versus best) that may be applied at a future mine in the Bristol Bay watershed is purely speculative and biases the BBWA. Ultimately, the operational practices will have to conform to a plan approved by the oversight regulatory agencies, and will be designed to meet the unique requirements of the site. All indications are that Pebble will be designed to "best" practices, and yet the 2013 Assessment has not changed their mine scenario to match.

<u>EPA Response:</u> See response to Comment 6.2.

6.28 The BBWA continues to be particularly misleading in addressing the issue of system failures through the use of data on past mining operations to imply by analogy that it is scientifically appropriate to realistically assess the probabilities of system failures. The USEPA has applied this approach for all system elements evaluated in the BBWA, including TSFs, pipelines, culverts, water collection and treatment systems and post closure residuals management systems. The document reflects either an intentional or an uninformed misapplication of modern engineering design principles that would be applied under stringent regulatory oversight, particularly when significant projects are implemented in sensitive ecosystems.

<u>EPA Response:</u> It is standard risk assessment practice to provide an estimate of the frequency of failure as a base estimate of the probability of failure. The likelihood of lower probabilities due to improved engineering practices is acknowledged in the assessment. We do not agree that it is "misleading" to imply "that it is scientifically appropriate to realistically assess the probabilities of system failures."

It is not biased to point out that the major features of a mine (pit, waste rock, and tailings) would persist in perpetuity. The record of mining environmental failures and permit violations demonstrates that operation in perpetuity is doubtful, if not impossible to meet.

6.29 (…) overtopping is a leading cause of dam failure. As such, even though the probability of failure is low, it is selected as the triggering mechanism for a dam breach at a hypothetical Pebble mine. Based on the probable maximum precipitation (PMP) storm event presented in Box 9-3 (pg 9-14) of the 2013 Assessment, the water surface elevation in the TSF would increase by 0.36 m in the Pebble 2.0 Scenario (Table 6.1, pg 6-10). This increase would be the catalyst for a dam breach by overtopping. With a Pebble 2.0 TSF dam height of 209 m, the 0.36 m freeboard requirement is extremely small (0.2% of the TSF dam height). This freeboard requirement to manage the probable maximum flood (PMF) generated from the PMP will likely be far exceeded in design and operation of the TSF dam, where freeboards will likely be several meters. (…) The 2013 Assessment is therefore basing their dam failure analysis on an extremely improbable event, once again demonstrating the bias in the report.

EPA Response: The assessment clearly acknowledges that a tailings dam failure is an extremely improbable event. However, the contention that overtopping does not occur because adequate freeboard is maintained is refuted by the recent overtopping of the Nixon Fork Mine dam. The effects of a tailings dam breach would be similar whether the breach was triggered by extreme precipitation, slope instability, erosion, foundation failure, or an earthquake, although downstream transport of tailings could be reduced in a dry weather failure with no precipitation generating additional flow.

6.30 The reference to no water treatment being used post-closure is removed from this figure [Figure 6.5]. However, as described previously, the 2013 Assessment continues to make reference to untreated leachate being discharged in perpetuity.

EPA Response: Some leachate would escape capture and treatment and that would continue in perpetuity, even if water treatment continued in perpetuity.

6.31 As per the Geosyntec 2012 report, including these examples in the Assessment continues to suggest the reopening of the Gibraltar mine under a new permit or modifying the discharge permit for the Fort Knox mine was inappropriate. The addition of the Fort Knox example to the 2013 Assessment serves to reinforce the bias in the report. Updates to the permits are appropriate based on new information and an improved understanding of the risks associated with discharge to the receiving environment. Stakeholder consultation and regulatory approval is required before any such alteration of the discharge permit could take place. This statement overlooks the process that is required to obtain approval of any changes to permit conditions, which includes careful analysis by the lead regulatory agency.

EPA Response: The comment is incorrect. Fort Knox did not get a modified discharge permit. The operators received a new permit to discharge—one they did not have before and one that, when they started mining, they said they would not need. Regardless, the comment does not contradict the assessment. Permits are modified to allow mines to reopen or continue operating.

Alaska Oil and Gas Association (Doc. #5485)

6.32 Assessment creates a hypothetical mine with support facilities, including a water treatment plant and tailing storage facility, designed for a worst-case failure scenario. As AMA's May 29, 2013 comments indicate, the hypothetical mine EPA assesses "would never be permitted, let alone proposed." The assessment should have included the modern, regulated, and responsible operations that the Pebble Project intends to employ. By failing to incorporate applicable state of the art engineering practices and current regulatory and mitigation requirements that ensure protection to the surrounding environment, EPA's conclusions in the assessment are arbitrary and misleading.

EPA Response: **See response to Comment 6.2. The scenarios are not designed to fail, but the assessment does evaluate potential consequences should failures occur.**

The Pebble Limited Partnership (Doc. #5535)

6.33 EPA claims that 'best practices' and modem practices have been used and that it has discounted some of the older mine sites (e.g., the Coeur D'Alene mines) but those claimed changes are not evidenced by the Assessment. The assumed controls are not regarded as 'good practice.' In particular, the mining, transportation, water management, and pipeline scenarios continue to assume construction and routine operations that will not meet current regulatory requirements.

EPA Response: **See responses to Comments 2.15 and 6.2.**

6.34 The mine scenarios presented in the Assessment do not reflect worldwide industry standards for porphyry copper mining. Throughout the document, EPA presumes a level of environmental performance by the mining industry that is erroneous: it would violate current State of Alaska and federal laws. Contrary to statements in Chapter 6 of the report (page 6-1, par. 2), the three mine scenarios do not represent realistic or plausible descriptions of potential mine development alternatives, and they are not consistent with current engineering practice and precedent.

The three mine size scenarios examined in the Assessment, referred to in the assessment as 'Pebble 0.25", "Pebble 2.0", and "Pebble 6.5" do not reflect specific preliminary mine plans submitted to state and federal agencies related to the Pebble Mine project. EPA promotes the gross misperception that the Assessment directly addresses a specific project and bases every finding and conclusion in the Assessment on a hypothetical Pebble mine design; which is contrary to the statement in the assessment that "It is not an assessment of a specific mine proposal for development". (…) This alone is a fatal flaw of the Assessment.

EPA Response: **The assessment states (p. 6-1) that "The word Pebble in the names of the scenarios represents the fact that we place our scenarios at the Pebble deposit." These scenarios are not and were not intended to be identical to specific mine plans submitted for the Pebble Mine project (as the comment notes). However, much of the information about the deposit and the anticipated modern conventional mining methods (including mitigation measures) is derived from the preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), which are described as "permittable." These facts are presented clearly in the assessment.**

6.35 The Assessment makes many invalid assumptions about tailings storage operations, and in particular about water and waste management practices. It ignores the fact that standard mining practices and designs include seepage control measures that are monitored and maintained; it goes as far to assume that water would be directly discharged to streams even if water quality standards are not met. The permit would not allow such a discharge. It makes estimates of total seepage rates for different assumed mine scenarios, which do not account for seepage control features that would be part of any new tailings storage facility (TSF) dam design in Alaska.

<u>EPA Response:</u> The assessment does not state that discharges not meeting water quality standards would be allowed. The assessment evaluates the likely impacts of the presented scenarios, which are based largely on the preliminary designs put forth by Northern Dynasty Minerals in Ghaffari et al (2011). Where aspects of the design are assessed to be inadequate, we would expect that additional design features or mitigation measures would be included in any future mine proposal.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

6.36 The Assessment distorts the scale of the hypothetical mine scenarios, and the associated hypothetical impacts, which results in a lack of critical context for its quantitative conclusions and misleads the reader regarding the significance of its findings.

<u>EPA Response:</u> See response to Comment 2.18.

6.37 The Assessment also describes impacts in terms of loss of stream channel length and wetlands areas, altered stream flows, and indirect impacts to streams and wetlands for various hypothetical mine scenarios. The Assessment does not, however, put these losses into any kind of perspective or characterize these habitats in terms of the proportion of the total resource base that they represent.

For example, the Assessment predicts the loss of 145 km of streams (under the Pebble 6.5 Scenario). The Assessment fails to explain that this loss represents only 0.3% of the 53,000 km of stream channel in the Nushagak and Kvichak watersheds, and even less in the entire Bristol Bay watershed. The predicted loss of anadromous fish habitat would be substantially less since the Assessment indicates that only 35 km of the 145 km of streams predicted to be lost under Pebble Scenario 6.5 are anadromous fish habitat.

The EPA should have included a comparative analysis at each of the five spatial scales comparing the quantity of anadromous fish habitat impacted with the total anadromous habitat available at each respective scale. This comparative analysis would quickly demonstrate that the impacted habitat is less than 1% of total habitat available at the Bristol Bay scale and possibly even at the Nushagak scale.

<u>EPA Response:</u> See response to Comment 2.18.

6.38 The Assessment is based on a hypothetical mine scenario that does not include avoidance, minimization, and mitigation methods. Development activities in wetlands and other water bodies are regulated through federal environmental laws and policies. This process outlines specific requirements to ensure the project addresses potential impacts to wetlands resources, including a requirement to offset those impacts through compensatory mitigation plans. Wetlands mitigation planning and protection and enhancement of fish habitat are related efforts and often focus on stream flow changes. Defining an acceptable, environmentally sound water management plan is but one of many requirements that must be met before approvals are granted to develop a project. The water management plan is usually founded on the protection, mitigation and/or enhancement of fish habitat. None of these critical aspects of development projects were incorporated in the Assessment’s hypothetical scenario.

<u>EPA Response:</u> See response to Comment 6.2. Although a detailed water management plan is beyond the scope of this assessment, the assessment does consider changes in

water flow and contaminant concentrations on an annual time scale. We would expect that a detailed water management plan would optimize release locations, timing, and flow rates to minimize negative impacts from the mine.

The potential for compensatory mitigation is addressed in Box 7-2 and Appendix J. The assessment considers risks at the sites in question. Even if compensatory mitigation were to occur elsewhere in the watershed, the risks in this particular area would remain the same.

6.39 In addition to the failure to incorporate modem construction standards and appropriate mitigation measures, the document continues to assume that a mine cannot be adequately closed. Some discussion of Alaska's bonding requirements has been added in a text box, but the text in Section 6.3 presumes that some closure issues will be unresolvable, implying that adequate bonding will not be available. It is unrealistic to assume that any mine with unresolvable closure issues would be permitted within the State of Alaska. The ability to successfully close a mine is a critical performance measure in the permitting process. Given the State of Alaska's permitting and bonding requirements, the assumed unresolvable closure issues are not realistic. These unrealistic assumptions affect the entire assessment: conclusions regarding effects of mine development on fish, wildlife, cultural resources, and water quality all assume long-term issues related to failure to adequately close the mine.

<u>EPA Response:</u> **Section 6.3 does not state that some closure issues will be unresolvable, although it does point out issues of potential concern and the uncertainties associated with closure mitigation measures. A risk assessment must consider the possibility that things may not happen as intended. Closing a mine entails more than re-grading and re-vegetating the land. There is little doubt that these activities can be accomplished over a relatively short period of time. Most uncertainty arises over water quality issues at the site. The tailings would need a water cover to avoid the production of acid rock drainage or metals leaching, and water from the pit would be affected by the mineralized side walls; any untreated drainage could exceed the standards for the protection of aquatic life (generally the most stringent of the water quality standards). Therefore, water management would be an issue over long timeframes, and perhaps into perpetuity. Bonding for these long term costs is complicated and issues of uncertainty that arise include the actual quality of the water throughout post-closure and the frequency with which a treatment plant may have to be replaced. The Red Dog Mine in northwest Alaska has bonded for perpetual water treatment and the Greens Creek Mine in southeast Alaska is in the process of updating its bond to include long term water treatment.**

6.40 For instance, the Assessment continues to assume that undersized culverts will be used, creating flow restrictions; the potential impacts associated with undersized culverts could be avoided easily. The Assessment's failure to present realistic mitigation measures, as would be required for any 21st century mine prior to development invalidates EPA's statement that new information has been submitted concerning mitigation measures.

<u>EPA Response:</u> **The culvert risks evaluated in the assessment take into account the use of best management practices and mitigation measures, which are discussed in text boxes throughout Chapter 10. Nonetheless, environmental characteristics along the**

transportation corridor would likely render the effectiveness of standard or even "state-of-the-art" mitigation measures highly uncertain (see Box 10-5 of the final assessment). Thus, although culverts and other infrastructure components can be designed to higher than usual standards, they are not always installed correctly or may not stand up to the rigors of a harsh environment.

6.41 The assumptions regarding project design and mitigation continue to assume that the project would not meet state and Federal regulations. As a result, the analysis tends to overestimate likely project effects.

<u>EPA Response:</u> See response to Comment 6.2.

6.42 Text still states on page 6-3 that "We specify that all mine components would be developed using modern conventional design and practice and operated under standard industry practices. Our purpose in this assessment is to evaluate the potential effects of mining porphyry copper deposits in the Nushagak and Kvichak River watersheds given design and operation to these standards." The reviewer's point on use of best practices is a good one, and has not been satisfactorily addressed. Given the extraordinary level of controversy and scrutiny associated with mining projects proposed in this watershed, it is also highly arguable that no project could ever be permitted if the State of Alaska were not convinced that the practices represented in the mine design adequately addressed potential risks and did not employ best practices that have been proven though prior experience with similar relevant mining scenarios, or from credible, well-documented feasibility studies and testing programs conducted by knowledgeable professionals. Additionally, in order to maintain viable access to mineral resources, modern mine operators, certainly most major international operators, are driven towards the adoption of best practices by their own corporate policies, the conditions established by major lenders (e.g., International Finance Corporation, or the 75+ major private banks who have adopted the Equator Principles), jurisdictional permitting requirements, and other important factors.

<u>EPA Response:</u> See response to Comment 6.2. The term "best practices" has a different meaning depending on the setting in which it is discussed and who is discussing it. In general, modern practices (also referred to as standard or conventional) are synonymous with what are considered "best practices." Our use of the terms standard, conventional, or modern is to eliminate the implication given with use of qualifiers such as best and good.

6.43 The current analysis uses three scenarios - Pebble 0.2, Pebble 2.0 and Pebble 6.5 - reflecting the amount of ore to be mined. All of these ore reserves are still extremely large in comparison with other current reserves worldwide. The three scenarios fail to bracket a reasonably range of mine sizes. The effect of this is that the range of impacts depicted in the document tends to be larger than would actually be expected.

<u>EPA Response:</u> See response to Comment 6.16.

6.44 Two additional mine scenarios have been added to the analysis, but all rely to some extent upon theoretical data. The mine scenarios generally fail to incorporate expected requirements of state and Federal agencies and therefore tend to indicate impacts greater than would be allowed under current regulations.

<u>EPA Response:</u> See response to Comment 6.2.

6.45 Failure to define a project that could reasonably be permitted affects the quality of the entire assessment. Impacts are overstated throughout the document due to assumptions regarding design and lack of mitigation.

<u>EPA Response:</u> See response to Comment 6.2.

6.46 There is no indication of the likelihood of construction within the document. The document continues to assume the mine would be constructed to standards that cannot be permitted in today's regulatory environment. As a result, the assessment does not provide a reasonable evaluation of the potential impacts of a project. All impacts are overstated due to the assumptions regarding a lack of mitigation and insufficient planning to avoid impacts.

<u>EPA Response:</u> See response to Comment 6.2.

6.47 Assessment does not take into full consideration measures to avoid or minimize the impacts predicted in the Assessment. EPA does state that it considers good mine practice, but then clearly ignores measures that are routinely used (and often required under permit conditions) to avoid or minimize impacts (e.g., see discussion below regarding discharge of untreated wastewater in the event of a wastewater treatment plant [WWTP] failure). Ignoring these mine management measures results in overstating the impacts from mining activities. Further, the Assessment admits that it does not take into consideration compensatory mitigation measures (p. 6-4), which the EPA acknowledges "could offset some of the stream and wetland losses" (p. 7-32). This fundamentally results in an overstatement of the significance of the findings.

<u>EPA Response:</u> See response to Comment 6.2.

6.48 The failure analyses included in the discussion of potential transportation corridor(s) fails to reflect prospective ecological risk assessment practices, and as such does not convey a credible understanding of potential ecological impacts associated with the spill and accident scenarios discussed in the assessment. The mitigation measures identified in the section that could reduce the risk of spills were not included in the calculations.

<u>EPA Response:</u> See response to Comment 6.40.

6.49 Current standards in culvert construction are not addressed. The analysis is therefore inaccurate as it appears to ignore recent changes in technology and expectation that have greatly improved culvert function. Therefore, the analysis overstates likely impacts.

<u>EPA Response:</u> See response to Comment 6.40.

6.50 The analysis presumes a single route and does not provide options for additional consideration. Failure to include design features that would mitigate impacts results in an overstatement of project effects.

<u>EPA Response:</u> See response to Comment 6.40. The assessment's road alignment matches the alignment proposed by Northern Dynasty Minerals in Ghaffari et al. (2011). We note in the assessment that environmental risks would not be expected to change substantially with minor shifts in road alignment.

6.51 The Assessment makes assumptions regarding the number of culverts and bridges, but these assumptions may not be relevant once a project is designed and permitted.

<u>EPA Response:</u> The assumption in the draft assessment regarding number of bridges came from Ghaffari et al. (2011). In the revised assessment, crossings that would be bridged are based on mean annual streamflows as explained in the text. Scenarios in which the majority of crossings would be bridged would probably not be realistic. The actual decision as to what type of structure (bridge versus culvert) would be constructed at each crossing would be made by industry engineers in consultation with Alaska permitting staff.

6.52 There was no inclusion of the LITH road design in the document. It was assumed that road construction would follow the ADEC BMPs. Other BMPs can be employed to reduce impacts of roads.

<u>EPA Response:</u> See response to Comment 6.40.

6.53 The frequency data used in the cited references were developed using PHMSA's and EUB pipeline incident dataset. The entire dataset includes releases from all reported spill volumes ranging from leaks to ruptures and all pipeline diameters. The scenario presented also describes the use of double-walled pipelines. The use of frequency data for all incidents rather than for a full bore rupture with a double-walled construction, as described in the scenario, overestimates the likelihood of a spill and is overly conservative for the presented scenario. The impact analysis should be consistent with that scenario presented and should be based on a dataset for double-walled pipelines that resulted in a full-bore rupture. The resulting release frequency based on this subset of the PHMSA and EUB dataset would more accurately reflect the pipeline scenario in the Assessment. As presented the Assessment, the conclusions on release impact are not supported because spill frequency statistics do not support a full-bore release from a 20 cm, double-walled, pipeline release condition.

<u>EPA Response:</u> Only the above-ground portions of the pipelines are double-walled in the assessment scenarios. Pipelines would be single-walled and buried, except at longer stream or river crossings where double-walled pipelines would be supported aboveground on road bridges. The revised assessment clearly distinguishes between all pipeline leaks and ruptures.

6.54 The three mine scenarios examined in the Assessment, referred to in the assessment as "Pebble 0.25 ", "Pebble 2.0", and "Pebble 6.5", do not reflect specific or even preliminary mine plans submitted to state and federal agencies related to the Pebble Mine project. Further, by attaching the word "Pebble" to each of the mine scenarios the Agency inappropriately promotes the gross misperception to the public that the Assessment directly addresses a specific mine project. This misapplication of "Pebble" is contrary to the statement in the Assessment that the document: "… is not an assessment of a specific mine proposal for development".

<u>EPA Response:</u> See response to Comment 6.2.

6.55 Pg 6-19 The paragraph remains essentially the same, and does not incorporate language that lets the reader know the stated situations are assumed scenarios created by EPA.

Assumptions regarding project design and the lack of mitigation affect the entire analysis and tend to result in substantial overstatement of potential project effects.

<u>EPA Response:</u> See response to Comment 6.2. Throughout Chapter 6 (e.g., Section 6.1), we explicitly state that these scenarios were developed by EPA, drawing heavily on specifics published by Northern Dynasty Minerals in Ghaffari et al. (2011). Many mitigation measures are described in the assessment.

6.56 No consideration is given in the current Bristol Bay Assessment to any types of tailings disposal methods other than a tailings pond based on slurry transfers in a location requiring a cross-valley dam. The reviewer is correct in the observation that there are a number of viable alternatives that would normally be considered in the siting and design of a tailings facility for an actual mine. The analysis assumes one approach only and does not address alternate approaches that may reduce risk. It is expected that alternate approaches will be evaluated during the permitting process. The analysis need[s] to incorporate alternative approaches into the assumed or alternative project design. Failure to do so results in an assessment that overestimates likely project effects.

<u>EPA Response:</u> The tailings impoundments are based on the preliminary plan put forth by Northern Dynasty Minerals in Ghaffari et al. (2011). The possibility of dry stack disposal was considered (and is discussed in greater detail in Box 4-7 of the final assessment), but was not used based on the plan detailed in Ghaffari et al. (2011) and what is practice at most other mines.

6.57 EPA states that the Bristol Bay watershed encompasses 23,539 square miles, and loosely describes existing infrastructure in the region. EPA fails to compare the area of the mine scenarios as a percentage of the total area. Based on the surface areas for the minimum and maximum mine scenarios listed in Table 4-3 (and assuming the total transportation corridor is 0.25 kilometers wide), the areas of development are approximately 0.1% and 0.2% of the total area of the watershed, respectively. Note that the minimum mine size would be a very large mine on a global scale.

<u>EPA Response:</u> See response to Comment 2.18.

6.58 Water balance has been addressed in more detail (Section 6.2.2), but not in a way that allows more accurate analysis of impacts to fish and wildlife. Some of PLP's 2011 data have also been incorporated, but the analysis does not account for the full range of scale in its impacts assessment, and is limited to patchy information on local populations. The comment stands. Failure to address this comment likely has resulted in an over-estimation of potential project effects.

<u>EPA Response:</u> Water balance calculations and effects on streamflow modifications with risks to aquatic life are described in Chapter 7. The remainder of the comment is unclear, and does not specify what a "more accurate analysis" of impacts would be. We did not attempt to relate changes in streamflow to wildlife populations and the comment does not suggest a way to do so. The analysis is limited to patchy information on local populations because this is the nature of the available data. The comment does not provide additional explanation of how this relates to over-estimation of potential impact.

6.59 The geographical basis for the water balance provided in Table 6.8 excludes the area outside the immediate vicinity of the mine site. Typically, project-area water balances take into account flows for individual surface water bodies, water-bearing units/aquifers, and areal variability of precipitation and runoff components. In short, this water balance appears to lack acknowledgement of the key natural systems at and near the mine site. Also, water balances consider seasonality aspects (for example, monthly) and the effect of wetter- and drier-than-average years.

<u>EPA Response:</u> The water balance in the assessment was intended to estimate the average annual consumption of water by mining operations, and was not intended to consider seasonality or annual variations.

6.60 (…) the mining operation would always consume some water and there would always be less water available in streams during active mining than there was before the mine was present. This contradicts Section 5.3.1 [previous Assessment] which states that "During the start-up phase, all water from the site would be collected and used in operations. However, during the minimum and maximum mine operations, 5 million to 48 million cubic meters of water available on the site per annum would exceed operational needs, and treated water would be discharged. (Section 4.3.7)" [previous Assessment]. This contradiction is important to rectify since it has implications to the health of the streams and fisheries below the mine.

<u>EPA Response:</u> The original draft assessment stated that some water would always be consumed during mining operations and therefore streamflows would be reduced. Our scenarios envisioned the capture of all site water to build up a reserve to begin operations. After reassessing the timeline and available water, we updated this in the revised assessment (Section 6.1.2.5). The revised text clarifies that site water would be diverted to TSF 1 after the starter dam is built to allow sufficient water for process plant start-up, but now does not state that all water from the site would be collected and used during the start-up phase.

6.61 There is more comprehensive discussion regarding calculation of water balance (whole new section 6.2.2). However, this new discussion does not provide sufficient depth of details necessary to understand how is the water balance affected with assumed water use in the mine, i.e., simple sensitivity analysis. Therefore, the analysis is still lacking in quality.

<u>EPA Response:</u> Details of the individual components for the water balance flows under each of the mine size scenarios appear in Table 6-3. This table provides sufficient quantitative information for the reader to assess the sensitivity of changes in the estimated quantities.

6.62 The percentage of water reintroduced to streams, including uncontrolled leachate escapes, would equal 74, 40, and 70% of the total water captured in the three scenarios, respectively: In this paragraph and elsewhere, the Assessment refers to uncontrolled leachate and appears to assume the quantities are large. However, elsewhere it is assumed that groundwater interception wells and pump backs will extend the cone of depression. It appears this is leading to a "worst of both cases" scenario. The WRDs will be built in lifts that result in high compaction layers that minimize infiltration and are typically designed to direct internal drainage to a designated collection point. In other words, the collection system is inherently more robust than implied in the Assessment.

<u>EPA Response:</u> We agree that additional design features and engineering controls could be implemented to reduce the amount of uncontrolled leachate, but we based our scenario on the level of control discussed in Ghaffari et al. (2011). Complete capture of groundwater flows with wells in soils similar to the thick, highly permeable sand and gravel overburden at the site requires closely spaced wells and high pumping rates and often results in losses between the wells. Ghaffari et al. (2011) show seepage cutoff walls around approximately 15% of the mine pit and waste rock pile perimeter. At the TSFs, Ghaffari et al. (2011) discuss seepage cutoff trenches along the toe of each embankment, but no seepage cutoff or recovery wells along the remainder of the TSF perimeters.

The assessment provides sufficient detail to allow the reader to assess the sensitivity of the results to different amounts of uncontrolled leachate. Although the amount of uncontrolled leachate does contribute up to about one quarter of the total return flow (Pebble 2.0 scenario), 95% of the leachate originates at either the TSF or from NAG and contributes little to the overall metals concentrations.

6.63 The Assessment has assumed no release of treated water to Upper Talarik and that the releases to the SFK and NFK are point source and at one location in each catchment. This is counter to the general environmental design approaches for water management (and good practice) that diversions and replacement flows are best returned to the original catchments. This assumption results in a flawed assessment of flow impacts.

<u>EPA Response:</u> Although we recognize that including a treated water return flow to Upper Talarik Creek would increase operator flexibility and additional options for optimizing streamflows, the assessment scenarios are based on the WWTP discharge infrastructure described in Ghaffari et al. (2011).

6.64 In addition to the failure to incorporate modern design construction standards and appropriate mitigation measures, the document continues to assume that a mine cannot be adequately closed and that substantial impacts will continue to occur hundreds or thousands of years after operations have ceased. Some discussion of Alaska's bonding requirements has been added in a text box, but the text in Section 6.3 presumes that some closure issues will be unresolvable. The text box inappropriately implies that adequate bonding will not be available. Such speculation is entirely inappropriate in a scientific document. The ability to successfully close a mine is a critical performance measure in both State of Alaska and federal permitting processes. Given the State of Alaska's permitting and bonding requirements, statements suggesting or implying assumptions that a project has unresolvable closure issues reflects bias and is not realistic. Any mine development project that cannot meet the rigorous State of Alaska bonding requirements would not be allowed to proceed. These types of assumptions affect the quality and integrity of the entire Assessment. The conclusions in the EPA's Assessment regarding the effects of mine development on fish, wildlife, cultural resources, and water quality are inappropriate assumptions to apply to 21st century mines which are required by regulatory authority to establish an approved mine closure plan prior to construction.

<u>EPA Response:</u> As discussed in the assessment, the State of Alaska requires bonding by mine operators to ensure proper closure and post-closure operation. Bonding has been inadequate in some cases in the past. The State's requirements have become more

rigorous, but there is some unquantifiable risk that the site would not be closed and operated in a manner that assures environmental protection. The assessment does not state that mine closure will be inadequate and that the owner will not be responsible for environmental liability, but does point out some of the closure issues of potential concern.

6.65 The installation of stormwater diversion structures in the operational phase is alluded to in the discussion of water diversion at closure in the last paragraph. However, the assessment of project impacts does not include mitigation measures that would reduce project effects. Therefore, the analysis overstates likely project effects.

<u>EPA Response:</u> The assessment includes numerous design features, best practices, and mitigation measures that would reduce project effects; no change required.

6.66 Section 6.3 the first paragraph remains essentially the same, and mitigation measures not clearly discussed. Section 6.3.1 the statement regarding turning off the pumps remains. These comments have not been addressed.

<u>EPA Response:</u> In the assessment scenarios, the mine pit is allowed to fill with water after closure to achieve a sustainable condition, restore groundwater equilibrium, and reduce the potential for oxidizing sulphide minerals. Continuing to pump water out of the pit and presumably treating it prior to discharge would counteract these aims, increase costs, and reduce the overall level of environmental protection. No change required.

6.67 The Assessment outlines a number of hypothetical problems associated with mine closure, which are all predicated on the assumption that there will be insufficient funding and/or political will to inspect and manage the facilities in a manner that will protect the environment in perpetuity. Adequate bonding to reclaim and stabilize the site – including monitoring, maintenance, and upgrading or replacement of treatment systems as new technologies are developed – would be needed before any development could be permitted to proceed. Bonding requirements would encompass a full suite of potential closure scenarios, including premature closure. The Assessment further maintains that use of modern technology to construct tailings dams increases risk because it is untested over long periods. However, modern dam design technologies are based on proven scientific/engineering principles and there is no basis for asserting that they will not stand the test of time.

<u>EPA Response:</u> A risk assessment must consider the possibility that things may not happen as intended. The assessment does not maintain that use of modern technology to construct tailings dams increases risks because it is untested over long periods. Rather, the assessment states that improved design, construction, and monitoring could reduce the failure rate by an order of magnitude or more. It also indicates that new technologies are inherently unproven, and that not all applications of proven principles result in successful technologies.

6.68 [The Assessment] implies that mine closure will be inadequate and that the owner will not be responsible for environmental liability. This is not realistic as comprehensive analyses and adequate bonding to reclaim and stabilize the site – including monitoring, maintenance, and upgrading or replacement of treatment systems as new technologies are developed – would be needed before any development could be permitted to proceed.

<u>EPA Response:</u> See response to Comment 6.64.

6.69 Some explanation is provided regarding the time to fill (now it is estimated to 20 to 300 years, depending on the mine scenario). However, no discussion regarding depth to the groundwater has been provided.

<u>EPA Response:</u> Our post-closure scenarios assume that the pit would continue to fill with groundwater and precipitation until it either reached equilibrium with groundwater levels around the pit or overflowed at the lowest elevation along the pit's perimeter (over natural ground or through an engineered channel). Given the dimensions of the pit and the range of elevations along the pit rim, the depth to groundwater would be expected to vary from about 0 meters to perhaps up to 100 meters.

6.70 The probability of a non-failure scenario is not emphasized, and the focus remains in this and other chapters on the potential for failures. As such, the risk analysis used in this assessment is biased.

<u>EPA Response:</u> Non-failure scenarios are reflected in Chapter 7, which considers effects resulting from the mine footprint, and in Chapter 8, which describes the water quality effects of a perfectly operating water treatment system. Other no-failure conditions such as non-leaking pipelines require no description. Potential failures are inevitably important aspects of risk assessments.

6.71 The construction method varies with a rockfill or earthen (borrow material) starter dam. Also if the model is clearly constructed from rockfill, why are failure mechanisms prevalent for upstream sand dams considered? EPA discussion about their assumed dam design/construction at Pebble is inconsistent with their discussions about their interpretations of the risk of dam failure.

<u>EPA Response:</u> Many of the leading causes of dam failure, such as overtopping, foundation failure, slope instability, and earthquakes, can affect both earthfill and rockfill dams.

6.72 The assessment assumes that the project would not be designed to capture spilled materials. This may not be a good assumption. The impacts described can be fully or at least partially addressed through proper project design.

<u>EPA Response:</u> The plan described by Ghaffari et al. (2011) does not describe any design features to capture spillway releases.

6.73 Regardless of whether the tailings are wet or drained, the tailings facility has to be designed to the same safety standard defined by the Alaska Dam Safety Program.

<u>EPA Response:</u> Comment noted; no change required.

6.74 A permitting requirement for the TSF is the management of the Inflow Design Flood (IDF). The IDF can either be stored in the TSF (a freeboard allowance for the IDF is required at all times) or routed through a spillway. Any mention of dam overtopping is not realistic as a TSF that does not include managing the IDF is out of compliance with the Alaska Dam Safety Program permitting requirements.

<u>EPA Response:</u> The contention that overtopping does not occur because adequate freeboard is maintained is refuted by the overtopping of the Nixon Fork Mine dam. Potential effects of a spillway release are considered in the final assessment.

6.75 No discussion is provided that explains how the footprints of the waste rock stockpiles were estimated. Section 6.3.3 ("Waste Rock") in the revised document has significantly reduced detail with respect to the discussion in Section 4.3.6 ("Waste Rock") in the original document. This discussion is therefore based upon unsubstantiated evidence.

<u>EPA Response:</u> Information on the areas and placement of the waste rock piles appears in Section 6.1.2.3 of the revised assessment. Table 6-2 provides additional detail on the footprints.

6.76 A more site specific analysis of water balance and treatment/collection failure needs to be completed for likely mine conditions and operations.

<u>EPA Response:</u> Comment noted; no change required.

6.77 Section 6.1.2.5 Mention of stream diversion has been deleted in this version, although a statement concerning a figure notes that for clarity, diversions of stormwater around mine components are not shown on the schematic.

<u>EPA Response:</u> Under the first bullet in Section 6.1.2.5, the assessment states that stormwater runoff that did not contact potential contaminants would be diverted around mine components.

6.78 The runoff calculations are not based on a quality assessment; the effects of that failure on the overall assessment is not known.

<u>EPA Response:</u> Runoff was estimated specific to each gage site, allowing derivation of watershed-specific runoff efficiencies. The comment does not provide a clear statement as to how these calculations are not based on a quality assessment.

6.79 The cone of depression would lower the groundwater table, drying up streams, ponds, and wetlands that depend on groundwater discharge and turning areas of groundwater discharge into areas of groundwater recharge: Assumes direct and complete connection between surface (i.e., precipitation) and underlying groundwater so potential impacts are likely exaggerated.

<u>EPA Response:</u> The comment's unsubstantiated claim that the stated effects require "direct and complete connection between surface (i.e., precipitation) and underlying groundwater" is incorrect. No change required.

6.80 The well field placed downstream from the TSF during operations would be retained and monitored post-closure, with water pumped and treated if determined to be contaminated by leachate from the TSF. The pit water would be monitored and treated prior to being released to streams, for as long as concentrations of contaminants exceeded effluent limits: Assumes capture of leachate so should be no/minimal release to wider environment. However, elsewhere the Assessment assumes leachate escapes and contaminates the streams.

<u>EPA Response:</u> In the assessment scenarios, captured leachate is tested and treated (if necessary) prior to release, but not all leachate is captured. No change required.

6.81 The Assessment makes a number of invalid assumptions about tailings storage operations, and in particular about water and waste management practices. To begin with, it makes unwarranted statements that assume that operators will violate their discharge permits, including the statement that "… the record of analogous mines indicates that releases of water contaminated beyond permit limits would be likely over the life of any mine at the Pebble deposit." This statement in the Assessment follows a reference to the report by Earthworks (2012), U.S. Copper Porphyry Mines Report: The Track Record of Water Quality Impacts Resulting from Pipeline Spills, Tailings Failures and Water Collection and Treatment Failure, which has been criticized by the Peer reviewers of the EPA Assessment. Furthermore, the Assessment reports that treated water returned to streams would be dictated by mining needs, rather than the needs of aquatic resources. The Assessment also ignores the fact that standard mining mitigation practices and designs include seepage control measures that are monitored and maintained. It makes inflated estimates of total seepage rates for different assumed mine scenarios, which do not account for seepage control features that would be part of any new TSF dam design in Alaska.

<u>EPA Response:</u> The comment does not contest any of the reported permit violations at analogous mines. We assume that any responsible mine operator would consider the needs of aquatic resources as well as the mine's water requirements, but we also recognize that mine operators cannot release water that is consumed by the mine. The assessment acknowledges that seepage control measures would be monitored but does not assume that these measures would be 100% efficient. Estimates of total seepage rates were based on our assessment of the designs described in Ghaffari et al. (2011).

6.82 Include an expanded discussion of premature closure, the uncertainty, and the potential impacts on fisheries and indigenous cultures as this condition is likely to occur.

<u>EPA Response:</u> We agree that premature closure is an important issue. However, the potential range of premature closure conditions was judged to be too uncertain to develop a defensible scenario and assess the associated risks.

6.83 The comparisons to the Nixon Fork mine are not relevant.

<u>EPA Response:</u> We disagree that events at an operating Alaska metal mine are irrelevant to potential metal mines in the region.

6.84 A closure bond is required to ensure there are sufficient funds for reclamation and closure, including the possibility of premature closure. The closure bond value is specified by the State to ensure adequacy. Review and update of the closure bond is required every five years. Thus, premature closure is anticipated as a possibility in the planning and bonding process.

<u>EPA Response:</u> We have modified the statement that premature closure is an unanticipated event in the final assessment.

6.85 Conceptual models have been simplified and redistributed but do not address specific mitigations; rationale given is it is not necessary, for the purpose of this assessment, to describe all mitigations. Box 4.1 suggests they've been intrinsically included in the analysis but the analyses are unchanged. The assessment assumes a project design that would not be permittable under current state and Federal regulations. Therefore the analyses throughout the document tend to overstate the likely impacts of a project.

<u>EPA Response:</u> See response to Comment 6.2. Also, mitigation is now included on the conceptual model diagrams, to indicate that scenarios assume appropriate mitigation measures are implemented.

6.86 The same estimates of CMC and CCC quotients are presented in the second external review draft in Tables 5-14, 5-15, and 5-16. Therefore, the comment stands: the results may well overly exaggerate the calculation of needed dilution for copper.

<u>EPA Response:</u> The CMC and CCC values for both the State of Alaska and the national criteria are correct. If the PLP's leachate tests are reliable, the quotients are correct.

6.87 No additional analytical data for pyritic tails was provided.

<u>EPA Response:</u> We provide no additional analytical data for pyritic tails because the PLP provided no analytical data.

<u>The Pebble Limited Partnership (Doc. #5752)</u>

6.88 Omitting modern mining practices from its risk scenarios: the Assessment devises exaggerated risk scenarios that are based on the absence of modern mine design and operating practices.

<u>EPA Response:</u> See response to Comment 6.2.

6.89 The Assessment's narrow focus on three similar hypothetical mine scenarios – apparently motivated by the prospect of vetoing a Pebble mine permit – has effectively eliminated from consideration numerous alternative management options throughout the Bristol Bay watershed. The failure to adequately and objectively evaluate those options (including ecological protection measures and habitat enhancement practices) has created a document whose narrow focus precludes the broad airing of issues that a risk assessment is supposed to provide.

Even the Assessment's narrow mine options are inadequately evaluated because they are based on a mine without best mining practices or compensatory mitigation – a mine that could never be permitted. Numerous peer reviewers of the May 2012 draft commented on the Assessment's failure to evaluate a scenario that included best mining practices and mitigation. For example, peer reviewer Steve Buckley commented: "There is inadequate information on, and analysis of, potential mitigation measures at the early stages of mine development, which would attempt to reduce the impacts of mining activities on fish and water quality."

<u>EPA Response:</u> See response to Comments 6.2. Compensatory mitigation issues are addressed in Appendix J.

6.90 Reviewer David A. Atkins noted the importance of mine mitigation measures: “The Assessment describes what is considered to be conventional ‘good’ mining practice, but does not adequately describe and assess mitigation measures that could be required by the permitting and regulatory process. A thorough analysis of possible mitigation measures as employed for other mining projects and the likelihood that they could be successful in this environment would be necessary.”

<u>**EPA Response:**</u> **These comments from Mr. Atkins were in response to the original draft assessment. Atkins subsequently reviewed the revised assessment, which included, among other additions, an entirely new appendix devoted to compensatory mitigation (Appendix J). After reviewing the revised assessment, Mr. Atkins noted that his earlier concerns were adequately addressed.**

6.91 The hypothetical nature of the mine scenario gives the Assessment a flawed foundation. Part of the unacceptable uncertainty in the Assessment is due to the lack of realism in the mine scenarios. EPA continues to attempt to evaluate hypothetical mines without considering engineered site-specific mitigation measures to minimize environmental impacts. EPA’s approach is unrealistic and leads to exaggerated projections of harm. As Dr. Dirk van Zyl explained to EPA in his comments on the initial draft Assessment:

“Developing a mine plan for a specific ore body is a large task and is undertaken by a large team of engineers and scientists. In the process of developing a mine plan many options are considered for each facility and its components, including mining methods, process design options, waste rock management options, tailings management options, shipment of product, etc. … While some of the components of the final mine may contain elements of the conceptual mine, it is impossible to know whether the hypothetical mine scenario is realistic.

“Using different options, both technological as well as site selection, for some or many of the facilities could result in impacts that are different from those described in the report. I would therefore suggest that using only the present hypothetical mine scenarios is insufficient. There could be a range of impacts, such as the surface areas of facilities, which in some cases could be smaller than what was chosen and in other cases larger. However, this does not mean that the hypothetical mine represents ‘average conditions.’ I therefore consider the mine scenario not sufficient for the assessment”.

<u>**EPA Response:**</u> **See response to Comment 6.2. The assessment evaluates one basic mine plan implemented at three different sizes, based on a preliminary plan for the Pebble deposit developed by Northern Dynasty Minerals (Ghaffari et al. 2011). We presume that the team of engineers and scientists who prepared Ghaffari et al. (2011) considered many options for each facility and its components (e.g., mining methods, process design options, waste rock management options, tailings management options, shipment of product) and selected the most favorable based on technical, economic, and environmental concerns. We acknowledge that Dr. van Zyl recommended assessing multiple alternative approaches, but that is a strategic issue related to the purpose of the assessment rather than a technical issue. Our intent in the assessment was to assess likely scenarios based on published preliminary information, not to analyze all potential design alternatives.**

6.92 EPA states that, in the past, mining financial assurances (in amounts set and required by government agencies) have often been inadequate. Id. at 6-36. If this is a potential future risk, it is one that is completely within the control of the government. Here, a more realistic assumption would be that the State of Alaska will require financial assurances that will protect this important fishery.

EPA claims that financial assurances "do not address chemical or tailings spills because of the greater degree of uncertainty related to these accidents." Id. at 4-10. This claim is incorrect. There is no reason that a properly crafted regulatory financial assurance requirement could not cover spill incidents.

Furthermore, as the Knight Piésold engineers have stated: "Adequate bonding to reclaim and stabilize the site – including monitoring, maintenance, and upgrading or replacement of treatment systems as new technologies are developed – would be needed before any development could be permitted to proceed." Knight Piésold Comments at 2 (emphasis added).

<u>EPA Response:</u> Box 4-3, which addresses financial assurance, has been expanded in the final assessment.

6.93 The Assessment exaggerates the risk from tailings storage facility operation. The Assessment also includes "a number of invalid assumptions about tailings storage operations …" Id. at 1. For example: The Assessment … ignores the fact that standard mining mitigation practices and designs include seepage control measures that are monitored and maintained. It makes inflated estimates of total seepage rates for different assumed mine scenarios, which do not account for seepage control features that would be part of any new TSF dam design in Alaska. Id. at 1-2. This assumption – that adequate mitigation measures will not be employed – along with a number of other technical errors in EPA's Assessment leads to a gross overstatement of adverse impacts associated with tailings storage facility operation.

<u>EPA Response:</u> The seepage control measures described in the assessment scenarios are based on the measures proposed in Ghaffari et al. (2011). We presume that the team of engineers and scientists who prepared Ghaffari et al. (2011) considered many options for each facility and its components (including mining methods, process design options, waste rock management options, tailings management options, shipment of product) and selected the most favorable based on technical, economic and environmental concerns. We agree that additional design features and mitigation measures could reduce the probability or severity of adverse effects. The assessment presents sufficient data for the reader to judge the sensitivity of many effects to variations in the design assumptions.

6.94 The Assessment omits the environmental protection and mitigation measures necessary for mine permitting. It combines these unrealistic omissions with unrealistic assumptions to raise unrealistic fears. The authors admit that the imagined risks cannot be reliably quantified. Thus the Assessment provides no basis for actually assessing its three "endpoints:" (a) any impacts on salmon, (b) any salmon impacts on wildlife, or (c) any salmon or wildlife impacts on Alaska Natives. Finally, the imagined risks are never placed in context of the productivity of the fishery in Bristol Bay, whose acknowledged value prompted the Assessment.

<u>EPA Response:</u> The risks that cannot be quantified are still real and must be considered.

<u>Northwest Mining Association (Doc. #5559)</u>

6.95 EPA's failure to consider the full panoply of federal and state programs developed by the Congress, the States and the relevant federal and state hardrock mine regulatory authorities to protect the environment when seeking to assess potential impacts of hardrock mines is shocking in view of the success the current regulatory programs have had in protecting the environmental since their inception in the 1990s.

<u>EPA Response:</u> See response to Comment 6.2. Regulations and financial assurance are briefly discussed in Boxes 4-2 and 4-3, but a full evaluation of their effectiveness is beyond the scope of this assessment.

6.96 EPA's Revised Assessment is based on a hypothetical mine that could not be permitted under existing State of Alaska and federal law requirements. No large scale modern mine (within the past 25 years) has been approved exactly as proposed by the company. Each of the many State and federal agencies review the permit application, baseline data and EIS requirements and each requires large or minor changes before it is satisfied that the mine will be able to operate according to that agency's requirements. EPA's Revised Assessment assumes designs for various aspects of the mine and then criticizes those designs as not being acceptable. EPA's Revised Assessment does not effectively address avoidance, minimization and mitigation, all of which are employed by the agencies and the companies to address concerns that arise over the initial design. This approach to "assume design and then say it is not acceptable" was used in EPA's Revised Assessment for: siting of mine facilities, siting of roads, siting of tailings pipeline, design of bridges, tailings management, water use, water discharge, financial assurance (bonding), etc.

<u>EPA Response:</u> See response to Comments 6.2.

6.97 EPA's Revised Assessment states that Pebble would be the largest mine of its type in the U.S. (which is not a true statement – the Bingham Canyon Mine has operated for more than 140 years and at some periods during its mine life has milled up to 500,000 tons per day as compared to the EPA Assessment use of 200,000 tons per day) and then utilizes the hypothetical mine focused on Pebble to represent all other large mines that could ever be developed in the Bristol Bay Watershed. This approach is blatantly wrong. If Pebble will be the largest, how can any others also be this large? The Assessment is fatally flawed when it assumes all other large scale mines in the region will look the same as the EPA hypothetical mine. Every mineral deposit is different and must be evaluated based on its particular geology, geochemistry, metallurgy, environmental setting, etc. The result is that every mine layout is different, every mine plan is different, every mill is different, every tailings impoundment is unique, etc.

<u>EPA Response:</u> Based on estimated size of the deposit, Pebble could be the largest mine of its type in the U.S. The assessment evaluates three mine size scenarios, representing a range of mine sizes that might be expected in the Bristol Bay watershed. Mines at deposits other than Pebble would fall at the small end of that range, whereas a mine at the Pebble deposit would likely fall at the higher end of that range.

6.98 The Executive Summary (p. ES-21) reads "Based on a review of historical and currently operating mines, some failure of the collection and treatment systems is likely during operation of post-closure periods." It then goes on to describe toxic effects that would likely kill thousands of fish. Yet the analysis in Section 6 of the Assessment indicates that the probability "cannot be estimated form the data." The Executive Summary also summarizes the analysis by saying that EPA reviewed the data and found the probability "High." The Assessment includes no data about frequency of failure.

<u>EPA Response:</u> The record of the mining industry indicates that water collection and treatment failures are common. The upper bound failure would kill thousands of fish, but that particular failure is not common. The revised assessment does not characterize the probability as high and includes failure frequency data from recent U.S. mines.

6.99 The Executive Summary conclusion in Table ES-1 lists the probability of problems with water collection and treatment as "High" during operation and "High" during post-closure. However, this contradicts Section 6.3.4 of the Assessment which concludes that one cannot quantify or predict risk of collection or treatment failure which is a reasonable conclusion given the uncertainties described. It reads, "The risks from water collection and treatment failures are highly uncertain…The range of failures is wide and the probability of occurrence of any of them cannot be estimated from available data." (p. 6-41). It is arbitrary and capricious for the Executive Summary to make a statement that is in direct opposition to the conclusions within the Assessment.

<u>EPA Response:</u> Although the probability of any failure scenario is unpredictable, it can be predicted that some failure is likely to occur. In fact, the record of the mining industry indicates that water collection and treatment failures are common.

<u>Millrock Resources Inc. (Doc. #5736)</u>

6.100 Failure to consider Modern Best Practice and Minimizing Limitations: The Assessment ignores modern-day mining practices and takes extreme liberties in minimizing the study's identified limitations. Rather than addressing the limitations, the Assessment proceeds to perform unrealistic analyses on sensationalized scenarios for hypothetical mining projects. Secondary prevention, mitigation and reclamation measures are not even considered in the Assessment. The Assessment does not utilize sensible mining practices. For example, the Assessment, which depicts a hypothetical TSF for Millrock's Humble prospect directly over Napotoli Creek - something a mining company or regulatory agency would not seriously consider. The Assessment identifies and evaluates early-stage exploration projects, such as Humble, as potential mines under Cumulative Effects and excludes them from the Summary of Uncertainties. The material depth of the Summary of Uncertainties stands alone as proof that the Assessment makes unrealistic suppositions.

<u>EPA Response:</u> See response to Comment 6.2.

<u>Kachemak Bay Conservation Society (Doc. #4284)</u>

6.101 The effects of a possible 45 square mile industrial footprint. The assessment considers risks from routine operation of a mine designed, using modern conventional mitigation practices and technologies and with no significant human or engineering failures. We believe that human and engineering failures must be addressed, as they are inevitable for such a large project over decades of operation. Historically the record is tragic! Engineered mining waste storage systems have been in existence for only about 50 years and their long-term success is not known; though many previous mine waste storage systems have failed, with disastrous results which will last thousands of years. All closed open pit mines in the US are declared hazardous waste sites by EPA, which require oversight management in perpetuity. Historically the corporations dissolve or declare bankruptcy, essentially leaving the burden of cleanup and impacts to the citizens through extremely expensive government cleanup programs. More information is needed. How exactly would the developers keep all toxic wastes from interacting with the environment, forever? KBCS believes this is an impossible task. Where has this been done successfully before?

EPA Response: Comment noted; no change required.

6.102 KBCS would like more information regarding the possibility and results that a change of mine ownership would have on the future operation and potential negative impacts on the operation. If there are failures of any or multiple environmental safeguards, who will fix it? Who will pay for it? Also, we are concerned with the common occurrence of corporate responsibility and expenses for mine management, maintenance, cleanup and oversight, after the mining is completed, being shifted to the public sector. This is morally reprehensible. If Anglo American and Northern Dynasty corporations cannot prove they have the financial and management ability to perform all necessary post mining oversight, maintenance and cleanup tasks, then the project should not be considered viable.

EPA Response: See response to Comment 6.64.

6.103 KBCS would like to see the post mining management plan. How would the operation be shut down, secured, monitored and maintained safe from impacting the surrounding region for the thousands of years necessary to protect the areas present pristine ecological conditions? This concept is, of course, absurd as no large scale mining effort has to date been successful in fully internalizing their impacts, waste storage, processing and other operating effects on the surrounding environment and wildlife. In fact, the historical reality has been the extreme opposite. All closed and abandoned large scale mining operations are listed by the EPA as contaminated or as Super Fund sites. It is unfathomable to believe that any corporation will have the capacity to maintain the safety measures needed, over the centuries required. Thus, even discounting the potential catastrophic potential of seismic impacts which are natural to the area, it is inevitable that something will go awry. Mining companies cannot be trusted when they make claims that their operations will not cause environmental damage.

EPA Response: A post-mining management plan is beyond the scope of this assessment.

IUCN SSC Salmonid Specialist Group (Doc. #5435)

6.104 We believe there is absolutely no question, given the scale and intensity of this mining project, that there would be significant impacts on the freshwater habitat of salmonids if this project moved forward. We are pleased to see that the revised EIS takes a risk assessment approach to the issue and outlines many of the impacts the mine is likely to have on physical, biological and social parameters. The mining development scenarios are troubling from a conservation perspective, and impacts need to be carefully considered in any decision regarding permitting.

<u>EPA Response:</u> Comment noted; no change required.

<u>Natural Resources Defense Council (Doc. #5378 and #5436)</u>

6.105 EPA's analysis first considers "routine" operations and their "unavoidable" impacts – in other words, the environmental impacts that will take place if a mine is developed assuming that mine experiences no significant human or engineering failures during operation or in the following centuries. Though EPA cautions that this assumption is not realistic – and accidents and failures always happen in complex and long-lasting mining operations, even assuming flawless planning, engineering, operation, and maintenance – the Assessment anticipates unacceptable adverse effects on the Bristol Bay environment, which is the threshold for initiating 404(c) action.

<u>EPA Response:</u> The assessment evaluates potential risks and associated impacts related to specific aspects of large-scale mining, but makes no claims about whether any adverse effects are unacceptable. Comment noted; no change required.

6.106 The plain language of the regulation contradicts Pebble's position that a "hypothetical" mine scenario is an improper basis for initiating 404(c) action. The regulation clearly contemplates 404(c) protection for "potential" disposal sites "before" submission of an application. Advanced restriction is just as viable as a 404(c) response to a permit application because both are based upon a predictive assessment from which "actual events will undoubtedly deviate."

<u>EPA Response:</u> Comment noted; no change required.

6.107 PLP referred to the "very same Wardrop Report" as a "fantasy proposal" when it delivered formal testimony to the EPA in August of 2012, and, in its submission to EPA regarding the first draft Assessment, as a "generic mine development scenario" that "today could not be legally built."

<u>EPA Response:</u> Comment noted; no change required.

6.108 A range of mining scenarios based on worldwide industry standards as well as specific preliminary plans for the mine development and operation in Bristol Bay watershed are now evaluated, as per the peer review panel's recommendations. In addition, the assessment includes consideration of impacts for mine-associated development and transportation corridors. The assessment includes discussion of risks and impacts during mine development and operation, as well as those associated with the post-mining period. It also includes new discussion and evaluation of mitigation and remediation during the mine operation and post-mining periods.

<u>EPA Response:</u> Comment noted; no change required.

6.109 Based on our review, as well as discussion included in the 2013 Assessment itself, the impact analysis is conservative and underestimates the potential negative impacts of large-scale mining activities in the Bristol Bay watershed. For example, the largest mine scenario analyzed (Pebble 6.5) is based on mining operations that would recover only 60% of the estimated 10 billion metric tons of ore deposit.

EPA Response: Comment noted; no change required.

6.110 It makes far greater sense for EPA to proceed, as it has in this case, by analyzing the potential effects of large-scale mining generally in an area of concern, based on scenarios that cover a range of potential mine design alternatives. Requiring the agency to wait for the filing of successive individual permit applications would result in a waste of resources, both for the agency and any interested parties.

EPA Response: Comment noted; no change required.

6.111 In this case, there can be no reasonable doubt that this standard has been met. As EPA has explained, "regardless of design and operation standards, any large-scale mine in the Bristol Bay region would have a footprint that would affect aquatic resources." In other words, unacceptable adverse effects will occur from any large-scale mine developed in Bristol Bay regardless if the mine designs are based on 2006 State permit applications, 2011 SEC filings, or future permit applications.

EPA Response: Comment noted; no change required.

6.112 EPA directly responds to the peer-review recommendation that it "[c]onsider adopting a broader range of mine scenarios, especially smaller size mines." The Assessment now includes Pebble 2.0 (1.8 billion metric tons of ore) and Pebble 6.5 (5.9 billion metric tons of ore), and adds a third and smaller Pebble 0.25 (0.23 billion metric tons of ore) even though a smaller mine is not economically viable in the region. (…) As EPA explains, Pebble 2.0 and Pebble 6.5 reflect projects "which are described in [the Wardrop Report]" as "economically viable, technically feasible and permittable" development. Because the Pebble deposits are low-grade deposits (the metal-to-ore ratio is low), mining in the area will only be economical if conducted over a large area, producing a large amount of waste. (…) If fully mined, this would represent the largest mine of its type in North America. (…) EPA's placement of the mine components described in the scenarios is also based on information either from the Wardrop Report, or where, in EPA's experience, modern mining practice suggests a component would be placed. (…) While other configurations are possible, they "would be expected to have impacts of similar types and magnitudes."

EPA Response: Comment noted; no change required.

6.113 The streams that would be lost under any of the three mining footprint sizes include those that directly provide habitat for salmonids, as well as those that may not contain salmonids at all times of year but provide important sources of water, macroinvertebrates, and other materials.

EPA Response: Comment noted; no change required.

World Wildlife Fund, Arctic Field Program (Doc. #5537)

6.114 Factions opposed to the EPA Watershed Assessment have objected to a process that does not review and assess a specific mine plan. Recent Alaska history shows that initial plans submitted by mining companies to State and Federal permitting agencies may have little to do with the eventual and ultimate development of the mining prospect. An example is the Red Dog Mine in Northwest Alaska, where, in 2008, the mining company Teck Cominco applied for and received mine extension permits for the nearby Aqqaluk deposit. Expanded mining footprints result in expanded local and cumulative environmental, cultural, and sociological impacts. This reality justifies the EPA's precautionary approach and eye toward long term and cumulative impacts.

EPA Response: Comment noted; no change required.

6.115 Expand the Assessment to include a mining scenario based solely on an underground mine at the Pebble East deposit. EPA should include the potential effects of this underground mine, since some stakeholders have indicated that Pebble may initially just apply for an underground mine plan. The analysis should also assess a larger mine plan then the current largest scenario in the final Assessment, to include mining at the full scale of the deposit.

EPA Response: See response to Comment 4.9 regarding an underground mine scenario. We recognize that the final size of a mine at the Pebble deposit could exceed the largest size considered in the assessment, but decided to focus the assessment on surface, open pit mining.

6.116 WWF applauds EPA's addition of potential mining scenarios to its earlier analysis from the proposed Pebble Mine, but understands that the total potential footprint of mining operations is unquantifiable at this point. For example, the potential impacts of the development and operation of a deep-water port are not fully analyzed. Also not fully understood is the potential volume, chemistry, and impacts of fugitive dust generated by mining, impacts of infrastructure development, and effects of transportation activities which may have a significant impact on fish, including salmon.

This Assessment appropriately analyzes the potential expansion of the Pebble Mine by assessing different scenarios. The first scenario is an open pit based on a small initial mine (0.25 billion tons, possibly the size of other potential mines in surrounding claim blocks that could be developed after Pebble's infrastructure is in place. The second scenario is a 20-year mine (2 billion tons). And the third scenario is a mine that would extract an ore deposit of 6.5 billion tons. The potential expansion of a single mine and/or development of additional mines in the region is important information for the government, public, investors and other stakeholders to know to further understand the potential ecological, cultural, and social risks of the project.

EPA Response: Comment noted; no change required.

Alaska Community Action on Toxics (Doc. #5541)

6.117 EPA readily acknowledges that the Watershed Assessment does not provide an in-depth review of a specific mining project. However, it does assess the potential environmental impacts associated with mining activities in the region given the nature of mineral deposits in the watershed, the requirements for successful mining development, and information filed by the mining companies themselves with both the State of Alaska and the U.S. Securities and Exchange Commission. The Watershed Assessment concludes that large-scale mining activities like the Pebble Mine would have potentially catastrophic impacts on Bristol Bay.

Even in a best case scenario – with no leaks or failures – the massive mine would destroy up to 90 miles of salmon stream, eliminate up to 4,800 acres of wetlands, and dewater an additional 34 miles of stream. Under routine operations, leaks would cause "toxic levels of copper" in the streams around the mine and kill salmon. And a tailings dam failure would be "catastrophically damaging to fisheries in the receiving waters."

EPA Response: Comment noted; no change required.

Earthworks (Doc. #5556)

6.118 During the peer review process, EPA was criticized for its use of a 'hypothetical mine plan,' based on published documents from the Pebble Partnership. However, EPA rightly notes that, "if the resource is mined in the future, actual events will undoubtedly deviate from this scenario. Even an environmental assessment of a proposed plan by a mining company would be an assessment of a scenario that undoubtedly would differ from the ultimate development" (ES – 24, emphasis added).

In fact, mine operations almost always differ significantly from the original mine plan as a result of mine expansions over the course of the mine life. The Fort Knox Mine, which was permitted in 1994, has undergone two expansions (2001 & 2007), in which the mine facility changed dramatically from its original mine plan. Similarly, the Kennecott Greens Creek Mine, which was permitted in 1983, underwent expansions in 1988, 1992, 2003 and 2012 – a dramatic change from the original mine permit. At the Zortman Landusky mine in Montana, there were 11 amendments to the original Zortman mine permit, extending the size of the mine from 273 to 401 acres, and 10 amendments to the Landusky mine permit, extending the size from 256 acres to 814 acres.

EPA Response: Comment noted; no change required.

6.119 We disagree with the incorporation of the Pebble 0.25 mine scenario in to the Assessment, as it presents an unrealistic mine scenario for the Pebble mine. It is much too small to justify the infrastructure required for this large, low-grade deposit. Even the Pebble 2.5 mine scenario is on the small side for this particular deposit, as evidenced by the designation of the 45-year, 3.8 billion ton scenario, as the "base case" for the Wardrop Study.[4]

EPA Response: See responses to Comments 6.97 and 6.115. We acknowledge in Section 6.1 of the final assessment that the largest mine size scenario considered in the assessment does not represent complete extraction of the deposit.

Pew Charitable Trusts et al. (Doc. #5655)

6.120 Environmental Protection Agency (EPA) data indicate that Pebble's footprint could span 32 square miles of wilderness-quality lands, requiring miles of roads and pipelines, a power plant and a deep water port and structures as high as Hoover Dam to perpetually contain an estimated 7 billion to 10 billion tons of contaminated tailings. The headwaters of the Kvichak and Nushagak Rivers, two of the eight rivers that feed Bristol Bay, is an inappropriate site for such a colossal open pit gold and copper mine.

EPA Response: Comment noted; no change required.

Alaska Wilderness League (Doc. #5656)

6.121 EPA readily acknowledges that the Watershed Assessment does not provide an in-depth review of a specific mining project. However, it does assess the potential environmental impacts associated with mining activities in the region given the nature of mineral deposits in the watershed, the requirements for successful mining development, and information filed by the mining companies themselves with both the State of Alaska and the U.S. Securities and Exchange Commission.

The Watershed Assessment concludes that large-scale mining activities like the Pebble Mine would have potentially catastrophic impacts on Bristol Bay

EPA Response: Comment noted; no change required.

Alaska Conservation Foundation (Doc. #6803)

6.122 In this second draft, EPA draws from a range of resources – from independent peer reviewed science to Environmental Baseline Data released by the Pebble Limited Partnership – to characterize the potential impacts of large-scale mining development on the Kvichak and Nushagak watersheds creating a document that seems to have a more balanced approach to considering the full range of potential stressors; i.e., there's less emphasis on the "catastrophic" failure mode and more on the sorts of "routine" failures that are more likely to occur.

EPA Response: Comment noted; no change required.

6.123 During the peer review process, EPA was criticized for its use of a 'hypothetical mine plan,' based on published documents from the Pebble Partnership. However, EPA rightly notes that "if the resource is mined in the future, actual events will undoubtedly deviate from this scenario *This is not a source of uncertainty, but rather an inherent aspect of a predictive assessment. Even an environmental assessment of a proposed plan by a mining company would be an assessment of a scenario that undoubtedly would differ from the ultimate development"* (ES – 24, emphasis added).

EPA Response: Comment noted; no change required.

American Fisheries Society, Western Division (Doc. #5377)

6.124 This version of the watershed assessment has been substantially modified and improved from the first review draft, with new material and analyses that clarify the scope and purpose of the document as well as address reviewers' other comments on the first review draft. (…) Specific improvements include:

- Analysis of a range of mining scenarios based on worldwide industry standards as well as available preliminary plans for mine development and operation in the Bristol Bay watershed;
- Consideration of impacts for mine-associated development and transportation corridors;
- Discussion of risks and impacts associated with the post-mining period, as well as during mine development and operation;

- Risk evaluations for a broader range of biological and cultural resources, including resident fish species, aquatic invertebrates, wildlife and Alaska native cultures; and
- Discussion and evaluation of mitigation and remediation during the mine operation and post-mining periods.

EPA Response: **Comment noted; no change required.**

6.125 This fact is identified throughout the report, but we believe the quantitative risk assessments should include maximum-impact scenarios as well. For example, the Pebble 6.5 Scenario estimates that 5.9 billion metric tons of ore might be removed yet the report acknowledges the deposit contains 10 billion metric tons for ore. As the magnitude of the operation increases, potential impacts will increase accordingly.

EPA Response: **We acknowledge in Section 6.1 of the final assessment that the largest mine size scenario considered in the assessment does not represent complete extraction of the deposit.**

Center for Science in Public Participation (Doc. #5540 and #5657)

6.126 BBWA mine scenarios are clearly based on published plans commissioned by Northern Dynasty Mines a 50% partner in the Pebble Prospect when they tried to sell their stake in the Pebble claims. What is NOT clear in the BBWA is that the 45 year 3.8 billion ton scenario is likely the most economic initial development scenario, which is significantly larger than the newly added 0.25 billion-ton and the 2.5 billion ton Pebble mine scenarios. Recommendation: Consider replacing the 2.5 billion ton scenario with the preferred 3.8 billion ton scenario.

2) The largest scenario considered by EPA, 6.5 billion tons, would recover just 60% of the estimated 10.8 billion ton Pebble deposit. If Pebble were fully developed it could be 40% larger than projected in the RWA with significantly higher potential impacts. Recommendation: Consider estimating potential impacts to fisheries from the 10.8 billion ton Pebble mine scenario.

EPA Response: **The 0.25 billion-ton scenario is included in the assessment in part to represent the potential for mining other, non-Pebble deposits in the Bristol Bay watersheds. It also represents an early stage of the potential build-out of a larger mine at the Pebble deposit. The scenario suggested in the comment falls within the range of sizes considered in the assessment. We recognize that the final size of a mine at the Pebble deposit could exceed the largest size considered in the assessment (see Section 6.1 of the final assessment).**

6.127 While the Pebble 0.25 mine scenario can be described as a viable mine scenario, it is not a realistic mine scenario for the Pebble mine – it is much too small to justify the infrastructure required for this large, low grade deposit. Even the Pebble 2.5 mine scenario is on the small side for this particular deposit, as evidenced by the designation of the 45-year, 3.8 billion ton scenario, as the “base case” for the Wardrop Study. (…) Recommendation: You might clarify that the Pebble 0.25 scenario is likely to be an example of a nearby mine scenario than a plausible scenario for mine development at Pebble.

<u>EPA Response:</u> It is stated in Ghaffari et al. (2011) that there would be an "initial life of 25 years"; therefore, the 2.0 scenario is realistic. This clarification is present in Chapter 6 of the revised assessment: "For the purposes of this assessment, we have also placed the Pebble 0.25 mine scenario at the Pebble deposit because of the availability of site-specific information. If mines are developed at other exploration sites in the watershed (Figure 13-1), they are likely to have characteristics and impacts much closer to those of the Pebble 0.25 mine scenario."

6.128 First, it presupposes that an EIS for a mine will provide a detailed analysis of the potential impacts of this type of mining on the region. An EIS is not designed to provide this level of analysis. An EIS is focused on a site-specific proposal. Second, throughout the 40+ year history of EIS analyses no mine has gone through that process, and been granted permits to operate, where the EIS/permits predicted that permit limits would not be met, or that damage to non-mine resources off the minesite would occur. Yet history is replete with examples of mines that have experienced significant problems in complying with their permits, and that have not met the predictions for performance that were analyzed in the associated EIS. An EIS must assume that fundamental predictions made for its analysis are correct (e.g., geochemistry and hydrology related to ARD contamination), and that mitigation measures will work as designed (e.g., seepage collection systems). But these EIS-related analyses have too often been proved to be wrong.

<u>EPA Response:</u> Comment noted; no change required.

6.129 "Cooling Tower Losses" are listed as one of the minor sources for water use/loss. I'm not sure if there will be significant cooling tower losses, since the mine plans to use waste heat for low temperature on-site applications (Ghaffari et al., 2011).

<u>EPA Response:</u> The cooling tower losses shown in the water balance for the Pebble 2.0 and Pebble 6.5 scenarios are taken directly from the average losses reported in Table 18.2.3 in Ghaffari et al. (2011). The losses reported for the Pebble 0.25 scenario equal the Pebble 2.0 losses reduced proportionally to the production ratio between the two scenarios.

6.130 In this section there is a discussion of the need to monitor some mine facilities, primarily the tailings dams, waste rock piles, and the abandoned open pit and underground mine, in potentially in perpetuity. With regard to the tailings dam and impounded tailings, it is noted: "… we do not assume that tailings consolidate to a fully stable land form. Thus, the system may require continued monitoring to ensure hydraulic and physical integrity in perpetuity." (p. 6-33). Recommendation: You could also add that another reason for the need to "maintain" the dam is that even though the tailings themselves may consolidate, they would still be susceptible to erosion if the integrity of the dam were to be compromised.

<u>EPA Response:</u> This point has been clarified in the final assessment.

6.131 The BBWA assumes all Potentially Acid Generating (PAG) waste will be identified and controlled prior to mine closure but prediction, isolation and control of PAG waste is an imperfect science; many examples of where PAG has not been successfully isolated and controlled exist.[15] The volume of ore at Pebble and NDMs finding a majority of 399 samples from 65 cores were acid producing and their conclusion that "it would take about 40 years for nearly all the pretertiary rock to become acidic…" suggests PAG management and control at Pebble will be difficult. Recommendation: Consider including or citing Figure 5 from NDMs report (footnote 9) to show PAG of Pebble tertiary rock, a safer assumption would to consider that PAG is not completely separated from NAG and base leachate models accordingly.

EPA Response: The assessment implicitly assumes that the results of the NAG humidity cell tests and barrel tests are representative of the rock that would be placed in the NAG waste rock piles. The estimated quantities of NAG and PAG waste rock are extrapolations from limited sampling. The assessment provides sufficient detail to allow the reader to assess the potential effect of different amounts of PAG material within the NAG waste rock piles or of variations in the actual amounts of NAG and PAG waste rock.

6.132 Both Illinois Creek and Nixon Fork were each "reopened" after spending several years in temporary closure status. Illinois Creek was closed in 1998 shortly after the mine was opened as the result of the bankruptcy of the Dakota Mining Corporation. The closure bond for the mine was not adequate to complete mine reclamation, and after considerable effort the Alaska Department of Natural Resources was able to contract with a newly formed Alaska corporation, the American Reclamation Group LLC, to 'operate the mine for closure' and reclamation was essentially completed in 2002.

EPA Response: Comment noted; no change required.

6.133 It has been my experience that nitrates remain significantly elevated for many years after mining ceases, particularly in discharges from waste rock piles,[8] and often above the water quality standard of 10 mg/L. Also the wording in "Table 6-9 – Stressors considered in the assessment and their relevance to the assessment's primary endpoint (salmonids) and USEPA's regulatory authority" "Nitrogen compounds are released during blasting and would deposit on the landscape." This wording in the table suggests that EPA is envisioning a plume of nitrogen in the air that settles over the landscape, but doesn't really show up in water. The primary vector for nitrogen releases will be through groundwater discharge to streams from the waste rock.

EPA Response: The comment is correct in that the assessment anticipates most of the nitrate from blasting would enter the atmosphere and then deposit on the landscape. Also, we did not address the direct deposition of nitrates on the waste rock during blasting. We do not consider it to be a significant or quantifiable issue.

6.134 You might also mention dust from the tailings pond, which is typically an issue, because the tailings ponds often have a significant amount of "beach" near the dam itself, both to enhance dewatering of the tailings and to lessen the amount of seepage under/around the dam. An example of the problems dust from a tailings impoundment can cause can be seen at the Questa mine in New Mexico, where heavy metals in tailings dust contaminated a high school.[9]

EPA Response: Tailings beaches would comprise primarily silica, but some other metals could be present also in minerals. Pyritic tailings would be stored subaqueously, so would not be on the beaches and not contribute to dusts. During mine operations, the

assessment states that dusts would be suppressed with water. In the closure phase, beaches would be reclaimed so that they would not produce dusts. Dusts were considered outside the scope of the assessment due in part to the fact that dusts are not regulated under the Clean Water Act, and partly because they would be controlled during operation and assumed dispersed predominantly over the mine site, with runoff from the site being captured and treated if contaminated with metals. However, mention of dust from TSF beaches has been added to Section 6.4.2.5.

<u>Borell Consulting Services, LLC (Doc. #4095)</u>

6.135 It has been shown by me and others that "The Assessment is based on a hypothetical mine that could not be permitted under existing State of Alaska and federal law requirements." Yet, the EPA Revised Draft has now expanded its evaluation to assume several other hypothetical mines will be developed in the region.

<u>EPA Response:</u> See response to Comment 6.2.

<u>J. M. Robbins (Doc. #4199)</u>

6.136 Third, we already know that tracing the reach of the groundwater affected by the Pebble mine is unknown. In fact, most of the science in this report is based on assumptions in which event the writers placed little confidence. To quote a few examples:

- p. 6-12 … However, a good deal of uncertainty exists because the humidity cell tests used to predict pore water chemistry represent a small sample of the ore body. Actual water quality in the tailings impoundment may differ significantly from what is estimated.
- p. 6-13 … Streams blocked by the mine pit or waste rock piles would, where practicable, be diverted around and downstream of the mine. However, the zone of groundwater depression around the mine pit and the slow filling of the post operation pit would likely dewater these streams for hundreds of years.
- Box 6.2 … Our analysis assumed that the drawdown at the mine pit was 100 m, but we also verified that the results were not very sensitive to this assumption.

(…) Therefore, the report is incomplete as it lacks information relevant to reasonably foresee significant adverse impacts on the human environment: i.e., water. 42 CFR 1502.22. Seepage of toxic and hazardous substances from this mine development is mentioned numerous times in the EIS. How much seepage and of what hazardous/toxic material is ill-defined. This commenter suggests that none is the appropriate amount. The environmental consequence of altering, depleting, polluting and using water is inadequately addressed in the statement.

<u>EPA Response:</u> We disagree with this comment. The rates and composition of seepage are quantified in Chapter 8 of the assessment.

<u>K. Zamzow, Ph.D. (Doc. #5054)</u>

6.137 Table 6-2. Mining scenario parameters: 1. It is not clear why the P025 scenario uses a very low mill rate, extending the period of mining to 20 years – this might be a good place to state the assumptions that were made. 2. Can you explain why the ratio of PAG to NAG waste rock moves to a much higher ratio of PAG between P2.0 and P65 scenarios?

EPA Response: We identified nine copper mines with deposits between 200 and 400 million tons (Mission, Safford [Dos Pobres], Copper Mountain, Lomas Bayas, Monywa – S&K, Piedras Verdes, Sanchez, Zaldivar, and Alumbrera). The life of each mine, calculated as the reserves divided by the production rate, ranged from 11 to 36 years (mean = 20 years). The ratios of NAG and PAG for the Pebble 2.0 and Pebble 6.5 scenarios were derived from the cumulative open pit phase volumes data for Cretaceous (PAG) rock and Tertiary (NAG) rock in Table 18.1.4 of Ghaffari et al. (2011).

6.138 Please explain why it is assumed that the tailings dam will start out as a downstream-construction method (the most stable) and move to a centerline-construction method (less stable) as the TSF grows.

EPA Response: Ghaffari et al. (2011) states: "The tailings embankments will be progressively expanded using downstream construction methods for the initial years, switching to centerline construction." Figure 18.3.3 of Ghaffari et al. (2011) shows the profile for such a dam. As with many aspects of the assessment scenarios, we presume that the experts who prepared the Ghaffari et al. (2011) report had access to the best available information and considered the engineering and economic tradeoffs of the proposed designs.

6.139 The EPA has appropriately characterized the Pebble 0.25 (P0.25), Pebble 2.0 (P2.0) and Pebble 6.5 (P6.5) scenarios as mine stages. The P0.25 stage is not economically feasible unless infrastructure has been developed, but it provides the lower bounds of impacts. The upper boundary considered by the EPA is at the P6.5 stage. This is the likely limit of ore that can be developed through open pit methods. However, it is not entirely appropriate for the EPA to ignore the 4.5 billion tons of higher grade ore that could be accessed as the open pit nears the end of its life. The risks are not simply additive; there would be a lower stripping ratio and less waste rock on the surface with underground mining. The long-term risks depend on the mine method employed. Block caving will leave the entire mine area rubble-ized, exposed to water and oxygen as discussed in Box 4-4. This provides a potentially potent source for acid drainage, a realistic pathway to the surface, and a low likelihood of mitigation or remediation once started. Including an underground mine could both provide a more realistic upper bound to the risk scenarios, and provide a format within which to compare risks of' alternative underground mining best practices.

EPA Response: We acknowledge that underground mining is possible and mention it in Section 4.3.2.1 of the assessment. However, we considered an underground mine scenario beyond the scope of the assessment, which focuses on surface, open-pit mining.

6.140 Table 6-1 is helpful. The paragraph following the table generally describes the components of the mine that went into scenario development. The constraints on the waste rock and TSF locations are described well. The section could be strengthened by describing in more detail the constraints of the other elements: the size of the mine is constrained by the balance of metal prices and energy costs; the time period of mining is constrained by the mill rate and metal prices; ore transport off-site is constrained by volume and infrastructure options. Although the placement of TSFs are described as constrained by topography, they should also be constrained by hydrology and risks related to contaminant transport (Section 6.1.2.4). It might also be noted that legally Lake Iliamna could be used for tailings disposal; it is the cheapest option but politically untenable at the present time. Box 6-1 is also helpful in clearly showing that the risks discussed in the mine scenarios are conservative at best.

EPA Response: Although the constraints noted in the comment would influence mine size, the length of time it was mined, and transport of ore off-site, this discussion is somewhat off topic from the purpose of the assessment. Since exploration of the Pebble deposit is further along than any other deposit in the area, we relied on the information presented in Ghaffari et al. (2011).

6.141 Table 6-2 makes clear that processing 6.5 billion tons of ore results in about 22.2 billion tons of waste: 10.9 billion tons of NAG waste rock, 4.7 billion tons of PAG waste rock, and over 6 billion tons of tailings. Is there a way to show this visually, similar to the way the height of the TSF-1 dam is shown in Figure 6-4? Is there a way to show the total waste at each of the stages P0.25, P2, and P6.5, with the relative proportions of NAG waste rock, PAG waste rock, and tailings?

EPA Response: Comment noted. We decided that providing the values was sufficient.

6.142 Why is the risk of pipeline failure presumed to be adequately reduced with double-walls where the pipeline is above ground, but a single-walled pipeline appears to be adequate when buried below ground (Section 6.1.3.2). Given the groundwater-surface water exchange, a pipeline failure below ground has the potential to contaminate surface waters; a double-walled pipeline for sections below ground would reduce the risk.

EPA Response: The aboveground portion is assumed to be double-walled, as described in Ghaffari et al. (2011), because it is more subject to mechanical damage.

6.143 Mine scenario footprint, P6.S. This suggests moving PAG waste rock into mined-out parts of the pit for storage to minimize the PAG waste rock outside the cone of depression. Has this been done at other copper porphyry mines?

EPA Response: This has either been done or proposed before. For example, at the Bonanza Ledge open pit mine in British Columbia, potentially acid-generating (PAG) waste rock was planned to be backfilled in the proposed Bonanza Ledge pit and flooded to minimize future oxidation and potential contaminant release. A similar management option has been proposed for the Genesis Project in Nevada.

6.144 Section 6.3.1 mentions that it is not possible to predict the long-term pit lake water quality. Given the completely uncertain long-term conditions, and the risks of seepage to aquatic life and potential risks of poor pit lake water quality on waterfowl, it is appropriate that EPA suggests long term monitoring and water treatment should be anticipated and bonded for. In addition to the uncertain efficacy of potential mitigation measures (such as pacifying the pit walls above the water line), microbial activity may influence the degree of acidity in the pit lake. For example, in a comparison of two lignite mining pit lakes, the difference in pit lake seasonal turnover may have created conditions that shifted the balance between oxidizing and reducing bacteria, thereby maintaining acid water at one pit lake and neutral pH water at another.[6] However, as mentioned elsewhere, the pit lake will existing perpetuity, and unless water quality reaches similar quality of surrounding waters, the risks could last longer than the human institutions available to manage them.

EPA Response: **The comment reinforces the statement in the assessment that pit lake water quality is not presently predictable. The revised assessment does state that predicting pit water quality has a high degree of uncertainty, but that water would need to be monitored and treated to meet effluent requirements prior to being discharged to streams, for as long as the water remained contaminated.**

6.145 In Section 6.1.2 there is a discussion of post-closure tailings water. Tailings pore water (seepage) is expected to be similar to that of humidity cell leachate and tailings pond water is expected to approach the chemistry of ambient water. The humidity cell tests showed wide variability in chemistry (Appendix H), and using the mean may underestimate contaminant leachate. Ammonia and the cyanide breakdown product thiocyanate (if cyanide is used in gold processing) may remain elevated for years in tailings pond water.[5] Tailings acid generation and dam failure will need to be prevented in perpetuity. A balance will need to be struck between drawing water down to relieve pressure on the TSF dam(s) and maintaining a water cover to reduce oxygen infiltration and acid generation (Section 6.3.2). Reducing the risk of dam failure inherently increases the risk of poor water behind the dam.

EPA Response: **The assessment is based on the design assumptions described for the three mine size scenarios (as detailed in Chapter 6). Other design assumptions or approaches and future data could lead to different conclusions. The assessment presents sufficient data for the reader to judge the sensitivity of many of the potential effects to variations in the design assumptions. More significant deviations from the mine scenarios may require additional analyses to assess likely effects.**

6.146 If NAG waste rock piles are reclaimed, why would they be weathering?

EPA Response: **Reclaimed waste rock piles would be shaped to an acceptable form and planned use. They would not necessarily be isolated from moisture or oxygen and so could potentially weather. The revision clarifies in the introductory portion of this section that wastes are reclaimed during the closure period. Additionally, we assume that existing water management structures and the WWTP would be monitored and maintained as part of post-closure operations.**

6.147 PAG waste rock (section 6.3.3) will need to be managed during operations so that it remains accessible for blending into mill feed, while minimizing the risk that uncontrolled seepage from unlined waste rock facilities poses to waterways. Milling PAG waste rock reduces the long-term risk of PAG leachate entering water, but may increase the short-term risk by making it untenable to encapsulate PAG within NAG cells. There is an assumption that the onset of acid generation will not occur until 20 years after extraction, providing a safety factor for management (Section 6.1.2.3). If accurate, the critical period of concern would be between 20 years after the mine starts up (when rock would begin generating acid) and 20 years prior to closure (rock after that could be milled or submerged before it began generating acid); in the P6.5 scenario of a 78 year mine life, the greatest risks would be in mine years 20-58. Nearly four decades over which seepage would need to be completely collected and controlled - a near impossibility.

<u>EPA Response:</u> No PAG waste rock would remain on the surface for more than 20 years in any of our scenarios. Section 6.1.2.3 states: "PAG waste rock would be stored separately from NAG waste rock and over the life of the mine would be blended with processed ore to allow consistency in chemical usage and to remove material from surface storage prior to its expected time of acid generation (e.g., within 20 years of its extraction)." Leachate management and monitoring would still be required to ensure acceptable performance.

6.148 In reality, acid onset will occur over a range of years (PLP's own data estimates-onset to acid ranges from one year to decades). In reality, there could also be intermittent closures over the life of the mine or premature closure (discussed in Section 6.3.5), leaving waste rock on the surface for longer periods of time than originally anticipated before final milling or submersion. This argues for continuing kinetic testing of multiple core samples representative of the entire ore body and hydrothermal alterations, and for continuing to collect and test core, samples for decades as deeper deposits are accessed. Rock should be placed as safely as possible as if the mine might enter an intermittent closure in the future. This might require placing PAG waste rock on liners to reduce the seepage into groundwater, and placing lysimeters within waste rock piles to monitor changing chemistry as has been done at Red Dog and other mines. Waste rock management plans should require that PAG rock never be outside the cone of depression, which may require processing PAG as the cone of depression at the end of mine life. PAG should be surrounded by NAG. Prior to permitting, a range of mitigation options should be presented along with known efficiency and failure rates at comparable mines.

<u>EPA Response:</u> Comment noted; no change required.

6.149 Table 6-9: Has anyone evaluated whether warmer temperatures in streams and an increase in TDS and potentially in selenium and nitrogen could trigger algae blooms (even if phosphorous does not increase)?

<u>EPA Response:</u> We believe that phosphorus is likely the limiting factor in algal production in these streams, and that algal blooms are unlikely.

6.150 1. Concentrations at which metals are a concern to aquatic life were compared to the concentration of metals reported by PLP in tailings and waste rock leachate (Section 6.4.2.3) to determine which metals were most likely to pose a risk to salmon. Metals were not a concern if the average concentration in the leachate was below toxic concentrations. This approach is conservative in that a) the methods used by PLP were flawed (e.g., used larger particles than the test method protocol) potentially underestimating the rate of release time to onset to acid drainage, and metal concentrations in leachate; b) samples submitted for testing were not representative of the ore body and may not have captured alteration types typically found in hydrothermal mineralization (described in Appendix H) therefore the full range of leachate concentrations are not known; c) concentrations on the upper end may be observed on a regular, seasonal basis with flushing effects after cold or dry periods.

2. Dust from the tailings beaches, with pyrite and metals that could initiate chemical contamination in wetlands (reductive environment) and streams (oxidative environment) has not been considered in the stressors evaluation (Section 6.4.2.5). This stressor should be

listed, along with mitigation options, particularly mitigation options that might be effective during winter’2910.2s extreme cold when there are high winds.

<u>EPA Response:</u> PLP did alter the standard ASTM method for the humidity cell testing; however, such alterations are not uncommon and typically have a rationale based on combined knowledge of the lithology, mineralogy, and geochemistry of the material. Multiple factors affect whether ions are released and their speed of release from minerals within a rock matrix (e.g., mineral grain size, solubility of minerals present, rock matrix particle size, location of minerals within the matrix, formation of secondary minerals, etc.). Additionally, air and water fluxes contribute to drainage quality along with the particle size. In the EBD, PLP states: “For finer particle sizes, there was a concern that a disproportionate amount of internal grain matrix would be exposed, which would be less representative of mined materials.”

It is not clear why the comment states the samples were not representative. The PLP EBD states that sample selection was designed to ensure different components would be evaluated, which included all lithologies, all alteration types and zones identified, and the range of potential contaminant and sulfide values.

We assumed that concentrations presented by PLP in their EBD were applicable to the Pebble deposit, and could be similar to what might be present at a different porphyry copper deposit. It would not be expected that concentrations at any given point in time would be identical to the means used in the assessment; however, there needs to be some basis on which to make comparisons and this was the method chosen. Without doing true site-specific seasonal testing, it is not possible to say how or even if the results would differ from the means and ranges seen in testing.

Regarding dust from tailings beaches, see response to Comment 6.134.

<u>V. Wilson III (Doc. #5529)</u>

6.151 Expand the Assessment to include a mining scenario based solely on an underground mine at the Pebble East deposit. EPA should include the potential effects of this underground mine, since some stakeholders have indicated that Pebble may initially just apply for an underground mine.

<u>EPA Response:</u> See response to Comment 6.139.

<u>M. Satre (Doc. #6756)</u>

6.152 The latest draft of the assessment completely ignores the direction that the EPA was given by the 2012 Peer Review Panel and continues to rely on a hypothetical mine scenario that could not be permitted under existing local, state, and federal laws.

The mine scenario used in the assessment is technically flawed and lacks sufficient detail for even the most basic scientific risk assessments. The scenario fails to come close to the standard of information that any project would be required to meet in a permit application. At a minimum this would normally include detailed plans for mine designs, mining rates, process flow sheets, recoveries, concentrate and tails composition, water management, water balances, waste rock characterization, and construction and operating plans for waste rock and tailings storage facilities. It would also include detailed information on the avoidance, minimization and mitigation plans that ensure that any project will have the least amount of impact to its surrounding environment.

<u>EPA Response:</u> Contrary to the comment, the peer reviewers recognized the need for a mine scenario to perform a risk assessment.

<u>D. L. Chesser (Doc. #3253)</u>

6.153 It is shameful that the EPA is using outdated mining information and methods to build a case against Pebble Mine before they have even seen the plans or permit applications. Use of a hypothetical mine as a basis for the assessment is grossly unfair and criminal, as far as I am concerned. The EPA has no idea what Alaska is all about. The EPA has no idea what current safeguards are already in place to protect the salmon fishery in Bristol Bay. The EPA has no idea, because no one at the EPA has even seen any detailed plans or environmental mitigation strategies for Pebble Mine. So, the EPA has made up a scenario based on outdated and unrealistic mining methods, and gave it a 'worst case scenario' spin. Yeah, great job EPA.

<u>EPA Response:</u> See response to Comment 6.2.

<u>G. Y. Parker (Doc. #5615)</u>

6.154 Pipelines – Recommended Mitigation and Restriction in a § 404(c) Determination: Highest engineering and operations standards.

<u>EPA Response:</u> The scenarios assume modern conventional industry practices. The assessment is not a regulatory document, so recommendations for mitigation are beyond its scope.

6.155 Pit walls and surface and groundwater from the pit - Recommended Mitigation: Short term treatments of pit walls to prevent oxidation may be available, but no long term mitigation for acid generation and metals leaching is available. Long term quality of pit water is unknown. Water treatment may be the only means available to mitigate the adverse effects of poor water quality in a final pit lake. Water treatment must address both surface and groundwater to be effective. However, issues of perpetual treatment arise. So no sustainable mitigation is available for pit lake water quality issues. Recommended Restrictions for a§ 404(c) Determination: No mitigation is available. Significant adverse effects on downstream water is unacceptable, so a prohibition of mining is required to achieve the purposes of the Clean Water Act.

<u>EPA Response:</u> See response to Comment 6.154.

<u>P. Walsh (Doc. #4398)</u>

6.156 You provide 3 scenarios ranging from 20-78 year duration mining operations. I find this the most unrealistic of anything in the plan. If large scale mining is permitted, it will last beyond any timeframe that is meaningful to planning. You don't have to go far to find examples of why this is true. Go just a few miles west to Platinum, Alaska, home of the Platinum Mine which has destroyed the Salmon River. This mine is in operation, and is already older than the 78 year maximum scenario in your assessment. The reason for the indefinite duration of mining is that technology continues to develop, and mining waste that is truly unusable now will become economically viable in the future as extraction technology advances. Thus, I think the only reasonable planning timeframe is to consider a large scale mine to be a permanent change. It will never be restored to natural function in a timeframe meaningful to management.

EPA Response: Comment noted. Timeframes were based on the size of the evaluated deposits and the production rates. Additional production (e.g., of the entire Pebble deposit) could extend the duration of mining. We believe that the Pebble 6.5 (78-year) scenario is reasonable, although we acknowledge that other scenarios are possible.

The Nature Conservancy (Doc. #4315)

6.157 In our first set of public comments regarding the Draft Watershed Assessment, we concluded that at a general level, our work corroborates and supports the EPA's findings in the Draft Watershed Assessment and that we believe EPA used appropriate scenarios to establish potential risks of types and scale of risks consistent with our analyses.

EPA Response: Comment noted; no change required.

American Fisheries Society (Doc. #3105)

6.158 The largest mine scenario used in the draft (6.5 billion tons) would only recover 60% of the estimated 10.8 billion ton deposit (see Ghaffari et al. 2011). So, there is a great likelihood that that the mine would be 66% larger, meaning that the assessment markedly underestimates the likely impacts of normal operations and potential catastrophic failures.

EPA Response: See response to Comment 6.119.

6.159 [The 2013 draft] (…) assumes that all acid generating waste will be identified before closure, despite the failure to do so in a preponderance of other abandoned mines (see Kuipers et al. 2006. Comparison of predicted and actual water quality at hardrock mines: the reliability of predictions in environmental impact statements. Kuipers and Associates, Butte, Montana).

EPA Response: Section 8.2.5 of the revised assessment discusses uncertainties related to imperfect NAG and PAG waste rock separation and its potential implications.

Ground Truth Trekking (Doc. #3928)

6.160 The proposed Pebble Mine would generate very large volumes of rocky and mud waste. For most readers, the amounts in question may be difficult to intuitively comprehend. For this reason, we suggest the Watershed Assessment add total waste tonnage to Table 6.2, Mine Scenario Parameters. We suggest also some form of simple graphic depiction of total waste volumes, on a meaningful scale, and perhaps comparison to metal volumes.

EPA Response: Comment noted, but we decided that providing the values was sufficient.

6.161 Waste rock is tentatively divided into Potentially Acid Generating (PAG) and Non-Acid Generating (NAG). Current plans call for storing both types in uncontained waste rock dumps (Exhibit 5), processing the PAG waste rock only at the mine closure (Wardrop 2011, Section 1.8.8). Both PAG and NAG waste rock can generate contaminants – acid mine drainage in the NAG waste, and metals leaching in the PAG waste.

Historically, waste rock has been a primary source of acid drainage. It often proves uneconomical or infeasible to relocate it to containment once acid generation is detected. Likewise, existing tailings containment facilities are typically not sized to contain the additional volume acid-generating waste rock, primarily because of the increased construction costs associated with expanding a tailings facility to contain the additional waste (Dave Chambers, Center for Science in Public Participation, personal consultation).

<u>EPA Response:</u> The revised assessment states that NAG and PAG waste rock would be separated in the waste rock pile during mine operation and processed throughout the mine life, as mill conditions permit, with the intent to process all of the PAG waste rock before mine closure.

<u>S. L. O'Neal (Doc. #5528)</u>

6.162 Further, in response to reviewer comments, authors added a 0.25 billion ton scenario to the revised Assessment. Although this subject falls outside my area of expertise, I am quite skeptical this is an economically viable mine size given the investment in exploration and infrastructure required prior to development. If the 0.25 billion ton scenario is deemed economically feasible and remains in the final Assessment, a 10.8 billion ton scenario should also be incorporated given that is the known size of the deposit as per Ghaffari et al. 2011.

<u>EPA Response:</u> See response to Comment 6.119.

<u>Moore Geosciences, LLC (Doc. #2911)</u>

6.163 The assessment makes a strong case that potential effects and management of those effects must be considered as lasting over millennia, not just during the operation of the mine. With such a large deposit and associated extensive development infrastructure it is very likely that monitoring and control will be required in perpetuity. There is little evidence that mines of this size and complexity and in such dynamic environments can be left alone after ore is depleted and the mine is closed. Monitoring and containment could outlast the "lifetime of human institutions" responsible for such regulation. In addition, future more variable climate conditions may increase the likelihood of increased releases of toxics into the aquatic system down gradient from the mine site, which makes designing wastewater treatment and tailings impoundments extremely difficult. The authors identify the need for monitoring and management of the physical mine site in perpetuity.

<u>EPA Response:</u> Comment noted; no change required.

<u>M. Schelmeske (Doc. #6280)</u>

6.164 You say that the mines and associated infrastructure will be monitored after closure but, since this needs to be for such a long time, how can we be sure that funding will always be there to do the required monitoring? What guarantee do we have that the monitoring will continue and the sites are taken care of? Please explain how you will monitor and correct environmental problems if the company goes bankrupt or closes down or something to that effect? I am very concerned that the mines will be abandoned after the money is made and there will be irreparable damage to the resources.

EPA Response: See response to Comment 6.64. Full consideration of these issues is outside the scope of the assessment, which focuses on evaluating potential impacts of large-scale mining rather than establishing a plan for monitoring and correcting any impacts.

D. Girvin (Doc. #6119)

6.165 I find it an outrage that during the video one of the Pebble Mine 'team' talks about how they have the capability to build the tails pit with no concern of leakage, then in the next breath says they will have several ponds to collect the leakage, and it will be pumped back to the main tanks, and they will build more collection tanks for the leakage as needed. Right after stating there will be no leakage! This is a horrible idea all the way, no matter how you look at it the risk is too great. Please do not do this.

EPA Response: Comment noted; no change required.

C. Borbridge (Doc. #5066)

6.166 More information could be provided on predicted failure rates of earthen dams. This should be beyond the predicted failure rates of standard or select engineered dams. We don't know what level of engineering will occur until the dam is built. The estimates of the durability of the dams should more specifically include estimates of longevity of earthen dams located in an earthquake zone. There is less certainty in engineering an earthen dam built with mine tailings as opposed to other more uniform earthen dam. As acknowledge in the study, there is more difficulty in predicting the performance of any structure the longer it must last. The requirement of these dams is that they last forever.

EPA Response: Comment noted, but we are unsure what additional information could be added that would be informative. Neither additional analysis of the historic performance of dams nor further discussion of a future dam in the Bristol Bay watershed (without a detailed engineering design) would provide any meaningful insights beyond what is already presented in the assessment.

Weber Sustainability Consulting (Doc. #4319)

6.167 Tailings may or may not present the magnitude of biogeochemical threat posed by waste rock dumps, but insofar as they do, then the sulfide minerals that break down to produce acid mine drainage promises to endure and to reduce salmon and trout populations inestimably because of the massive quantities presented.

The physical effects of tailings sedimentation spread among the many rivers and lakes below the Pebble deposit were there to be tailings containment failure due to weather events beyond design parameters, earthquakes, or combined effect of more than one of these events, spells disaster for salmonid spawning in streams. Clean gravels and rock streambeds are crucial to these fish, as we see in trout streams across western America. The immense volumes of tailings discussed in the 0.25, 2.0 and 6.5 versions of the Pebble mine mean little to most people witnessing these phenomena.

<u>EPA Response:</u> Comment noted; no change required.

<u>M. Apel (Doc. #0151)</u>

6.168 Specifically, Page 21 of the Executive Summary discusses the estimation of tailings dam failure, noting the use of standard engineering practices for these kinds of dams. Yet, it doesn't seem to take into consideration the higher risk or impact of seismic activity in the area, and its relationship to 'standard engineering' design.

<u>EPA Response:</u> Standard engineering practice includes the assessment of seismic risk, the determination of appropriate seismic parameters, and appropriate design and construction to achieve the required level of safety.

<u>L. Trasky (Doc. #5050)</u>

6.169 Because billions of tons of acid generating mine waste must be stored behind porous earth fill dams in perpetuity, it is inevitable that these dams will eventually fail or leak. Over thousands of years the system of pipes, drains and liners necessary to capture and return the contaminated water leaking from the largest earth fill dams on earth will eventually break or corrode under the crushing pressure and highly corrosive environment underneath the largest earth fill dams on earth. There will be no way to replace any of these pipes, pumps and equipment which will be located hundreds of feet under the tailing dams. There is also some question if anyone will notice or care in a thousand years. There have been at least 93 tailings dam failures since 1960 and 47 since 1990 when it can be assumed modern regulatory and engineering practices have been in place. A number of the most dramatic tailings dam failures have occurred in the U.S. The failed dams have been much smaller than the proposed Pebble dams and none have been in place for thousands of years.

<u>EPA Response:</u> Comment noted; no change required.

<u>Stratus Consulting (Doc. #5433)</u>

6.170 This revision of the Watershed Assessment contains a much longer discussion of waste rock leachate, and the "routine operations" scenario now assumes that some of this leachate would escape. In this scenario, toxic effects are predicted for substantial portions of the South Fork Koktuli River and Upper Talarik Creek drainages. This is probably more realistic than the "no failure" scenario described in the previous draft, given the difficulty that mine developers would have in collecting all of the leachate in these high-permeability materials. EPA also calculated the leachate collection system effectiveness that would be required to ensure that copper concentrations do not exceed standards in downstream waters. These calculations estimate that more than 99% of the leachate would need to be captured, which provides more context for the toxicity of these leachates than in the previous draft.

<u>EPA Response:</u> Comment noted; no change required.

<u>J. Bronson (Doc. #5523)</u>

6.171 Finally, please include more discussion about what will happen to the waste rock piles after the mine closes. Who will maintain them and for how long? I assume that you share Alaskans' desire for the Bristol Bay watershed to still support salmon streams a hundred and a thousand years from now. If the waste rock piles are not maintained and monitored, it is fairly universally accepted that contaminants likely will be released and will damage the salmon runs. Please help the public realize that if Pebble is permitted, that we are taking on a commitment for centuries.

EPA Response: The assessment assumes that monitoring and wastewater collection and treatment would continue for as long as necessary to meet relevant criteria and standards. However, it is acknowledged that there is an unquantifiable risk of premature site abandonment.

Chapter 7: Mine Footprint

The Pebble Limited Partnership (Doc. #5536)

7.1 *Original Draft Location: Page:* 3.5, *Section*: Report Section Identification: 3.5 Types of Evidence and Inference, *Excerpt*: [blank]

Original Comment from State of Alaska: The risk assessment approach using types of evidence and inference, conceptual modeling and characterization of risks by the lines (or multiple lines) of evidence is appropriate for generally understanding and scoping the watershed risk assessment. Higher risk (probability) failure or impact effects will likely require additional studies and numerical modeling to refine and better understand and quantify project risks and uncertainties.

Recommended Change: Recommended Change: The study should outline what additional data, studies and numerical models would be appropriate to evaluate higher risk mine elements (i.e., tailings facilities failures), that would be appropriate to support a comprehensive watershed assessment and risk analysis, and will prepare agencies and lay the groundwork for future mine permit studies.

Comments Regarding Adequacy of Response in Second Draft:

Addressed: No.

Comments: None of the risk assessments in the revised document (Chapters 7 through 11) specifically address additional data that would be required to address higher risk mine elements, conduct watershed assessments, or be required for future permitting. The document continues to focus on assumptions and extrapolations without demonstrating the need for further analysis.

EPA Response: Chapters 7 through 11 do include descriptions of critical uncertainties and additional data, assessment, and analysis needs (e.g., the need for better understanding of factors limiting fish populations and groundwater-surface water connectivity, as discussed in Chapter 7). Identifying studies that should be performed to generate additional data and models is beyond the scope of this assessment.

7.2 *Original Draft Location*: Page: 2.9, Report Section Identification: 2.2

Original Comment from State of Alaska: Only resident, non-anadromous Dolly Varden are considered in the assessment but there are significant anadromous Dolly Varden populations in the Kvichak and Nushagak watersheds.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Chapter 7 - Anadromous Dolly Varden are not addressed, and no reason given as to why this is so. Dolly Varden should be included in the analysis.

<u>EPA Response:</u> The presence of both anadromous and nonanadromous Dolly Varden is noted in Chapter 7. The assessment acknowledges that the distribution of anadromous Dolly Varden in the Nushagak and Kvichak River watersheds is not known.

7.3 *Original Draft Location*: Page: 5.1, Report Section Identification: 5.1.2

Original Comment from State of Alaska: It is stated that the abundance counts "…underestimate true abundance by a large and unknown factor" and "…true spawner abundance is probably substantially higher than the values presented…" However, by using the "highest" index counts, it is likely to be representative, or possibly an overestimate of average, and applying this "highest" index count across an entire stream system, or even across large areas (i.e., reaches) of the stream where spawning may or may not occur (because spawning is generally restricted to particular reaches or habitat conditions that do not exist everywhere in the stream), could very well overestimate impacted numbers of fish. In addition, the values presented in Table 5-1 seem to be consistent with the reported numbers of sockeye and Chinook by the ADFG counts since 1955. With over 30 years of data, apparently consistent with the 4 years of data collected for the Pebble Limited Partnership Environmental Baseline Data, using the highest index count may result in an overestimate of the number of impacted salmon. Further, the Northern Dynasty Tailings Impoundment A Initial Application Report by Knight Piesold (September 2006) clearly states that TSF areas were selected because of a measured lack of significant populations of anadromous fish. Some level of verification between the EPA estimated direct fish impact and the Northern Dynasty fish data would seem to be needed.

Recommended Change: Provide discussion on similarity/differences between Pebble Limited Partnership Environmental Baseline Data (2004-2008) data and ADFG (1955 on) data, and be clear and correct on likelihood of over or under estimation of numbers, particularly across stream reaches/areas. It would be prudent to more clearly separate out discussion of effects into those caused by habitat lost under/upstream of the mine and TSF areas (e.g., direct), and those downstream from the mine area (e.g., indirect). Edit language to refrain from broad statements of significance of impact without site-specific data analysis to show it.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No comparison of the ADFG counts and PLP counts was provided. The discussion of the two data sets appeared to be mostly unchanged. There is no clear indication of when the estimates were an over or under estimation. The structure of the effects discussion is largely the same, separating out habitat modifications, stream flow modifications, and water quality issues from the effluent. The comment still needs to be addressed.

EPA Response: We used the highest index count because it is mathematically closer to the true number of salmon using a given survey reach in a given year than the average of a series of counts. Salmon show up in the survey reach over several weeks, and total abundances within reaches change nearly continuously as spawners move through, die, or drift downstream. Each of the periodic surveys only counts a fraction of the fish using the survey reach because none of the individual fish are present for the entire spawning period. Thus, the peak count is the closest to the true number and it is theoretically impossible for it to exceed the true number. Averaging a series of survey counts, especially when some of the surveys were conducted at a time when few or no spawning salmon were present, only serves to deflate the estimate and move it farther from the true number. The comment implies that index counts are somehow being extrapolated to areas outside of the survey reaches, but that is not correct. We did not state or imply that ADF&G data were inconsistent with, or better or worse than, PLP data. We also are not judging the significance of fish populations under the TSFs. We are simply presenting available fish data along with the appropriate caveats.

7.4 *Original Draft Location*: Page: 5.3, Report Section Identification: 5

Original Comment from State of Alaska: When reading the text in the Executive Summary, Chapter 2, Chapter 5, Appendices A through F, much discussion is based on the entire Bristol Bay region. However, unless there is a water quality issue downstream or a dam break, the effects to the entire Bristol Bay region would be minimal. The Figure on page 5-3 shows that there is no rearing or spawning area of pink salmon anywhere near the mine disturbance. The Figure on page 5-4 shows that there is no rearing or spawning area of chum salmon near the mine disturbance. The Figure on page 5-5 shows that there is no rearing or spawning area of sockeye salmon in the mine disturbance (although it is close). The Figure on page 5-6 shows that there is minor rearing or spawning area of Chinook Salmon in the mine disturbance, and the Figure on page 5-7 shows that there is definite rearing or spawning area of coho salmon in the mine disturbance, but it is small in extent and at the head of the watersheds compared to the rest of the entire Bristol Bay region. The Figure on page 5-8 shows significant use by Dolly Varden fish, but this fish does not appear to be of great value in the Bristol Bay region. It appears that the Bristol Bay Watershed Assessment is constantly citing the overall value of Bristol Bay region fisheries but downplays the actual amount of these stream lengths (that have the valuable fish) which would be affected by the mine.

Recommended Change: Recommended Change: Depict more accurately the amount of stream segments that are rearing and spawning areas for the valuable fish and which could be affected by the mine and compare them to the total length of rearing and spawning lengths for the Bristol Bay region. It will be seen that the amount of blocked and eliminated segments are a very small percentage of the total for the region.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: There is no detailed analysis of the amount of stream segments that are potentially affected compared with the species and life stages used in these areas, aside from what is presented in Figures 7-2 thru 7-8. Tables

13-2 thru 13-7 do have the potential overlap of affected waters with species and life stages present, but there is no indication of the extent to which the overlap occurs (i.e., km of stream or area of lake/wetland impacted). The comment has not been adequately addressed. Failure to incorporate the relative value of the headwater habitats to the entire populations of each species results in an overstatement of effects.

<u>EPA Response:</u> We recognize the need for a better sense of context within the larger region, and the final assessment has been revised accordingly. The AWC and AFFI databases are the best, most consistent record of reported fish distributions, and are the basis for the depictions of fish rearing and spawning areas (e.g., in Figures 5-4 through 5-8 and Figures 5-10 through 5-11 in the final assessment). Tables 7-5 and 7-8 in the final assessment summarize the total length of AWC streams and the length impacted by the footprint.

7.5 *Original Draft Location*: Page: Multiple, Report Section Identification: 2.0 and 4.3.7

Original Comment from State of Alaska: High seasonal fluctuations exist in the mine area as shown in Figure 2-7, page 2-23. However, the seasonal effects were not adequately considered in the water balance estimation. Frozen conditions would have a major impact on flows in creeks and runoff. Peak seasonal precipitation and snow melt would also have a major impact on the water balance. Water balance estimated with averaged precipitation (as in Box 4-2, page 4-28) will not represent the seasonal field conditions.

Recommended Change: Recommended Change: Provide temporal and seasonal fluctuation of rainfall, stream flow, and groundwater level. Evaluate the mining impact on water balance under long term average condition and high seasonal flow condition.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The same figure is incorporated in the revised text (Figure 7.5) and the suggested analysis has not been incorporated. Since the analysis continues to rely upon average streamflow ignoring consideration of seasonal fluctuations, accurate predictions of streamflow impairment are questionable.

<u>EPA Response:</u> The assessment primarily considers potential changes in annual streamflows that would be caused by development of the mine scenarios. For some aspects, such as the water table drawdown due to the pit dewatering, seasonal fluctuations would be small compared to the amount of drawdown. For specific stream reaches in which seasonal flow variations would be more pronounced, available data do not permit quantification of location- and species-specific impacts on fish. Section 7.3.4 discusses the uncertainties and assumptions associated with the streamflow change analyses. The mine operator would have some flexibility to use available onsite storage to optimize the timing and rate of water releases and provide seasonal variability.

7.6 Figure 7-1 (p. 7-3): Conceptual model illustrating potential linkages between sources associated with the mine scenario footprints, changes in physical habitat, and fish endpoints.

The figure provides a conceptual model/illustration of the potential impacts from the mine footprint on fish and fish habitat. The conceptual model/illustration lacks two important elements: 1) a level identifying potential mitigation and enhancement measures that might be incorporated to minimize or, in some cases, eliminate impacts; and 2) an assessment of scale incorporating relative size of potential impacts with increasing distance from the mine footprint, further distinguished as direct vs. indirect impacts. The figure currently lacks a context for the spatial scale of these potential impacts.

In contrast, a more appropriate conceptual model would identify both direct and indirect impacts along with state of the art mitigation measures including habitat replacement and enhancement along with the associated long-term maintenance of those habitats as mitigation. Examples of well accepted habitat replacement measures include engineered stream channels for spawning and rearing, construction of ponds for rearing, flow mitigation infiltration galleries, connectivity to off-channel habitat, removing fish passage barriers and implementation of a water management plan designed to enhance fish habitat suitability with controlled flow releases. In addition, avoidance of critical habitats where possible is standard practice. The Assessment's conceptual model fails to acknowledge implementation of Best Practice Management Plans and ignores existence of mitigation and enhancement measures designed to minimize or eliminate impacts to fish habitat.

<u>EPA Response:</u> Mitigation measures are discussed throughout the assessment. Scenarios assume that modern conventional mining technologies and practices are utilized and the assessment considers risks from routine operation of a mine designed using modern conventional mitigation technologies and practices. Mitigation is included in the conceptual diagrams for Chapters 7 through 10 and discussed briefly in each chapter. Appendix J provides new material outlining potential mitigation options and considerations of their potential effectiveness.

7.7 Figures 7-2 through 7-8: Anadromous and Resident Fish Distributions from ADFG fish distribution catalogue.

The distribution of sockeye and coho in the South Fork Koktuli appears to be a relatively liberal interpretation of upstream extent of fish distribution, but it is difficult to distinguish the exact location of Frying Pan Lake in the Assessment's figures. Sockeye should not be found upstream of Frying Pan Lake. In addition, the distribution of chinook in all three watersheds does not reflect current data on chinook as understood by PLP's baseline data and impact analysis.

<u>EPA Response:</u> The assessment relies on the 2012 AWC and AFFI catalogs for fish distribution information. These provide the best, most consistent records of fish distribution, and they are revised as new waters are added and status indicators are updated. However, we do acknowledge potential errors in these databases.

7.8 The Assessment describes the Bristol Bay sockeye salmon fishery as the largest in the world (46% of world population of sockeye). It is unclear from the Assessment what EPA's assumptions are regarding the percentage of sockeye production comes directly from the South and North Fork Koktuli, or the Upper Talarik. Furthermore it is unclear if within this region the values presented in the Assessment are intended to represent annual or inter-annual variation. ERM's analysis (see Tables 1 and 2 and related discussion above) indicates that the number of sockeye produced by the North Fork Koktuli (as well as the South Fork Koktuli and Upper Talarik Creek) in comparison to the total district inshore run for the Nushagak and Naknek-Kvichak systems, is very low. When compared to overall Bristol Bay production, the proportion attributable to sockeye production by the three drainages is near zero. This is not to suggest that these fish are not important, but only that they represent a small fraction of overall production, and are nominal in comparison to the annual Bristol Bay commercial harvest (25 to 30 million sockeye commercially harvested annually). Implying, as the Assessment does, that the loss of stream habitat in these drainages will have a net effect on sockeye numbers at the Bristol Bay scale is not supported by the data.

The Assessment describes the chinook salmon returns in the Nushagak River as averaging over 100,000 individuals per year. The analysis presented in the Assessment is incomplete and misleading in that it fails to recognize that the North and South Forks of the Koktuli River (tributaries of the Nushagak) and other reaches within the immediate area of the hypothetical mine location are relatively minor contributors to the overall Nushagak River chinook salmon production. The North and South Forks of the Koktuli River (tributaries of the Mulchatna River, a major Nushagak River tributary) are relatively minor contributors to overall Nushagak River chinook salmon production. Specifically, as discussed above, the percentages of the Nushagak watershed's annual return of sockeye salmon and commercial catch of sockeye salmon attributed to the North Fork Koktuli are 1.5% and 0.1%, respectively, and to the South Fork Koktuli are 4.5% and 0.2%, respectively.

Sections 5 and 7 present evidence of the loss of fish and fish habitat due to reduced water availability to stream flow and direct impacts on habitat. While under the scenarios presented in the Assessment this may be true, a complete analysis is not presented.

<u>EPA Response:</u> See response to Comment 5.14. No specifics about how the analyses in Sections 5 and 7 are incomplete is provided in the comment, so this portion of the comment cannot be addressed.

7.9 *Page*: 7-3, *Section:* Conceptual Model, *General Subject Area*: CSM for salmon populations.

Excerpt: Conceptual Site Model - Associates between Salmon populations and environmental stressors associated with mine footprint operations.

Technical Comment from ERM: The assessment is unclear on what spatial scale this CSM refers to and how the mine footprint overlays on the various scales of possibility.

Citations: No reference provided.

Comment Category: Spatial Scale of CSM.

<u>EPA Response:</u> These diagrams capture linkages operating at multiple spatial scales, and we have added text to help identify which factors are emphasized at which scales in the subsequent analyses. The diagrams are used to convey relationships and acknowledge the complexity of pathways, and provide a general conceptual overview. They are not intended to provide scale-specific bases for quantitative modeling.

7.10 *Original Draft Location:* Page: 5.1, Section: Report Section Identification: 5.1.2 Spawning Salmon Abundance, Excerpt: [blank]

Original Comment by State of Alaska: The repetition of the fact that fish numbers were underestimated, similar to the report-wide repetition of the importance of groundwater-to-surface water interactions, seems to be an attempt to influence the reader, without adequate supporting data. In the last sentence of the first paragraph of this section it says true spawner abundance is underestimated by a "…large and unknown factor." It is unclear that this is true for the Pebble Mine area where a large number of headwater streams are present.

Recommended Change: Use site-specific data instead of broad generalizations. Provide the data, summarize, and move on. Remove repetition. Address in uncertainty section if needed.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The term "underestimate was emphasized throughout the 2013 version. Within Section 7.1.2 (which was Section 5.1.2), additional information was provided regarding why it was considered an underestimate of the spawning salmon abundance, with the sentence: "We recognize that survey values tend to underestimate true abundance for two reasons: an observer in an aircraft is not able to count all fish in dense aggregations, and only a fraction of the fish that spawn at a given site are present at any one time (Bue et al. 1988, Jones et al. 2007)." This does not adequately address the comment.

EPA Response: The recommendation to reduce repetition and focus discussions of estimation errors in uncertainty sections has been adopted. Site-specific data for aerial observer efficiency (e.g., mark-recapture, weir counts) were not provided in the EBD, so we generalized the best available information from peer-reviewed literature regarding aerial observer efficiency.

7.11 Spawner Index Counts (Chapter 7 p.12):

Between 1955 and 2011, sockeye salmon counts in Upper Talarik Creek have ranged from 0 to 70,600, with an average of 7,021 over 49 count periods (Morstad pers. comm.). Between 1967 and 2009, chinook salmon counts in the Koktuli River ranged from 240 to 10,620, with an average of 3,828 over 29 count periods. (Dye and Schwanke 2009)

Discussing these statistics in the absence of the total number of sockeye salmon in the Mulchatna, Nushagak, and wider Bristol Bay Watersheds fails to provide the appropriate context to understand the spatial scale involved and does not consider the detailed fish/habitat data found in the EBD (PLP 2012).

EPA Response: The detailed fish and habitat data contained in the EBD do not contain sufficient information on sampling efficiency, effort, and sampling design to allow an outside user to estimate valid watershed-level population estimates. Observations on densities from specific sampling efforts do provide useful insights that are used for illustrative purposes in the assessment.

7.12 As mentioned above, the Assessment establishes as an endpoint to assess the abundance, productivity, or diversity of the region's Pacific salmon and other fish populations. However, the Assessment fails to actually analyze this endpoint qualitatively. Instead, it simply talks about impacts to fish habitat and wetlands. For example, regarding sockeye salmon, the average annual inshore run of sockeye salmon (the key fish species identified in the Assessment) in Bristol Bay was 37.5 million fish between 1990 and 2009 (p. 5-11). Based on the highest index spawner count over the 5 year survey period, approximately 90,200 sockeye salmon were estimated in the Mine Scenario watersheds, (which include the South and North Fork Koktuli Rivers and the Upper Talarik Creek, Table 7-1 on p. 7-13). Accepting that this estimate may underestimate the actual population, these fish represent about 0.25% of just the returning sockeye salmon in the Bristol Bay watershed, and certainly a much lower percentage of the total population. Although this is a crude estimate, it provides an order of magnitude sense of the potential project effect on fish populations, which the Assessment fails to provide.

EPA Response: See responses to Comments 5.14 and 5.26.

7.13 The Assessment acknowledges that the Pebble Project has invested in a "relatively intensive network of stream gages" in order to characterize streamflows in the area, but this statement requires additional qualification if it is to be properly understood. The network is arguably the most comprehensive and intensive network of streamflow data collection sites ever assembled for a proposed mine, anywhere in the world. The information gained from this network is being used, in part, to calibrate water balance models capable of making detailed predictions of flow reduction impacts in streams in and around the Pebble mine study area, and to guide studies on the location, timing, and rate of treated water discharge to the streams for mitigating potential impacts.

EPA Response: The importance of this monitoring framework and baseline data is acknowledged in Chapter 7.

7.14 *Original Draft Location: Page:* 5.16, *Section:* Report Section Identification: 5.2.1.1, *Excerpt:* [blank]

Original Comment by State of Alaska: Text states that loss of headwater habitats will have indirect impacts on fishes and their habitats in downstream mainstream reaches of each watershed. However, it is not prefaced that this assumption does not take into consideration any risk mitigation measures such as stream diversions.

Recommended Change: Draft Recommended Change: Preface that this assumption is based on no mitigations measures implemented to reduce potential impacts.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: This statement in the text remains unchanged. The document consistently assumes minimal to no mitigation or avoidance of environmental effects. Failure to define a project that meets current standards regarding construction, design, mitigation, and avoidance of impacts results in an overstatement of effects throughout the document.

EPA Response: Acknowledgement that total stream loss is not necessarily unavoidable is included in the revised assessment (Section 7.2.4).

7.15 In addition to failing to provide context for the stated impacts, the Assessment also fails to discuss the relative amount of the various ecological resources that it states will be affected by the hypothetical mine scenarios. Specifically, the Assessment describes impacts in terms of loss of stream channel length and wetlands areas, altered stream flows, and indirect impacts to streams and wetlands for various hypothetical mine scenarios; however, the Assessment does not put these losses into any kind of perspective or characterize these habitats in terms of the proportion of the total resource base that they represent at any of the five spatial scales previously identified. It is further noted that stream length alone is not a sufficient indicator of habitat productivity. EPA's assumption that all stream reaches have equally productive habitat is not valid.

For example, the Assessment predicts the loss of 145 km of streams (under the Pebble 6.5 Scenario). The Assessment fails to reference that this represents only 0.27% of the 53,000 km of stream channel in the Nushagak and Kvichak watersheds, and even less in the entire Bristol Bay watershed. A similar calculation could be made in terms of the relative impacts to wetlands.

EPA Response: **The purpose of the stream segment characterization analysis is to help quantify the range of potential habitat conditions present within the various scales of analysis in the assessment. Text has been added to Section 7.2 highlighting the fact that not all streams are highly productive habitat for salmon. More important, we do not assume that loss of a kilometer in a large watershed is somehow less significant than the loss of a kilometer in a small watershed.**

7.16 Perhaps more significantly, the Assessment fails to place the mine-related impacts to anadromous fish habitat in perspective. The Assessment indicates that 35 km of the 145 km of streams predicted to be lost under Pebble Scenario 6.5 are anadromous fish habitat (p. 7-22), but does not present these data in context of the respective spatial scales. Approximately 14% of the streams in the Nushagak and Kvichak watersheds are considered anadromous fish habitat (p. 3-18), so the 35 km of predicted anadromous fish stream impacts represents less than 0.5% of the anadromous fish habitat in these two watersheds, and a substantially lower percentage in the entire Bristol Bay watershed.

EPA Response: **We do not assume that loss of a kilometer of salmon habitat in a large watershed is somehow less significant than the loss of a kilometer in a small watershed. Text describing proportional impacts to AWC length and total stream length within the mine scenario watersheds has been added to Chapter 7.**

7.17 The Assessment also fails to discuss the relative amount of the stream channel habitat preferred by anadromous fish that potentially would be impacted, but this value can be characterized by using some of the data presented in the document. For example, the Assessment states that the streams that provide the best habitat for salmon are medium sized streams (0.15 to 2.8 m^3/sec) with less than a 3% gradient (p. 3-21). The Assessment reports that the percentage of streams meeting these criteria in the Nushagak and Kvichak watersheds is 27% (Table 3-3, p. 3-31), while about 23% of the streams in the Mine Scenario Watershed meet these criteria (Table 7-4, p. 7-16), and only 19% of the streams that are predicted to be directly impacted under the Pebble 6.5 Scenario meet these criteria (Table 7-6, p. 7-25). This suggests that, on average, the streams that are predicted to be impacted by the mine scenario are likely to be proportionally less valuable than streams elsewhere in the Nushagak and Kvichak watersheds. This kind of analysis is needed in the Assessment to help readers better understand the context and relative value of the habitats predicted to be impacted. Additional data regarding the quality of habitat in the subject area can be found in the Environmental Baseline Document (EBD; PLP 2012).

<u>EPA Response:</u> Additional context for the mine scenario watershed habitats is now provided. We provide additional discussion on why it is premature to assume that these habitats are less ecologically valuable than streams elsewhere in the basin.

7.18 Furthermore, for a true objective analysis of direct impacts to anadromous fish habitat, the EPA should provide a comparative analysis at each of the five spatial scales, comparing the quantity and relative value of anadromous fish habitat impacted with the total anadromous habitat available at each respective scale. This comparative analysis would demonstrate that the direct habitat loss is less than 1% of total habitat available at the Nushagak / Kvichak scale, and far less at the Bristol Bay scale.

A similar analysis should also be done with fish counts. Using the same data contained in the Assessment, Tables 1 and 2 illustrate proportionally, from a stock perspective, the contribution of sockeye and chinook from the three watersheds in the proposed mine footprint relative to the overall populations in the larger river systems. The stocks spawning in the three tributaries are proportionally small relative to the overall salmon populations in Bristol Bay.

As shown in Table 1 [***table deleted from this document; see original public comment for table***], the percentages of the Kvichak watershed annual return of sockeye salmon and commercial catch of sockeye salmon attributed to the Upper Talarik Creek are 0.8% and 1.6%, respectively. Table 2 [***table deleted from this document; see original public comment for table***] illustrates similar data for the Nushagak watershed percentages (1.5% and 0.1%, respectively, for the North Fork Koktuli; 4.5% and 0.2%, respectively, for the South Fork Koktuli). These kinds of comparative analysis would be useful to include in the Assessment to help readers better understand the spatial context and relative value of the habitats predicted to be impacted.

<u>EPA Response:</u> See response to Comment 5.14.

7.19 In terms of wetlands, the Assessment predicts direct wetland impacts and references indirect wetland impacts, but again does not take into consideration potential optimization of water management or reference that mitigation would be required to permit a project similar to the scenario on which the Assessment is based.

<u>EPA Response:</u> Water management "optimization" is discussed in Appendix J.

7.20 The Assessment continues to mislead the reader and misrepresent its findings by incorrectly representing precision and accuracy. The Assessment implies precision by providing results to several significant digits (i.e., 0.28 km^2 of wetland impacts in the mine pit, Table 7-7 on p. 7-25). For an ecological risk assessment of a 115,500 km^2 watershed, presenting predicted impacts to this level of precision (i.e., plus or minus a half a hundredth of a square kilometer) suggests to the reader a higher level of precision than actually exists.

The Assessment also suggests these predictions are accurate; while they may support a degree of accuracy for a specific hypothetical mine plan, the Assessment's approach tends to mislead the reader into thinking that the predictions are an accurate representation of impacts from a mine that would actually be constructed in the area. To avoid this, providing results in terms of ranges rather than a single number would better represent the true accuracy of the findings.

<u>EPA Response:</u> The surface areas of important mine footprint features such as the mine pit were derived from plans outlined by Ghaffari et al. (2011). The assessment repeatedly acknowledges the fact that these plans represent plausible, but not the only possible, scenarios.

7.21 The direct impacts from the hypothetical mine footprint are lumped with indirect impacts extending longitudinally downstream without proper analysis of indirect impacts (Section 7.2 Habitat Loss of the Assessment, pp. 7-15 through 7-33). For example, the Assessment conflates indirect impacts to aquatic habitats such as reduced surface water flows, off-channel habitat effects, modification to groundwater flow pathways, etc. into the same category as direct impacts associated with the mine footprint. In this manner, the Assessment wrongly avoids evaluation of the level of indirect impacts across a continuum with increasing distance downstream. Instead, the Assessment treats indirect impacts on par with direct impacts. This is evident in the Assessment's analysis of stream habitat losses when it states, "A total of 8 km, 24 km and 35 km of documented anadromous fish streams would be eliminated, blocked, or dewatered by the mine footprints…" (p. 7-26). These stream lengths indicate the Assessment has lumped the indirect effects associated with dewatering with the stream reaches affected by direct impacts, resulting in an overestimate of habitat impacts. It is not reasonable to equate stream reaches with flow reductions as a 100 percent loss in habitat; anadromous fish will continue to use these reaches, and, in some cases, the habitat quality might be enhanced with appropriate targeting of water delivery to meet specific life history needs. As a result, the actual quantity/length of anadromous stream habitat directly impacted by the hypothetical mine footprint would likely be less than the estimates provided by the Assessment.

<u>EPA Response:</u> *Streamflow modification* refers to increases or decreases in streamflow attributable to mine operations. *Dewatering* refers to the loss of surface flow in streams (and thus complete stream and wetland loss) due to the groundwater cone of depression created by the mine pit and its dewatering process. Thus, dewatered streams are included with buried and blocked streams in the assessment. Streams subject to streamflow modification are treated separately, as the comment states is appropriate. We define these terms more clearly in the revised assessment to help alleviate the confusion captured by this comment.

7.22 The Assessment quantifies the effects of mining development on downstream aquatic habitat, but doesn't specify how this is done, and no recognition is given to the inherent variability of such estimates and their dependence on hydrologic processes such as surface water/groundwater interactions. In contrast, regulatory and permitting requirements for mining developments in Alaska necessitate the completion of extensive flow reduction studies with watershed specific models to analytically quantify potential flow reductions and assess different mitigation strategies. Furthermore, the Assessment makes some invalid assumptions about the discharge of treated water to the streams. Firstly, contrary to its stated assumption, the location of treated water discharge during mine operations would not depend on mine water requirements, but rather would be guided by an aquatic habitat impact analysis and mitigation plan. Secondly, contrary to the Assessment's implied assumption that streamflow reductions would increase during pit filling after the end of mine operations, an even greater amount of water that had been required for tailings management would become available for discharge, so streamflow reductions would actually decrease during pit filling if required to meet streamflow mitigation objectives. The first priority would be to meet these objectives; water surplus to these objectives would be directed to the pit.

<u>EPA Response:</u> The assessment does acknowledge the need for flow requirement studies during the permitting process. We have elaborated on water management assumptions to clarify this point.

7.23 Wetlands Functions: These ratios are simple comparisons, but they show that wetlands are widespread throughout Bristol Bay and development projects overlap a small proportion of them. Scale provides context to help understand the magnitude of impacts. An even more informative metric than wetland acreage would be to compare the acreage of pre-development wetland functions with post-development wetland functions, after factoring in a project's comprehensive and multi-disciplinary avoidance, minimization, and compensatory mitigation plans. Without a quantitative understanding of wetland functions it is difficult to understand the context of the acreage values presented in the BBA. Readers are uninformed whether the impacts are insignificant, moderate, or severe.

The BBA does not include a Wetlands Functional Assessment or other site-specific information on wetland functions. The BBA often states that wetlands are important for salmon, but it does not clarify that this only applies to wetlands that perform specific ecological functions that in turn support salmon. A Functional Assessment will provide this information and it is a required step in the permitting process. In part, the Functional Assessment will show on maps where the wetlands are located that provide ecological functions important for salmon. These maps will show the degree these functions are performed (e.g., high, moderate, low). The Functional Assessment will also report the acreage of wetlands that perform these salmon related functions. Appendix J, which discusses compensatory mitigation, generalizes all the mine impacted wetlands as "highly functioning" without having any site-specific Functional Assessment data to support this term. The BBA does not contain data to show which of the potentially mine impacted wetlands are important for salmon.

<u>EPA Response:</u> The comment that potentially affected wetlands cannot be described as high functioning because a functional assessment has not been completed ignores the fact that the potentially affected wetlands are largely or completely unaltered, which would by definition make them reference standard wetlands, the highest functioning wetland for that wetland type.

7.24 *Original Draft Location:* Page: 5.12, Section: Report Section Identification: 5.2 Fish Distribution, Excerpt: [blank]

Original Comment from State of Alaska: Blanket statements are provided for fish with priority habitats (spawning, rearing, etc.) under the proposed footprint of the storage facilities, but for chum the habitat area under the storage facility is not shown, and for other salmon the relatively small area of the impacted priority habitat is not mentioned…rather a blanket statement is made that the habitat will be impacted. Making this statement without qualification or reference to further analysis, leads the reader to an initial conclusion of "impact" without understanding extent of that impact. TSF 2 and TSF 3 are often referenced, but are not included on Figures 5-1 through 5-7. Frying Pan Lake and Koktuli Mountain are referenced for, but not included on, Figure 5-6.

Recommended Change: A qualifier or some reference to further analysis in Section 5.2 should be added to provide readers with an understanding of the general size of the impact. It doesn't have to be really specific, or the reader should be referenced to Section 5.2 for further insight to the level of impact. Add TSF 2 and 3 to Figures 5-1 through 5-7. Add Frying Pan Lake and Koktuli Mountain to Figure 5-6.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Impacts to fish are typically lumped without consideration of species. The only species-specific discussion is on page 7-27, which is the same information presented on page 5-16 of the original document. TSF2 and TSF3 labels were provided on Figure 7-12, but not included on the fish distribution maps (Figures 7-2 thru 7-8 or old Figures 5-1 thru 5-7). Frying Pan Lake and Koktuli Mountain were not added to the dolly varden figure.

<u>EPA Response:</u> TSFs 2 and 3 have been added to figures illustrating the mine scenario footprint, and species distribution maps in relation to the mine footprints are now explicitly presented in Chapter 7.

7.25 *Original Draft Location*: Page: 5.16, Section: Section 5.2.1.2, Excerpt: [blank]

Original Comment from Environ: Organic inputs and nutrients from areas upstream of the proposed mine site are unlikely to provide a vast quantity of materials to downstream third and fourth order streams. Drifting macroinvertebrates directly downstream might diminish to a degree, but the amount of the reduction would be a direct result of the footprint size and location, and what types of vegetation etc., would be removed, and through avoidance, minimization and mitigation techniques, this could be contained to a minimal impact.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The discussion on the importance of headwater streams, and the nutrient contribution, is largely unchanged between 2012 and 2013. The discussion is fairly general, and it does not appear the get incorporated into the potential impacts discussion, just in terms of overall loss of nutrient sources. However, it is also not recognized that these impacts could be minimized or avoided depending on the vegetation removed. This is another example of a case where the assumed lack of mitigation results in an overstatement of effects.

<u>EPA Response:</u> Potential mitigation approaches for lost foodweb effects and considerations of their effectiveness are now discussed in Appendix J.

7.26 Original Draft Location: Page: 5.64, Section: Section 5.4.7, Excerpt: [blank]

Original Comment from Environ: This section seems to assume that the requirements under Section 404(b) of the Clean Water Act will not apply to the project. This is not a good assumption. If impacts to wetlands are unavoidable, mitigation will be required.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Only the filling of wetlands is addressed in the risk characterization section, not the potential for wetland mitigation. Compensatory mitigation is addressed in Box 7-2. The statement in the Executive Summary indicates that, "Compensatory mitigation measures could offset some of the stream and wetland losses, although there are substantial challenges regarding the efficacy of these measures to offset adverse impacts." (page ES-26). The analysis does not include any assumptions regarding design features that would avoid impacts and/or mitigation measures that would offset impacts, therefore, the document overstates the impacts that would be expected.

<u>EPA Response:</u> See the revised Appendix J for a full discussion of this topic.

7.27 Consideration of Mitigation Measures: The Assessment does not take into full consideration measures to avoid or minimize the impacts predicted in the Assessment. EPA does state that it considers good mine practice, but then clearly ignores measures that are routinely used (and often required under permit conditions) to avoid or minimize impacts (e.g., see discussion below regarding discharge of untreated wastewater in the event of a wastewater treatment plant [WWTP] failure). Ignoring these mine management measures results in overstating the impacts from mining activities. Further, the Assessment admits that it does not take into consideration compensatory mitigation measures (p. 6-4), which the EPA acknowledges "could offset some of the stream and wetland losses" (p. 7-32). This fundamentally results in an overstatement of the significance of the findings.

<u>EPA Response:</u> The scenarios assume that modern conventional mining technologies and practices are utilized. The assessment considers risks from routine operation of a mine designed using modern conventional mitigation technologies and practices. We acknowledge that the scenarios represent reasonable scenarios, but they are not the only scenarios possible. The revised Appendix J provides a more comprehensive treatment of compensatory mitigation options.

7.28 Risk Characterization (Section 7.2.4): On page 7-31 the Assessment characterizes the risks that would occur due to "direct loss or blockage of these streams" as "…leading to losses of local, unique populations [that] would erode the population diversity that is key to the stability of the overall Bristol Bay salmon fishery." (Schindler et al. 2010)

The Assessment's lumping of direct and indirect impacts into a cumulative estimate of stream reach loss, coupled with statements about the uniqueness and importance of salmon stocks in the hypothetical mine area that are critical to the Bristol Bay salmon fishery, is flawed and lacks documentation. The issues with lumping direct and indirect impacts are discussed above. And there is no basis to assume that the stream habitat directly and indirectly impacted by the hypothetical mine footprint should be weighted as more important than other anadromous salmon habitat in the Nushagak and Kvichak watersheds. The risk characterization should treat this anadromous habitat equally in the Assessment.

Furthermore, suggesting that the reaches directly affected by the hypothetical mine area support unique salmon stocks that are critical to the future of the Bristol Bay fish populations is not supported by the Assessment or any other report publically available. Assertions that sockeye utilizing habitat in the proposed mine footprint are demonstrably unique and critical for the stability of the overall Bristol Bay sockeye fishery are unfounded. The Assessment has not presented data demonstrating that the sockeye returning to the mine footprint area or the North and South Forks of the Koktuli are phenotypically or genotypically unique relative to other populations in the Nushagak Mulchatna system. The life history variations, including the run timing for sockeye distributed in the forks of the Koktuli and Upper Talarik, are similar longitudinally in the system, suggesting that these fish do not represent a distinct genetic group but more likely represent an upstream component of a larger riverine population. Thus, it does not logically follow, as the Assessment suggests, that the Bristol Bay sockeye salmon population and fishery would be dependent upon these relatively small components of larger populations.

<u>EPA Response:</u> In the Bristol Bay region, hydrologically-diverse riverine and wetland landscapes provide a variety of salmon spawning and rearing habitats. Environmental conditions can be very different among habitats in close proximity, and recent research has highlighted the potential for local adaptations and fine-scale population structuring in Bristol Bay and neighboring watersheds (Quinn et al. 2001, Olsen et al. 2003, Ramstad et al. 2010, Quinn et al. 2012). The assessment does not assume lack of local adaptations among fish populations in the study area.

7.29 Section 7.3 – Stream Modification: This section describes indirect impacts from water withdrawals on stream flow conditions. Section 7.3 states a >20% reduction in stream flow for the PLP 0.25 scenario will result in a reduction in fish habitat of 15 km of stream reach. The Assessment's conclusions are based on scenarios that are not realistic and are not reflective of best available practices for flow mitigation. In addition, the scenarios are based on an analysis that does not utilize best practices in groundwater and surface water modeling which would be appropriate (and required) to permit the hypothetical mine (e.g., MODFLOW, PHABSIM, etc.).

<u>EPA Response:</u> Potential streamflow mitigation approaches are discussed in Appendix J. The assessment recognizes the value of flow-habitat modeling that would be required for setting flow targets.

7.30 Table 7-19 (p. 7-50): The analysis of this table is flawed. The Assessment claims the hypothetical mine scenarios will result in a 20% stream flow reduction. The table is not transparent with respect to the method for calculating the impact percentage for respective streams. Even assuming one accepts this 20% reduction, the resulting length of stream affected by the stream flow reduction is over estimated. The Assessment does not make it clear that a 20% reduction in flow does not necessarily correspond to a 20% reduction in habitat.

<u>EPA Response:</u> Methods for calculating streamflow alterations are described in Section 7.3. Estimates of alteration length are actually conservative, since streamflow alterations were calculated at the downstream end of each reach, whereas actual percent alterations increase closer to the source of the alteration.

7.31 *Page:* 7-33, *Section:* 7.3 Streamflow Modification.

Excerpt: Section describes indirect impacts from water withdrawals on stream flow conditions. It describes a >20% reduction in stream flow for the PLP 0.25 scenario will result in a 15 km of stream reach of reduced fish habitats.

Technical Comment from ERM: The assessment's conclusions are based on modeling of scenarios that are not realistic and do not include mitigation measures.

Citations: Cites GW modeling reports.

General Subject Area: Fish and Fish Habitat effects of water reduction.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: Potential streamflow mitigation approaches are discussed in Appendix J.

7.32 Page: 7-45, Section: 7.3.1

Excerpt: It is important to note that the WWTP is designed to discharge to the South and North Fork Koktuli River watersheds via the WWTP outfalls, so no treated flow from the Upper Talarik Creek watershed would return to source streams in that watershed.

Technical Comment from ERM: This is a simplistic approach to discharge management and does NOT represent best practice. It is good practice that discharges optimize release patterns to maximize the environmental value of the discharges (and to minimize negative effects of any discharge).

Citations: [blank].

General Subject Area: Streamflow Management/Mitigation.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: The assessment used the water treatment facility scenario described in Ghaffari et al. (2011), and explicitly acknowledges that details of the water management system will likely differ.

7.33 *Page:* 7-48, *Section:* 7.3.1.4

Excerpt: After the mine closes, pit dewatering would cease, leading to pit filling. As the pit fills, water from the pit that had been returned to streams via pumping to the WWTP would no longer be available for streamflow.

Technical Comment from ERM: Assumes that pit dewatering would cease immediately after closure commences (i.e., mining operations cease). Good practice would be to slowly reduce pumping to provide a gradual transition from dewatering/treatment/ discharge to minimize quality issues and also maintain streamflows.

Citations: [blank].

General Subject Area: Water Management/ Treatment.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> We provide one scenario for post-closure. We acknowledge that details of the water management system will likely differ.

7.34 *Page:* 7-46, *Section Number:* 7.3.1.1, *Section Title*: Pebble 0.25 Scenario.

Excerpt: Overall, it is projected that 73.5% of captured watershed flows would be returned (Table 6-3), but the location of return would vary depending on the mine needs for process water and the location of mine facilities and water treatment.

Technical Comment from KP: This is an incorrect statement. In standard practice and design, the discharge locations would be independent of process water needs and the location of the WTP. Discharge locations would be determined by numerous factors including items such as instream flow requirements.

Citation/Reference: [blank].

General Subject Area: Water Management.

Comment Category: Invalid assumption.

<u>EPA Response:</u> The cited statement refers to flows of water within mine operations, including flows captured in discrete pathways such as the waste rock pile footprint, TSF leakage, and captured flow returns to the WWTP (as described in Table 7-16). It does not simply refer to the return of flow to stream channels. Chapter 7 text acknowledges that instream flow requirements and results of flow-habitat studies will need to inform permitting and appropriate flow management.

7.35 Page: 7-48, Section Number: 7.3.1.4, Section Title: Post-Closure.

Excerpt: After the mine closes, pit dewatering would cease, leading to pit filling. As the pit fills, water from the pit that had been returned to streams via pumping to the WWTP would no longer be available for streamflow.

Technical Comment from KP: The effective consumption of water during steady-state operations is the water consumed in the tailings mass. This consumption ceases after shutdown. Additional water is also available for discharge at closure from reclaimed areas. The rate at which the pit is allowed to fill at closure will be a function of how much water is available from the entire mine site and the how much water is required for streamflow. There is no reason to believe that this would be less than during the operational phase.

Citation/Reference: [blank].

General Subject Area: Water Management.

Comment Category: Invalid assumption.

<u>EPA Response:</u> The comment is correct that the rate at which the pit is allowed to fill can be controlled by the mine operator. At one extreme, all water entering the pit could be pumped out, treated, and returned to the streams, thereby restoring the streams to full flow. In this case, the pit would never fill and active pumping from the mine pit and treatment of the pumped water would continue in perpetuity. At the other extreme, all

water from the mine site—including from reclaimed areas—would be diverted to the open pit as suggested in Ghaffari et al (2011).

Our analysis assumes that after mine operations cease, water would not be actively pumped from the mine pit. The water balance calculations assume that all runoff from reclaimed areas outside the drawdown zone is returned to streams, after treatment if necessary. These reclaimed areas include all plant and ancillary areas, the TSFs, and the waste rock piles outside the drawdown zone. Precipitation falling within the drawdown zone is assumed to continue to flow into the mine pit. Given the long estimated fill times for the mine pit, the assessment scenarios do not assume that the mine operator would incur the extra costs associated with ongoing pumping and treating water from the pit. It may be possible to capture surface runoff from the reclaimed waste rock piles within the drawdown zone to reduce water losses into the pit, but the amount of water available for reintroduction into the streams would still be less than under operating conditions. More aggressive means could be implemented to more fully restore baseline stream flow rates, but this would occur at the expense of increasing the time required for the mine pit to fill, increasing the time and costs for active pumping, and increasing the volume of water requiring treatment before discharge.

7.36 *Page*: 7-51, *Section Number*: 7.3.2.1, *Section Title*: Altered Streamflow Regimes.

Excerpt: PLP has invested in a relatively intensive network of stream gages, water temperature monitoring sites, fish assemblage sampling sites, groundwater monitoring wells, and geomorphic cross-section locations.

Technical Comment from KP: This is arguably the most comprehensive and intensive network of data collection sites ever assembled for a proposed mine, anywhere in the world.

Citation/Reference: [blank].

General Subject Area: Baseline data.

Comment Category: Invalid statement.

<u>EPA Response:</u> We have incorporated data from the PLP's Environmental Baseline Document throughout the assessment. We agree that data provided in the EBD, and subsequently reported to the AWC and AFFI, do indeed provide valuable insights into presence and distribution of fish. Indeed, these data are the basis for our maps and calculations of impacted salmon habitat.

7.37 *Original Draft Location:* Page: 5.42, Section 5.2.2.3, Excerpt: 1st paragraph.

Original Comment from Environ: Due to the failure to consider approaches to mitigate reductions in flow (e.g., drill a well into a hydrologically disconnected aquifer and augment flow), this section overstates likely impacts of a project.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Mitigation measures were not considered for streamflow reductions, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59).

EPA Response: The scenarios acknowledge the possibility of mitigating effects by storing and distributing effluent water, although we recognize the great challenges this would pose in terms of research, engineering, water management, and long-term monitoring to successfully implement in a way that protected locally-adapted fish populations. The water management scenarios considered in the assessment are consistent with the preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), which include water withdrawals.

7.38 *Original Draft Location*: Page: 5.21, Section 5.2.2.1, Excerpt: first paragraph.

Original Comment from Environ: The report assumes that impacts to stream flow will not be mitigated. This is probably not a good assumption. In assuming no mitigation, you have assumed a worst case scenario. The report should explain that this is a worst case scenario and should also discuss possible approaches to mitigating the impacts.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: There was no discussion on potential mitigation within the streamflow assessment, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59). This does not adequately address the comment. The assumptions of the analysis should have included a project design in line with current construction standards and the mitigation that would be required to meet state and Federal regulations. Failure to assume a project design that meets current design and regulatory requirements results in an analysis that consistently overstates likely project impacts.

EPA Response: See response to Comment 7.37.

7.39 *Original Draft Location*: Page: 5.3, Section: Section 5.2.2.3

Original Comment from Environ: Due to the failure to consider approaches to mitigate reductions in flow (e.g., drill a well into a hydrologically disconnected aquifer and augment flow), this section overstates likely impacts of a project.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No mitigation was proposed for streamflow modifications, other the statement, "Alternative flow management strategies may be feasible, depending on the capacity to store and release flows to meet environmental flow objectives." (page 7-59). This does not adequately address the comment. The assumptions of the analysis should have included a project design in line with current construction standards and the mitigation that would be required to meet state and Federal regulations. Failure to assume a project design that meets current design and regulatory requirements results in an analysis that consistently overstates likely project impacts.

<u>EPA Response:</u> See response to Comment 7.37.

7.40 *Original Draft Location*: Page: 5.27, Section: Section 5.2.2.1, p 5-27, 1st sentence under post-closure.

Original Comment from Environ: This is an assumption and should be stated as such. The reclamation plan may call for a different strategy which could affect the effects. Alternative strategies should be discussed.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: New Section 7.3.14 re-states the same sentence. Alternative designs and mitigation approaches are not adequately addressed in the document.

<u>EPA Response:</u> The scenario presented (the cessation of pit dewatering after the mine is closed) is a likely and common approach in mining. Alternative scenarios may be possible but are not within the scope of the assessment. No change required.

7.41 The Assessment states that it takes into consideration "modern conventional mitigation practices as reflected in published Pebble materials and as suggested in mining literature and consultations with experts" (p. ES-26), but in fact it does not… Another example relates to stream flow modification. The Assessment notes, but the Executive Summary does not, that the extent of stream flow modification is very sensitive to the location of the WWTP (p. 7-59). The Assessment also assumes no WWTP discharge to Upper Talarik Creek (p. 7-46). Thus, the Assessment fails to recognize an obvious mitigation measure that would be implemented (and likely required by permit) for the hypothetical project. This is an example of the Assessment's failure to consider measures to optimize water management in ways that could reduce impacts related to stream flow modification.

<u>EPA Response:</u> See response to Comment 7.37.

7.42 *Page*: 7-59, *Section*: 7.3.4, *General Subject Area*: Water Management/ Treatment.

Excerpt: However, model results were very sensitive to the location of WWTP discharges. For example, in this assessment we estimated reductions in streamflow of 46% in Upper Talarik Creek at gage UT100D (Tables 7-19 and 7-20). Wobus et al. (2012) estimated much less severe reductions of less than 10%, largely, because their assessment placed one of the two WWTP outfall points at this location (Table 7-20) and ours did not. Other significant divergences between streamflow alteration estimates in this assessment and Wobus et al. (2012) also are most likely due to differences in the location of the WWTP outfalls (Table 7-20).

Technical Comment from ERM: Assessment acknowledges that location of WWTP outfall is critical to impact assessment; however, it does not consider the very obvious design option of directing flows to multiple points and to the UT. The Assessment does acknowledge that different (and reasonable) assumptions significantly reduce impacts. Good practice is to model the outcomes of different locations and then optimize the locations and volumes to minimize the impacts.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: See response to Comment 7.37.

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7.43 *Id*. at 25.

Fourth, the lack of specificity as to mining in particular also conflicts with EPA's guidance. As to mining specifically, the Region 10 Primer requires that "[a]ssessment methods … be tailored to the type of mining and impacts that are taking place" and further instructs that an assessment evaluate specific characteristics of the site for the purposes of developing an appropriate monitoring program. Watershed Assessment Primer at 26 (emphasis added). Because this Assessment is focused on hypothetical mining activities, such tailoring is impossible here.

Both because of the extent of uncertainty and EPA's failure to properly account for it, the Assessment deviates impermissibly from Agency guidance. The Region 10 Primer has recognized:

> Predicting the future effects of current changes is … hampered by lack of data. Each watershed is unique, and projecting future impacts of management changes may be most accurate when based on the watershed's responses to impacts in the past. Without accurate records, impact prediction becomes guesswork.

Id. at 46 (emphasis added).[4] Peer reviewer Dirk van Zyl concluded that the hypothetical mine scenario is "not sufficient for the assessment" because differences from the actual mine plan will change the expected impacts to salmonid fish. Final Peer Review Report at 39. Dr. van Zyl described EPA's discussion of *cumulative* mining impacts as "speculation":

> The cumulative assessment is very conceptual at best, as there are no specific proposals from any of the other potential resource areas. Cumulative impacts can only be evaluated once further details about other potential mines and their plans are available. At this time, this section can at best be seen as speculation.

Id. at 97.

As discussed above, EPA does not deny that the Assessment is based on *hypothetical assumptions* about *potential future* mining. No permit application has been submitted. No detailed mining plan is yet available. Consequently, EPA has predicted impacts without accurate records or even a current, site-specific plan. The resulting uncertainties are incompatible with a scientific watershed risk assessment.

[4] "Projecting changes to groundwater-surface water interactions in the footprint area with any specificity is not feasible at this time." Assessment at 7-58.

<u>EPA Response:</u> Risk assessments by definition deal with the possible effects of hypothetical (i.e., potential) future events. The assessment scenarios are based on site-specific plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011) and are consistent with modern, conventional mines.

7.44 Among the fundamental deficiencies in the Assessment is its failure to consider and evaluate with care the baseline data made available by PLP and other public sources. As explained by Buell & Associates, Inc., "EPA drew the wrong conclusions regarding adult salmon spawning distribution and relative ecological importance by failing to examine site specific and publicly available data on the habitat conditions, fish species distribution, and densities of juvenile salmonids found in their mine development impact areas." Comments of Buell & Associates, Inc., *An Evaluation of EPA's Bristol Bay Watershed Assessment 2013 2nd Draft Assertions Regarding Fish Habitat Mitigation Measures Efficacy and Applicability*, at 12 (May 22, 2013) (herein "Buell & Associates"). For example, EPA concluded that salmon spawn above Frying Pan Lake in the South Fork of the Koktuli, a conclusion that is not supported by available data. *Id*. "If EPA had completed an adequate evaluation of the public sources of information, it is likely that their conclusions regarding the overall ecological significance and magnitude of potential impact would have been different. *Id*. at 14.

To the limited extent that the drafters have evaluated PLP data, they are critical of fishcounting methodology such as snorkel surveys, electrofishing, minnow traps, beach seines, gill nets, angling and dip netting, contending that these methodologies "very likely underestimate[ ]" the presence of fish. Assessment at 7-14. Yet, the report provides no basis for this criticism. The Assessment notes the "extreme difficulty of observing or capturing all fish in complex habitats" and apparently considers this sufficient to indict the data derived from well-recognized methods to evaluate the presence and distribution of fish. Id. It is revealing, however, that the Assessment cites only to databases that most experts would acknowledge yield less dependable data than those acquired from onsite evaluations of the sort performed by Pebble contractors. See Buell & Associates [Doc. #3650.5] at 12. Certainly, in the absence of better data or any suggestion that there were defects in methodology, the PLP data is the best scientific information available, yet EPA failed to use it.[<u>Footnote</u>: The Assessment uses the "highest index counts," and, accordingly, the numbers reported in Table 7-1 may well overstate the number of fish in the streams at issue.]

<u>EPA Response:</u> See response to Comment 7.36. We used the transparent and comprehensive State of Alaska catalogs to characterize fish distributions. Regarding the use of highest index counts noted in the comment footnote, see response to Comment 7.3.

7.45 As for the transportation corridor, EPA statements belie its foregoing conclusion: EPA wrote that *it could not estimate* changes in fish productivity, abundance, and diversity from the construction and operation of the transportation corridor based on available information. Id. at 10-40.

The same inability applies to the mine footprint, yet EPA reached some remarkable conclusions. Although EPA lacks salmonid abundance and productivity data in the specific watersheds at issue, see id. at ES-28, EPA nevertheless speculated that the direct loss of stream habitat from the mine footprint would lead to "losses of local, unique populations" and “would erode the population diversity that is key to the stability of the overall Bristol Bay salmon fishery ….” Id. at 7-31. There is no evidence that there are “unique populations” of species near the Pebble Deposit, let alone that those populations would be wiped out or that population diversity would be “erode[d]” by potentially affecting less than 1% of the total watershed area. See Environmental Resources Management, Comments on EPA’s May 2013 Bristol Bay Assessment, at 15-16 (June 28, 2013) [Doc. #5536.3] (“ERM Comments”); HDR Engineering, Inc., Wetlands Review of the 2013 EPA Bristol Bay Assessment, at 3 (June 28, 2013) [Doc. #5536.5] (“HDR Comments”). Most importantly, EPA has admitted that it cannot translate potential habitat loss – its primary assessment criterion – to actual population impacts. Id. at ES-28. EPA simply does not have the information that could justify its sweeping conclusions about the impact of a Pebble deposit mine on the Bristol Bay fishery.

<u>EPA Response:</u> In the Bristol Bay region, hydrologically-diverse riverine and wetland landscapes provide a variety of salmon spawning and rearing habitats. Environmental conditions can be very different among habitats in close proximity, and recent research has highlighted the potential for local adaptations and fine-scale population structuring in Bristol Bay and neighboring watersheds (Quinn et al. 2001, Olsen et al. 2003, Ramstad et al. 2010, Quinn et al. 2012). Given this evidence, and lacking specific data for the populations in question, it would be premature to presume that fish within the footprint of the mine or located downstream are not part of genetically distinct populations.

7.46 The Assessment Engages in Advocacy by Selective Omission. Although the evidence shows that the Pebble mine project poses no significant risk to the Bristol Bay fishery, the Assessment has been drafted to make it appear that it does. This distorted picture is achieved largely through a common advocacy device: selective omission. The most important omissions are:

1. Avoiding discussion of the watershed context: the Assessment speaks of lost streams and wetlands from the mine scenario footprint, but never confronts the fact that the entire mine scenario watershed has less than one-quarter of one percent of the salmon that enter the Bristol Bay watershed to spawn.
2. Omitting scientific analysis of compensatory mitigation: the Assessment suggests that compensatory mitigation of the foregoing loss of habitat is unlikely to succeed, due to the absence of suitable mitigation sites. In fact, the Pebble deposit area has many such sites, and the net loss of salmon habitat will likely be zero once compensatory mitigation is included in the analysis. (…)

<u>EPA Response:</u> See response to Comment 2.18. See the revised Appendix J for further discussion of the challenges associated with compensatory mitigation.

7.47 Compensatory mitigation could eliminate any net loss of salmon habitat. Habitat improvement techniques have a long and successful track record of improving salmon productivity, particularly in the Pacific Northwest and Alaska. There are a variety of proven methods that can be used to promote fish production and habitat productivity, including several within the very same watersheds that EPA has concluded cannot support compensatory mitigation projects. As explained by Buell & Associates [Doc. #3650.5]:

> EPA concluded in the [Assessment] that no on-site mitigation measures were available to offset the impacts from their development scenarios within the three primary watersheds. This assertion is refuted by a large body of scientific literature combined with the ecological conditions within these watersheds… [F]or more than 75 years fish habitat managers have successfully applied in-stream mitigation measures in numerous salmon supporting watersheds.

Buell & Associates at 17 (reviewing "techniques or approaches that have been used by others to address similar mitigation or habitat improvement issues [that are] appropriate for the species and ecological conditions associated with the Pebble deposit area").

<u>EPA Response:</u> See the revised Appendix J for further discussion of the challenges associated with compensatory mitigation.

7.48 4. The Assessment exaggerates the risk from wastewater treatment plant operation.

The Assessment exaggerates risks from WWTP operation in at least four ways. First, EPA fails to appreciate the value of the extraordinary environmental investigation conducted by PLP. While acknowledging PLP's extensive stream gage network to measure local stream flows, EPA misses the role that this network will play in mine planning. As Knight Piésold [Doc. #5536.4] explains:

> The network is arguably the most comprehensive and intensive network of streamflow data collection sites ever assembled for a proposed mine, anywhere in the world. The information gained from this network is being used, in part, to calibrate water balance models … to guide studies on the location, timing, and rate of treated water discharge to the streams for mitigating potential impacts.

Knight Piésold Comments at 2. Knight Piésold continues by pointing out that the Assessment never explains how it quantifies the effects of mining development on downstream aquatic habitat. In contrast, permitting requirements for mines in Alaska require "extensive flow reduction studies with watershed specific models to analytically quantify potential flow reductions *and assess different mitigation strategies*." *Id*. (emphasis added). (p. 23-24)

Second, the Assessment makes incorrect assumptions about discharges of treated water. Contrary to the Assessment's assumption, such discharges would not depend on mine water requirements, "but rather would be guided by an aquatic habitat impact analysis and mitigation plan." Id. at 2. (p. 24)

Third, as ERM [Doc. #5536.3] points out:

> The Assessment also assumes no WWTP discharge to Upper Talarik Creek (p. 7-46). Thus, the Assessment fails to recognize an obvious mitigation measure that would be implemented (and likely required by permit) for the hypothetical project. This is an example of the Assessment's failure to consider measures to optimize water management in ways that could reduce impacts related to stream flow modification.

ERM Comments at 9.

Fourth, the Assessment assumes that streamflow reductions would increase during pit filling. In fact, because water would no longer be required for tailings management, streamflow reductions could be *decreased* during pit filling as necessary to meet streamflow mitigation objectives. Knight Piésold [Doc. #5536.4] Comments at 2-3.

<u>**EPA Response:**</u> **Chapter 7 of the final assessment includes discussion and acknowledgment of the importance of the streamflow monitoring framework and baseline data. The assessment recognizes that these data will provide important inputs for future flow-habitat evaluation, and that various flow storage and release scenarios could be possible. We did not assess post-closure streamflow changes in the final assessment. See response to Comment 7.37.**

7.49 Instead of assessing impact on the Bristol Bay fishery, EPA lists a series of theoretical risks associated with mining activities in the region and calculates the amount of habitat that might be physically affected near the Pebble Deposit. EPA never translates that information into an assessment of harm to the overall fishery. This approach was soundly criticized by the peer review panel during its review of the initial draft Assessment. Because EPA failed to modify its assessment methodology, the second draft Assessment is equally flawed.

In both the initial and second draft Assessment, EPA uses lost or degraded fish habitat as a surrogate for estimating mining-related impacts on salmonid populations. *Id*. at ES-28 ("Estimated effects of mining on fish habitat thus become the surrogate for estimated effects on fish populations."). This approach led to a dead end. As EPA admits, the "[c]onsequences of the loss and degradation of habitat on fish populations *could not be quantified* [in the draft Assessment] because of the lack of quantitative information concerning salmonid populations in freshwater habitats." *Id*. (emphasis added). In other words, EPA cannot translate habitat loss into any meaningful assessment of risk to salmonid populations within the Bristol Bay watershed. This limitation is no minor defect – it represents the failure of the Assessment to meet its primary objective.

As explained by David Atkins following his peer review of the initial draft Assessment: "Development of the mine as proposed would eliminate streams and wetlands in the project area permanently. The importance of this impact is not put in context of the watershed as a whole, so it is not possible to determine the magnitude of the risk to salmon." *Final Peer Review Report: External Peer Review of EPA's Draft Document, As Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*, at 13 (Sept. 17, 2012) ("Final Peer Review Report"). According to Dr. Dirk van Zyl: "It is unclear to the reader how significant a loss of 87.5 km of streams in the Nushagak River and Kvichak River watersheds is to the overall ecosystem. Are there any criteria that can be used to develop such an expression? … EPA['s] Assessment does not provide any insight in the magnitude of risk except to provide a value for the consequences." *Id*. at 58. Dr. Dennis Dauble adds: "What is lacking is quantitative estimates of spawning and rearing habitat that would be lost relative to the total habitat available. Having this information would help provide perspective of overall risk to individual watersheds and the Bristol Bay watershed as a whole." *Id*. at 53.

EPA never addresses these issues. Instead, EPA focuses its assessment on less than 1% of the overall land and water resources within the Bristol Bay watershed. See Assessment at 2-8. To put the scale of EPA's assessment into perspective, the Bristol Bay watershed is approximately 115,500 km^2, the combined Nushagak and Kvichak River watersheds are 59,890 km^2, the local watersheds surrounding the Pebble Deposit are 925 km^2, and the largest mine scenario footprint is 75 km^2. Id. EPA describes near-mine impacts to local streams and wetlands, but EPA never relates those potential adverse impacts to the Bristol Bay salmon fishery as a whole. In the words of Dr. van Zyl from the last peer review process, the draft Assessment still "does not provide any insight in the magnitude of risk" to the Bristol Bay fishery. Final Peer Review Report at 58. And yet, EPA unaccountably concludes that "a largescale mine and its associated transportation corridor would affect the abundance, productivity, and diversity of Pacific salmon." Assessment at 12-1. Given the Assessment's total failure to quantify salmon impact in the context of the Bristol Bay fishery, EPA's conclusion is remarkably independent of EPA's evidence.

<u>EPA Response:</u> Characterization of the landscape factors, influencing salmon habitat potential, is now included to provide context for the stream habitat impacts described in the assessment (Chapter 3). The assessment describes the magnitude of risks to salmon habitat. Due to lack of knowledge about limiting factors, ascribing comprehensive risks to salmon populations is not feasible. For additional responses to specific peer review comments and the peer reviewers' comments on assessment revisions, see the publicly available Peer Review Response to Comments document.

7.50 In contravention of this principle, the Assessment avoids analysis of the broader watershed significance of its hypothetical risk scenarios. In fact, the Assessment is not a "watershed assessment" at all, an omission that did not escape the notice of the peer reviewers.

As peer reviewer David Atkins explained:

> The importance of this impact is not put in context of the watershed as a whole, so it is not possible to determine the magnitude of the risk to salmon.

Final Peer Review Report at 13. Peer Reviewer Dennis Dauble made a similar observation:

> The Integrated Risk Assessment (Chapter 8) did a creditable job of summarizing habitat losses and risks from mine operations. What is missing, however, are quantitative descriptions of habitat lost relative to total habitat available in the larger watershed and individual systems. Habitat loss should be further discussed in terms of salmonid life stage and productivity (i.e., not all stream miles are equal).

Id. at 16. Mr. Dauble further explained that: "What is lacking is quantitative estimates of spawning and rearing habitat that would be lost relative to the total habitat available. Having this information would help provide perspective of overall risk to individual watersheds and the Bristol Bay watershed as a whole." *Id*. at 53.

Reviewer Dirk van Zyl made the same point with specific reference to the Assessment's estimated loss of stream miles:

> It is unclear to the reader how significant a loss of 87.5 km of streams in the Nushagak River and Kvichak River watersheds is to the overall ecosystem.

Id. at 58. All of these peer reviewers are making the same point: unless the Assessment places its imagined impacts in the context of the whole watershed (as called for by EPA guidance) it fails to provide the means to evaluate their significance.

<u>EPA Response:</u> The risks to salmon are described in the revised assessment in terms of habitat potentially lost at scales ranging from the mine site to the major watersheds. It would be desirable to estimate the loss of salmon production at each scale, but neither the published literature nor the PLP's Environmental Baseline Document provide the productivity data for streams by life-stage that would make that possible. The quotations in the comment are from peer review of the original draft assessment. The reviewers were satisfied with our responses to those comments (see the publicly available Peer Review Response to Comments document).

7.51 As Dr. van Zyl explained during the peer review process on the initial draft Assessment: "Any mine in Bristol Bay will have to undergo a rigorous and lengthy regulatory review and permitting process." Final Peer Review Report at 48. Part of that process, Dr. van Zyl explains, would include consideration of "common mitigation measures" and compensatory mitigation when "damages to wetlands are unavoidable… It is unclear why this was not included in [EPA's] evaluations." *Id*. Other peer reviewers agreed. As Mr. Akins pointed out: "The Assessment describes what is considered to be conventional 'good' mining practice, but does not adequately describe and assess mitigation measures that could be required by the permitting and regulatory process. A thorough analysis of possible mitigation measures as employed for other mining projects and the likelihood that they could be successful in this environment would be necessary." *Id*. at 99; *see also id*. at 14 (comments of Steve Buckley) and 49 (comments of Dr. Phyllis Scannell). EPA disregarded these and similar comments raised by members of the public: the draft Assessment still ignores standard mining practices and techniques that could effectively mitigate any environmental harm associated with mining in the Bristol Bay watershed, as explained below.

<u>EPA Response:</u> Mitigation to compensate for effects on aquatic resources that cannot be avoided or minimized by mine design and operation would be addressed through a regulatory process that is beyond the scope of this assessment. Nevertheless, in response to public and peer review comments we have included a discussion of compensatory mitigation in Appendix J of the revised assessment.

7.52 The Assessment's narrow focus on three similar hypothetical mine scenarios – apparently motivated by the prospect of vetoing a Pebble mine permit – has effectively eliminated from consideration numerous alternative management options throughout the Bristol Bay watershed. The failure to adequately and objectively evaluate those options (including ecological protection measures and habitat enhancement practices) has created a document whose narrow focus precludes the broad airing of issues that a risk assessment is supposed to provide.

Even the Assessment's narrow mine options are inadequately evaluated because they are based on a mine without best mining practices or compensatory mitigation – a mine that could never be permitted. Numerous peer reviewers of the May 2012 draft commented on the Assessment's failure to evaluate a scenario that included best mining practices and mitigation. For example, peer reviewer Steve Buckley commented:

> There is inadequate information on, and analysis of, potential mitigation measures at the early stages of mine development, which would attempt to reduce the impacts of mining activities on fish and water quality.

Final Peer Review Report at 14. Dirk van Zyl, the reviewer with the most experience in mine engineering, commented:

> While the failure mode is adequately described, engineering and mitigation practices are not adequately described by EPA.
>
> Any mine in Bristol Bay will have to undergo a rigorous and lengthy regulatory review and permitting process. I do not know of a process that will exclude consideration of the impact of all mine facilities on the streams and wetlands in the region. Therefore, I would suggest that the full implications of "mine operations conducted according to conventional practices, including common mitigation measures, and that meet applicable criteria and standard[s]" should have been addressed in the report… "When damages to wetlands are unavoidable, the Corps can require permit[t]ees to provide compensatory mitigation." It is unclear why this was not included in the evaluations.

Id. at 48. Dr. van Zyl also pointed out that "there are reasonable mitigation measures that would reduce or minimize the mining risks and impacts beyond those already described and incorporated by the EPA in the assessment. There are a host of measures that are not addressed in the assessment …" Id. at 102.

<u>EPA Response:</u> These comments from Mr. Buckley and Dr. van Zyl were based on the original draft assessment. Both reviewers subsequently reviewed the revised assessment, which included, among other additions, an entirely new appendix devoted to compensatory mitigation (Appendix J). After reviewing the revised assessment, Mr. Buckley noted that the reorganization of the assessment improved the discussion about when and where mitigation measures might enter the regulatory process and Dr. van Zyl offered "no further comment" on mitigation measures other than follow up comments on financial assurances and double-walled pipes. Analysis of alternative mitigation measures is outside the scope of this assessment.

<u>The Pebble Limited Partnership (Doc. #5535)</u>

7.53 The Assessment does not discuss mining effects on the abundance, productivity or diversity of the region's salmon or other fish populations, but rather simply reports on the estimated impacts to stream channels and wetlands. For example, regarding sockeye salmon, the average annual inshore run of sockeye salmon (the key fish species identified in the Assessment) in Bristol Bay was 37.5 million fish between 1990 and 2009 (pg 5-1 1). Based on the highest index spawner count over a 5 year survey period, approximately 90,200 sockeye salmon were estimated in the Mine Scenario watersheds, (which include the South and North Fork Koktuli Rivers and the Upper Talarik Creek, Table 7-1 on pg 7-13).

These fish represent about 0.2% of just the returning sockeye salmon, and a much lower percentage of the total population. Although this is a crude estimate, it provides an order of magnitude sense of the potential project effect on fish populations, which the Assessment fails to provide.

The Assessment then leaps to conclusions regarding risks to the region's wildlife and Alaska Native cultures based on assumed impacts to salmon, which it never quantifies. Thus, no meaningful conclusions regarding the potential risks to wildlife or Alaska Native cultures can be drawn from the Assessment.

EPA Response: The inability to derive population estimates from aerial index counts is discussed in Chapter 7 of the assessment. These counts are not population estimates, and it is inappropriate to compare index counts (known underestimates) with basin-level population estimates. Also see response to Comment 7.3.

Alaska Miners Association (Doc. #2910)

7.54 Error #9: not addressed. EPA uses a particular location that overestimates impacts to anadromous fish habitat (2012 TR, page 15.).[Footnote: Error 9 in AMA's 2012 Technical Review included an incorrect reference. It referenced analysis in Section 1.D of the technical review. It should have read Section 1.C on page 8-9.] AMA's 2012 technical review referenced a simple GIS analysis that determined that the location of EPA's hypothetical mine may not be representative of other locations in the Bristol Bay watershed with respect to anadromous fish habitat. That is, other locations may affect less fish habitat. This non-representative location means that the impacts are likely incorrect for other mines, and may be incorrect for other tailings and waste rock locations chosen for Pebble. EPA ignored this critique and failed to acknowledge this significant source of error in their 2013.

EPA Response: Even if the location of tailings storage facilities and waste rock piles for a mine at the Pebble deposit differed from the exact positions detailed in the scenarios, they would be expected to have similar types of impacts.

N. Dawson (Doc. #2915)

7.55 I will argue that "consequences of the loss and degradation of habitat on fish populations could not be quantified because of the lack of quantitative information concerning salmonid populations in freshwater habitats." It is true that we may not know the "direct count" of every salmonid in the freshwater river systems of the Bristol Bay region, however, we do know that not only do these freshwater systems provide the spawning grounds for over 4,000,000 sockeye salmon based on tower counts conducted year by the Alaska Department of Fish and Game (see Fishery Management Report No. 07-40). We also know that acidic conditions in these river systems, even if caused by natural forces such as volcanic activities, can substantially reduce available habitat and therefore reduce salmonid presence and spawning success in these river systems (see Fishery Management Report No. 07-40 for more information on these "lahar events"). We know enough to be able to confidently say, with the best available science, that large scale mining activity in the region will ADVERSELY AFFECT SALMON FISHERIES IN THE REGION. Nowhere in the report does it say that mining will help, or assist the salmon fisheries, the long term economy, or the cultural heritage of the people of Bristol Bay. Do we really want to focus on how to minimize impacts of large scale mining, or do we want to focus on NOT ALLOWING the environmental degradation of large scale mining in the first place. Finally, many peer-reviewed papers have discussed the long-term datasets associated with the Bristol Bay fishery, and commonly cite why we know more about the Bristol Bay fishery than many other fisheries in the world. Therefore, it is not a well executed excuse to say, "We do not know detrimental impacts because we do not have baseline data or population estimates." Because of the yearly fish counts conducted by the Alaska Department of Fish and Game, and the nature of the freshwater systems in the region (water is clear, so direct fish counts are reliable data sources) we KNOW the estimated count of fish returning to the tributary rivers every year, and therefore, we can estimate the detrimental effects to these populations (e.g., Hilborn 2006).

EPA Response: Several issues are raised in this comment. The scope of the assessment is to evaluate potential risks of large-scale mining to salmon and other endpoints. Unfortunately, although we do have good estimates of abundance at the large watershed scale, we do not have reliable data on fish abundances in most individual tributaries. Even if we did, there are multiple uncertainties associated with projecting the risks to those populations given specific mine-related activities. These uncertainties are described in the assessment. Given the balance of evidence and uncertainties, we are able to describe potential risks, but cannot predict specific outcomes.

S. L. O'Neal (Doc. #5528)

7.56 P. 7-2: "These data, collected by the ADF&G and various consultants and non-profits, are captured in the Catalog of Waters important for Spawning, Rearing, or Migration of Anadromous Fishes – Southwestern Region (also known as the AWC, Johnson and Blanche 2012) and the AFFI (ADFG 2012)."

Although the assessment relies on AFFI for resident fish distribution, consultants do not often report presence of resident fishes, so impact again is underestimated.

EPA Response: Uncertainty associated with the AWC and AFFI databases is highlighted in Chapter 7.

7.57 P. 7-11: Relying on 'highest reported index spawner counts' vastly underestimates fish abundance and ultimately impact.

EPA Response: Comment noted and addressed in uncertainty discussion.

7.58 Table 7-2 should be eliminated. Reporting Average index spawner counts is extremely misleading regarding salmon abundance.

EPA Response: We present these data as the best available information, and expressly acknowledge their limitations.

7.59 Table 7-3 should be eliminated because of the limitations of juvenile and resident abundance data (which are well summarized in the associated text).

EPA Response: See response to Comment 7.58.

7.60 P. 7-52: The "sustainability boundary approach" used to evaluate risks associated with potential flow alterations should be more thoroughly explained, and citations should be provided.

EPA Response: Additional text and citations have been added.

7.61 P. 7-58: Reliance on PHABSIM modeling has significant limitations.

EPA Response: Comment applies to any modeling approach; no change required.

7.62 P. 7-60: Although the Biotic Ligand Model (BLM) has been considered for use in Alaska, it has not been used to date. Copper standards calculated using the BLM are significantly more protective than those using the hardness-based standards typically used in Alaska. Consequently, relying on the BLM model may again underestimate impacts if mine developers were in fact obligated to meet the hardness-based standard.

EPA Response: The statement is correct. Comments have been added to clarify this point in Chapters 8 and 14.

Iliamna Village Council (Doc. #5784)

7.63 From the considerations outlined above, there can be little doubt that the construction and operation of the Pebble 2.0 mine will cause extensive damage to and diminishment of salmons pawning and reproduction in the Nushagak and Kvichak watersheds. It is, in my opinion, likely that the entire spawning runs will be eliminated in a large portion of these watersheds and that this elimination will be essentially irreversible. This will be especially evident in the Lake area, and will affect villages in this area more than any others.

Diminished salmon spawning means diminished wildlife in the area. The USEPA report discusses the fact that brown bears, wolves, eagles and other wildlife depend critically on spawning salmon for their survival, as do other fish populations such as rainbow trout. These effects will have significant bearing on the viability of Alaska Naïve Villages such as Iliamna.

EPA Response: Doc. #5837 rescinded this comment; no change required.

7.64 Groundwater Drawdown

As the mine pit deepens from withdrawal of ore, it will tend to fill with water coming from the groundwater aquifers in the region. This water must be continuously pumped from the pit in order for mining operations to continue. Most of this water will be returned to the rivers or streams in the area. The USEPA quotes Pebble Mining estimates the 70-80 % of the water used in the mining operations will be returned, generally after use in mining operations such as milling and flotation processes, and generally after wastewater treatment to remove any added impurities. The important point is that much of this water came to the mine site as groundwater and leaves as surface water, which is not of uniform temperature and composition. The result is that the groundwater flow in the region will be diminished and the positive effects of this flow eliminated.

EPA Response: Doc. #5837 rescinded this comment; no change required.

K. Zamzow, Ph.D. (Doc. #5054)

7.65 I appreciate the detail that went into the maps of wetlands/stream losses and maps of changes in hydrology across the Upper Talarik, South Fork Koktuli, and North Fork Koktuli along with the accompanying discussions explaining how these were derived; both were helpful and enlightening.

EPA Response: Comment noted; no change required.

Bristol Bay Native Corporation (Doc. #5438)

7.66 Additionally, BBNC notes that the Revised Assessment is also conservative because it contains assumptions and data sets that substantially underestimate the amount of habitat that would be lost under the hypothetical mine scenarios. As discussed in BBNC's comments on the Draft Assessment and reasserted here, EPA estimates wetland impacts using National Wetland Inventory ("NWI") maps that underestimate jurisdictional wetlands, leading to narrow calculations of the habitat likely to be lost under each of the Revised Assessment mine scenarios.

Though it includes a much more in-depth and focused analysis, the Revised Assessment consequently remains conservative in its quantification of aquatic habitats and its assessment of the impacts to such habitats. The Revised Assessment, nevertheless, provides ample support for the conclusion that large-scale mining in Bristol Bay will result in extensive habitat degradation and destruction of fishery and water resources.

EPA Response: Comment noted; no change required.

7.67 Estimating Habitat Loss

BBNC's 2012 Comments and Technical Submissions: Mine Footprint: "The Draft Assessment underestimates the amount of habitat that would be lost under the hypothetical mine scenario. It does this in part by excluding certain areas from the mine footprint and, consequently, from the calculation of habitat acres lost to the mine footprint." (BBNC Part I Comments, at 2).

BBNC submitted technical comments by Thomas Yocom, explaining that EPA underestimated the 25- year mine scenario tailings storage facility footprint by 1,000 acres when it used hypothetical footprints taken directly from the Wardrop Report, thereby underestimating direct and indirect impacts to habitat. (BBNC Comments Part I, Attch. A, at 2-3).

Revised Bristol Bay Watershed Assessment: The Revised Assessment uses the same assumptions and Wardrop Report data to calculate habitat acres that would be lost to the mine footprint. (Revised Assessment, at ES-10).

However, the 25-year mine scenario footprint was revised slightly upward between the Draft and Revised Assessments – from a 14.9-km^2 tailings impoundment in the Draft Assessment to a 15.8-km^2 tailings impoundment in the Revised Assessment. (Draft Assessment, at ES-11 and Revised Assessment, at ES-11).

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC appreciates that EPA has revised its calculation of the 25-year mine scenario tailings storage facility footprint to accurately account for the size of a facility. BBNC would like to point out that EPA's calculations are still based on conservative assumptions and data found in the Wardrop Report.

EPA Response: Comment noted; no change required.

7.68 *BBNC's 2012 Comments and Technical Submissions: Use of Maps and Datasets*: "[T]he Draft Assessment bases its estimate of stream losses on the Alaska National Hydrography

Dataset (ANHD), which uses a coarse scale and therefore underestimates the reach and extent of streams in the vicinity [and] bases its estimate of wetland losses on National Wetlands Inventory (NWI) maps, even though Pebble Limited Partnership (PLP) delineated substantially more wetland and aquatic areas within its 'mine mapping area' than are shown in NWI maps of the same areas. As a result of this underestimation of habitat losses, the risks associated with such habitat loss are understated." (BBNC Part I Comments, at 2)

Revised Bristol Bay Watershed Assessment: EPA's Revised Assessment continues to use National Wetland Inventory maps to calculate wetlands impacts. EPA's Revised Assessment also continues to use the ANHD data to estimate the reach and extent of streams in the mine footprint vicinity that will be eliminated, blocked, or altered in flow. (Revised Assessment, at 7-21).

BBNC's Response to the Revised Bristol Bay Watershed Assessment: Use of these maps and datasets leads to a conservative overall quantification of jurisdictional wetlands acreage and stream reaches likely to be lost or negatively impacted under each of the Revised Assessment mining scenarios.

<u>EPA Response:</u> Comment noted; no change required.

7.69 *BBNC's 2012 Comments and Technical Submissions: Mining Scenarios as a means of Estimating Habitat Loss and Mine Footprint:* "The Draft Assessment is […] based on a reasonable hypothetical scenario… EPA does not need to wait to see the details of any specific mine Section 404 permit application to determine whether unacceptable impacts will result from large-scale hardrock mining operations." (BBNC Comments Part II, at 12) "The hypothetical mine plan examined by EPA in the Draft Assessment, moreover, is drawn from preliminary plans for the Pebble Project as described by Northern Dynasty Minerals" in its State water rights applications and in the 2011 Wardrop Report." (BBNC Comments Part II, at 12).

Revised Bristol Bay Watershed Assessment: EPA revised the Watershed Assessment to include a substantially smaller Pebble Mine scenario consisting of 0.25 billion tons of ore.

BBNC's Response to the Revised Bristol Bay Watershed Assessment: Although this mining scenario is substantially smaller than the 2.0 billion tons and 6.5 billion tons Pebble Mine scenarios included in the original Draft Watershed Assessment, the 0.25 scenario is still quite large with a total surface area impact of 5.88 square kilometers.

Inclusion of the 0.25 billion ton scenario analysis – a Pebble mining scenario so small it would be uneconomical to develop in such a remote area – allows EPA to include very conservative assessment of negative impacts to the Bristol Bay watershed from mine development. Even under the very unlikely 0.25 scenario analysis, the Revised Assessment concludes that mining development would cause the unacceptable direct loss of 24 miles of streams, 5 miles of known spawning and rearing habitats for salmonids, and 1,200 acres of wetlands. (Revised Assessment, at ES-14).

<u>EPA Response:</u> Comment noted; no change required.

Northern Dynasty Minerals Ltd. (Doc. #3650)

7.70 Footprint Impacts are Misleading.

- The 2013 draft BBWA predicts that development of mine facilities at Pebble could directly affect as much as 90 miles of streams, including 22 miles of salmon habitat. Using 'stream miles' in this way to characterize project effects on aquatic habitat is both crude and misleading.
- Because the Pebble deposit sits at the very upper reaches of the watersheds in which it is located, nearby streams are very small, and often ephemeral or back-channel trickles that freeze over in the winter and do not support fish. A more accurate description of Pebble's potential footprint impact on aquatic habitat would therefore reflect the total area of stream habitat affected. Rather than 90 miles, such an approach would suggest that Pebble's footprint will affect little more than ½ square mile of fish habitat, and significantly less salmon habitat.
- Habitat quality matters too, but EPA totally ignores the $40 million+ of water and fish studies that Pebble has undertaken over the past decade when they characterize footprint impacts. If Pebble's data had been considered, study authors might have reported that the most productive and well-used aquatic habitat exists well down river from Pebble, and that stream habitat affected by the project's footprint is among the lowest quality (in terms of fish production and fish use) within the system.

EPA Response: The variable habitat potential among streams under the mine footprint is explicitly acknowledged and analyzed in Chapter 7. PLP data have not been ignored, and has been used extensively throughout the Assessment (for example, see response to Comment 7.36).

- Finally, EPA refuses to acknowledge that impacts on fish habitat can be offset through fish mitigation projects – essentially enhancing natural fish productivity by opening up new habitat areas or creating improved habitat conditions.

This was a major Peer Review criticism of the 2012 draft BBWA, which EPA addressed by including a discussion of fish mitigation practices and approaches in an appendix to the 2013 report and then promptly refusing to incorporate any such projects in its hypothetical mine. In fact, study authors went so far as to suggest there are no opportunities in the 400 square mile area surrounding Pebble to undertake any fish mitigation projects.

This is wholly incorrect. Pebble has already identified opportunities to more than offset direct project effects on stream habitat through fish mitigation projects in close proximity to the proposed mine development. Throughout the 400 square mile area surrounding Pebble, there are tremendous opportunities to undertake fish mitigation projects that would substantially increase the productive capacity of the area for both salmon and resident fish species.

EPA Response: See the revised Appendix J for a thorough discussion of compensatory mitigation measures, including those suggested by Northern Dynasty Minerals and the Pebble Limited Partnership.

7.71 EPA used the National Hydrography Dataset as a basis for determining the number and location of stream channels in areas they claim will be affected by development of their mine pit, waste rock storage, and three tailings storage facilities (TSF 1 on NFK 1.190, TSF 2 on SFK 1.190, and TSF 3 on SFK 1.240) at maximum hypothetical development (BBWA2, Chapter 7, Box 7-1). They then used information from the State of Alaska's Anadromous Waters Catalog (AWC) and Freshwater Fish Inventory (AFFI) to estimate fish species distribution. EPA erroneously assumed that the information contained in these sources was accurate and that fish species distribution, as reflected, indicated the presence of spawning salmon and ecologically important rearing habitats. These assumptions are demonstrably false and not supported by readily available public empirical data from the mine site and the three hypothetical tailings storage facilities.

Several examples illustrate the fatal flaws in EPA's assumptions and conclusions regarding adult salmon spawning distribution and importance:

- If EPA had reviewed, in detail, the adult salmon spawning distribution data presented in Pebble Limited Partnership's Environmental Baseline Document (EBD), presented to EPA in 2011, they would have discovered that no adult salmon have ever been reported as spawning in the SFK watershed upstream of Frying Pan Lake, which is located downstream of EPA's hypothetical mine. This information is also contained in the AWC.

<u>EPA Response:</u> **See response to Comment 5.36. This comment is consistent with the maps include in Chapter 7. See Chapter 7 for a discussion of this topic, and for maps distinguishing AWC reaches where spawning, rearing, or presence has been documented.**

- If EPA had reviewed, in detail, the adult salmon spawning distribution data presented in the EBD they would have concluded that the upper portion of UT contains a relatively large spawning population of coho salmon, sockeye spawning numbers that are a small fraction of those that spawn in the remainder of the stream, and that Chinook salmon spawning consists of a few individuals.
- If EPA had reviewed, in detail, the adult salmon spawning distribution data presented in the EBD they would have concluded that TSF 2 contains a small population of coho, Chinook, and chum, which spawn in the lower portion of the watershed. TSF 3 has a small run of coho salmon.
- If EPA had reviewed, in detail, the adult salmon spawning distribution data presented in the EBD they would have concluded that TSF 1 contains a small population of coho and Chinook.

<u>EPA Response:</u> **Contrary to this comment, salmon species distribution data presented in Chapter 7 are consistent with these observations. However, we make no assumption that low abundances of spawning salmon make these reaches somehow unimportant, as the comment may imply (see response to Comment 5.36).**

7.72 EPA drew the wrong conclusions regarding adult salmon spawning distribution and relative ecological importance by failing to examine site specific and publically available data on the habitat conditions, fish species distribution, and densities of juvenile salmonids found in their mine development impact areas. This fact alone invalidates the conclusions in the BBWA2 draft relating to impacts. This fact along invalidates the conclusions in the BBWA2 draft relating to impacts.

<u>EPA Response:</u> No inconsistencies are identified in the comment. See responses to Comments 5.36 and 7.71.

7.73 The following publically available data should have been included in any science based ecological risk assessment. It is also important to note, that EPA staff (one of the co-authors of the BBWA2) was personally made aware of the availability of this information at a June 12, 2008 presentation to the Pebble Fish Technical Workgroup meeting hosted by the Alaska Department of Natural Resources. The following publically available data should have been included in any science based ecological risk assessment:

1. Northern Dynasty Mine's 2005 Progress Report on fish sampling activities in 2004. This report included adult salmon spawning counts for the SFK, NFK, and UT. It also included site specific fish density and fish species composition data for approximately 100 locations within EPA's mine development area, UT watershed, and the watersheds encompassed by EPA's TSF's 1, 2, and 3 (NDM 2005),
2. Two Technical Memoranda, prepared by J.W. Buell (Buell and Associates, Inc.) from 1991 and 1993, which documented fish distribution and relative abundance of fish at approximately 50 locations in and around the Pebble Deposit (Buell 1991, 1994),
3. A 2005 Alaska Department of Fish and Game memorandum which documents fish distribution and species composition, habitat parameters, and fish densities, which can be calculated from information contained in the data sheets, from locations within the TSF 1 and TSF 2 watersheds (ADFG 2005),
4. Information on preliminary adult salmon spawning escapement estimates presented at the annual agency meetings for 2004-2007 (this information was also presented during the technical workgroup meeting), and
5. A binder, containing hundreds of pages, of fish capture data for the period 2004-2007 for all sampling conducted by PLP consultants up to that date and reported to the Alaska Department of Fish and Game per their collection permit reporting requirements. This data contains site specific information on fish species composition, lengths of fish captured, and data which could be used to calculate fish densities at selected locations by incorporating habitat information contained in the 2005 Northern Dynasty Mines Progress Report. This binder of empirical data was offered by PLP to all attendees present at the Technical Workgroup meeting referenced above, including EPA Alaska staff who is one of the co-authors of the BBWA2.
6. As for the transportation corridor, EPA failed to review data for each proposed stream crossing known at the time of sampling, which contains information fish species presence, lengths of captured fishes, stream dimensions, substrate composition, and basic water quality parameters among other data which are contained in Chapter 15 of the EBD (PLP 2011).

<u>EPA Response:</u> These data have not been ignored. Contractors and other entities responsible for the fish collection efforts described above are required to submit these data to ADF&G as part of fish collection permit conditions. One of the authors of the assessment was the author of the ADF&G memorandum cited above, and was also responsible for entering the Buell reports listed above. We do not cite all of these

individual draft reports, preliminary data sets, or binders, but we reviewed these data as they had been submitted to the ADF&G data portals. We also cite the PLP's Environmental Baseline Document, where much of the supporting data from preliminary reports was compiled and summarized over multiple years.

Information that PLP and contractors provided to the ADF&G was posted by ADF&G on their Fish Resource Monitor website. This website:

1. **delineates the waters specified by the ADF&G as being important for the spawning, rearing and migration of anadromous fishes and provides access to supporting field data and observations, and;**
2. **provides a geo-spatially explicit, searchable data portal to the Alaska Freshwater Fish Inventory (AFFI). The AFFI identifies locations where particular freshwater fish species and life stages have been observed and provides access to supporting field data and observations.**

Information provided by the ADF&G Fish Resource Monitor, including all of the PLP data posted there (e.g., data for survey projects HDR04, HDR05, HDR07, PEB91, and 08163), was carefully and thoroughly examined. We used these data to help determine the documented presence and distribution of endpoint fish species within the study area. We cite the AWC and AFFI databases throughout the assessment, because they are the best, most consistent record of reported fish distributions in the region (though they are not without flaws, as acknowledged in the assessment). We use fish abundance and density estimates sparingly in the assessment, for numerous reasons that have been detailed throughout the assessment.

7.74 In addition to the publically available information available to EPA since 2008, the EBD contains a considerable body of information on habitat conditions and dimensions, fish species composition and distribution, and site specific fish density information. This information is contained in EBD Chapter 15 and its supporting appendices. It is obvious that EPA did not examine the EBD in detail, because several statements regarding the lack of suitable data can be proven false, because that information is contained in the EBD.

What all of this empirical and publically available information shows is that:

- Salmon spawning in the TSF 1 watershed is limited to a few coho salmon and an occasional Chinook. The fish density data from multiple public sources show very low juvenile densities and spotty distribution, which are consistent with small numbers of spawning adults. No sockeye or chum salmon are known to spawn in the TSF 1 watershed.
- Fish density and fish distribution for the TSF 2 watershed shows the same characteristics.
- Available data for TSF 3 shows low densities of coho salmon in the lower portion of the SFK 1.240 watershed.

If EPA had completed an adequate evaluation of the public sources of information, it is likely that their conclusions regarding the overall ecological significance and magnitude of potential impact would have been different. Having an empirical data-informed conclusion on the relative importance and habitat conditions of these watersheds would have led EPA to a more scientifically defensible assumptions and conclusions about the magnitude of impact and a more defensible conclusion regarding the sufficiency and quantity of potential mitigation measures to mitigate their estimated impacts.

<u>EPA Response:</u> See response to Comment 5.36.

7.75 Flow Effects are Over-Stated

- BBWA study authors predict that changes in stream flows surrounding Pebble will reduce the "quality of downstream habitat" and "diminish fish production". Although EPA presents no cause-effect linkage to demonstrate or quantify this impact, the assumptions underlying their conclusion are also incorrect.
- EPA acknowledges that Pebble will have surplus water that it can treat and release to offset flow changes in nearby streams, but chooses to utilize these surplus waters in the most rudimentary and inefficient way possible. Specifically, EPA chooses to release all surplus waters from its *hypothetical* mine in a steady flow into two of three nearby streams, while leaving the third (the one with highest fish values) devoid of any make-up water. No rationale is provided for this approach, and it is not consistent with what a reasonable mine developer would in fact do.
- Notwithstanding EPA's highly inefficient and ecologically indefensible management of surplus waters, study authors actually predict limited impacts on downstream habitat. Depending on which *hypothetical* EPA mine is considered, more than 90%, 85% or 70% of stream reaches near Pebble would experience flow reductions less than 20%, which EPA characterizes as providing a "relatively high level of ecosystem protection" or only "minor impacts."
- Bear in mind that Pebble expects to achieve far better outcomes than EPA forecasts when managing downstream flow effects. Pebble has invested more than $40 million on fish and water studies, in part to understand the effects of flow reductions on downstream aquatic habitat and to inform surplus water release strategies. None of this data, nor Pebble's sophisticated habitat modeling capability was considered by EPA. When Pebble releases a comprehensive development plan in late 2013, it will include a strategic plan for releasing surplus waters in the three streams near the deposit to optimize downstream habitat conditions. It will demonstrate that the habitat effects of downstream flow changes at Pebble are negligible and will have no adverse impact on any Bristol Bay fishery.
- It's worth noting that, according to EPA, the three water courses near Pebble that may experience flow changes are among 65,701 similar stream and river reaches in the Nushagak and Kvichak watersheds. Collectively, these 65,000+ streams and river reaches support about 20% of the Bristol Bay sockeye salmon fishery.

<u>EPA Response:</u> The assessment acknowledges the importance of streamflow habitat modeling in any subsequent mine plan development.

7.76 Chapter 7 Page 7-32 states:

"The mine scenarios evaluated in this assessment identify that the mine footprints alone will result in the loss (i.e., filling, blocking or otherwise eliminating) of high-functioning wetlands and tens of kilometers of salmon-supporting streams. Such extensive habitat losses could also result in the loss of unique salmon populations, potentially eroding the genetic diversity that is essential to the stability of the overall Bristol Bay salmon fishery (i.e., reduction in the portfolio effect discussed in Section 5.2.4)."

"The public and peer review comments on the first external review draft of this assessment identified an array of compensation measures that commenter's believed could potentially offset these impacts on wetlands, streams, and fish…"

"Potential compensatory mitigation measures identified by commenter's and discussed in Appendix J include mitigation bank credits, in-lieu fee program credits, and permittee responsible compensatory mitigation projects such as aquatic resource restoration and enhancement within the South and North Fork Koktuli Rivers and Upper Talarik Creek watersheds as well as more distant portions of the Nushagak and Kvichak River watersheds. The following additional measures are identified in Appendix J:

- Beaver dam removal
- Flow management
- Spawning channel construction
- Aquatic resource preservation
- Old mine site remediation
- Road removal
- Road stream crossing retrofits
- Hatchery construction
- Fish stocking
- Commercial fishery harvest reductions

As discussed in Appendix J, there are significant challenges regarding the potential efficacy of compensation measures proposed by commenter's for use in the Bristol Bay region, raising questions as to whether compensation measures could address impacts of the type and magnitude identified for the mine scenarios."

<u>EPA Response:</u> See the revised Appendix J for further discussion of mitigation opportunities and challenges.

7.77 Boulder placements have had two major problems in past applications. The first is placing these large objects on an inappropriate stream bottom. In numerous situations, the bottom substrate was too small to properly accommodate the increased water velocity around the boulder(s) and the resulting scour and deposition resulted in the boulder effectively burying itself in the channel. This situation results in the total loss of any habitat initially gained and in some instances resulted in channel migration away from the "improvement". The second problem was the improper placement of the boulder(s) within the channel with respect to channel bank stability. In these instances, boulders were placed too close to a bank, which resulted in unacceptable bank scour during high flows or the bank materials themselves were too small to resist the increased water velocity associated with boulder placements in proximity to the bank.

<u>EPA Response:</u> See response to Comment 7.76.

7.78 3.3.3.1.2 Selected Examples

Placement of rock into streams has been accomplished in a variety of configurations ranging from single boulder placement, clusters of varying numbers of rocks, specifically designed spur dikes (Figure 3.5) [***figure deleted here for copyright reasons; see original public comment for figure***], large downstream or upstream oriented V-shaped structures covering the width of the stream, and placement of "boulder fields" to increase juvenile rearing habitat. Elser (1968) conducted an evaluation of "rock deflectors" (essentially the same configuration as the "boulder structures" shown in Figure 3.4) [***figure deleted here for copyright reasons; see original public comment for figure***] placed in channelized sections of Prickly Pear Creek, Montana. Sections of this stream had been channelized and straightened during previous railroad and road construction activities. Approximately 6.75 miles of a 30.5 mile section of stream had been channelized. The objective of the habitat rehabilitation was to restore the sinuosity of the channel and provide structural elements that would create channel scour, resulting in the formation of pool habitat, which had essentially been eliminated from the altered sections of the stream. Rock deflectors were installed primarily in the Wolf Creek Canyon zone of the stream which had about 5.0 miles of its 8.8 mile total length altered. The deflectors were placed at 180-200 foot intervals on opposite sides of the channel. Comparisons of the fish populations before and after installation of the rock deflectors and with adjacent unaltered sections showed that the fish populations and age structure in the sections with rock deflectors were similar to unaltered sections in the same zones. Non-game populations were absent from the altered sections, but comprised 30% of the fish population in the "improved" sections. Trout populations in the areas with the rock deflectors were 78% higher than in the altered sections. The fish population levels in the "improved" area were significantly different from the altered, but untreated reaches.

Two studies in Norway (Hvidsten and Johnsen 1992 and Bremset et al. 1993) evaluated the placement of large cobble-small boulders across the bottoms of selected reaches of lowland rivers that had been channelized. In the River Soya, (Hvidsten and Johnsen 1992) natural stream bottom materials were generally small 2-4 inches in diameter. Blasted rocks up to 16" in diameter were placed across the stream in a weir formation and in some sections the entire width of the river (20 m) was covered with stones. Densities of Atlantic salmon, > age 0+ increased from about 7 fish/100 m^2 to 25-125 fish/100 m^2 in the channelized section. Salmon densities in reference sections ranged from 7 to 64 fish/100 m^2. Brown trout densities increased after treatment in the channelized section, but were not significantly different from the reference reaches. However, it was noted that the length of fish in the treatment areas did increase, indicating an increased ability of the habitat created to support larger fish. Fish densities decreased over time as sediment filled the treated areas. However, trout densities again increased when upstream sources of sediment were controlled. In the River Gaula, Central Norway, mean densities of presmolt Atlantic salmon and brown trout were 5-10 times higher than in corresponding "unimproved" areas (Bremset et al. 1993). The authors note that the differences in population densities were greatest for older presmolts, again indicating a greater capacity to support larger juveniles. This latter study again documented the decrease in rearing capacity as sediment from uncontrolled upstream sources altered the newly created habitat.

A combination of boulder wing deflectors, clusters, and boulder weirs was placed in Hurdygurdy Creek, a tributary to the South Fork Smith River in northwestern California (Moreau 1984). Hurdygurdy Creek's channel morphology had been severely altered by a massive flood event in 1964, resulting in a stream channel that lacked complexity, a thalweg, spawning gravel, and with limited instream cover. These structures were installed in 1981 and worked as projected. Two years after treatment, population estimates for steelhead parr increased 100%, while at the control sections populations declined by 56% and 61%. Spawning gravels did accumulate behind the rock weirs and Chinook salmon did use these gravels. In Aikens Creek, a tributary to the Klamath River in northwestern California, a control section, a section with just boulder clusters, and a section treated with a combination of boulders and logs attached to the boulders were evaluated. The objective of the project was to provide suitable rearing habitat for steelhead presmolts. Juvenile steelhead numbers increased two and four fold in the boulders only and boulder/log combination treatment area, respectively (Overton et al. 1981).

In Red Cap Creek, in northwestern California, 80 boulders were placed singly or in clusters to increase the rearing habitat capability for steelhead trout. A treatment section was compared to a control section by electrofishing during summer low flow conditions. The before and after comparison showed a decline of 35% in population numbers of 1+ steelhead in the control section versus a 300% increase in the treated section (Overton et al. 1981).

Anderson et al. (1984) describe ten different habitat improvement designs, consisting of 80 total structures placed in southwestern Oregon streams. These structures included various materials (boulders being a main component in many designs) and physical configurations designed to accomplish different objectives. Some were designed to collect gravel sizes suitable for spawning salmonids, while others were designed to provide rearing habitat for specific life stages of anadromous salmonids. In a well documented example from the West Fork Smith River, a before and after treatment evaluation of habitat carrying capacity for coho salmon parr, steelhead age 1+, coastal cutthroat trout age 1+, and unidentified age 0 trout showed values of +17%, +30%, 33%, and -6%, respectively.

Ward (1997) provides an excellent review of the uses of boulders and boulder clusters to increase the carrying capacity for juvenile salmonids. Ward's review documents a number of specific projects, but the results are consistent among studies. If the boulder structures are installed in the appropriate locations and the management objective is to increase the habitat carrying capacity for coho parr and presmolt steelhead or coastal cutthroat trout, then these projects show an increase in carrying capacity of 100-300% over control or pre-project conditions.

Two studies document the use of microhabitats created by boulder structures and single boulder placements for brown trout (Shuler et al. 1994) and rainbow trout (Streubel and Griffith 1993). These two studies demonstrated the disproportional use of the microhabitats created by boulders and boulder structures by these species. In 10 study sections of the Rio Grande River, Colorado, 65-69% of adult and juvenile brown trout, respectively, were associated with two types of boulder structures. No use of single boulder placements was documented. Streubel and Griffith (1993) evaluated the use of the pockets of water created by single boulder placements in Fall River, Idaho by rainbow trout. They describe the use of this microhabitat type by rainbow trout from 150-300 mm in length. Critical factors identified, which strongly influenced habitat use, were water depth and surface area of the pool associated with a particular boulder placement.

<u>EPA Response:</u> See response to Comment 7.76.

7.79 3.3.3.1.3 Summary

Boulders, either singly, in clusters, or combined with other materials such as large wood, have been used in a variety of designs and stream situations to improve fish habitat in western North America. Boulder placements or structures can be highly cost effective, generally because the boulders were in proximity to the stream and often with road access. In the Keogh River in British Columbia, boulders were placed with a helicopter and costs were considered comparable with road access and placement with heavy equipment. Cost per boulder has varied from \$50 to \$1,300 per m^3 with most cost estimates at least 20 years old. Another factor to consider is that over time, the recommended size of individual boulders has increased for instream applications to a generally agreed to size of about 1 m in diameter being the most effective at creating the desired microhabitat, requiring little maintenance, and are of sufficient size to stay in place during high flows.

Based on the results of previous habitat improvement projects and experimental design projects, it is apparent that boulders accomplish four things extremely well. First, boulders as rip rap can help stabilize eroding banks and provide fish habitat for a variety of species and life stages. Second, boulders or boulder clusters provide excellent anchors to attach large wood which together provide a variety of microhabitats for salmonids. Third, boulders have been used to build weirs that span the entire channel width to reduce water velocities and cause deposition of desirable sized gravels that can be used for spawning and provide low water velocity habitat upstream of the weir. This latter habitat’s carrying capacity can be improved with the addition of instream wood, brush piles, or smaller cobbles/boulders (see Solazzi et al. 1999 for some evaluations). Fourth, single boulders or boulder clusters create scour and deposition zones that can result in the creation of suitable spawning sites. In addition, these structural elements create low or negative velocity zones immediately downstream of the boulder which results in shear zones which deliver drift organisms directly into a low velocity rearing microhabitat.

Boulder placements provide suitable rearing habitat for age 1+ salmonids, particularly rainbow trout, cutthroat trout, and coho salmon. Age 0 juveniles are seldom found in the evaluations, primarily because they prefer the very low velocity areas associated with the shoreline and/or stream bottom. Age 0 fish generally are unable to fight the current found in boulder dominated areas. Also, given the preference for age 1+ fish to use the microhabitat behind the boulder, any age 0 fish that moved into this microhabitat would soon become prey for an older fish.

Given the fact that many stream channels in EPA’s hypothetical mine area lack either large wood or large boulders, placement of boulders to create any of the four conditions outlined above certainly appears feasible. These structural elements can be added to existing or created channels to create habitat complexity or to accomplish specific objectives like providing additional rearing habitat for age 1+ or 2+ fish, which could increase the carrying capacity for juvenile coho and Chinook salmon. However, three factors need to be carefully consider before considering boulder placement: 1) is the type of habitat(s) created limiting smolt or juvenile resident fish production, 2) will the stream bottom on which these boulder(s) be placed suitable to handle the hydraulic conditions that will occur during high flows and allow the desired habitat type to be created, and 3) are the adjacent bank conditions suitable to minimize any bank erosion or additional hydraulic forces that may result from placing boulders in the channel. Boulders can be used in the right situation to create a variety of desired microhabitats and conditions (e.g., deposition of spawning sized gravel), protect stream banks at appropriate sites, serve as anchors for large wood applications, and create desired instream complexity. Boulder elements may be applied in main stem channels or in side channel or alcove situations, depending on site specific conditions. EPA's exclusion of these types of habitat mitigation measures seriously undermines the credibility of the BBWA2 conclusions.

EPA Response: See response to Comment 7.76.

7.80 3.3.3.2 Wood Applications (logs, root wads, whole trees, brush bundles)

3.3.3.2.1 General Description

Wood as used in this document generally refers to the intentional placement of portions, or in some cases, entire trees into a stream channel to accomplish a specific objective(s) (Reeves and Roelofs 1982). Most commonly, wood is placed either as pieces of a log directly into the channel, a root wad placed in or along the edge of a channel, a log diagonally projecting from the stream bank, a full channel width log perpendicular to the flow creating a dam pool or plunge pool, or in conjunction with some other habitat element (e.g., logs cabled to a boulder cluster) in order to create habitat complexity within the channel. The size of the channel dictates the appropriate configuration(s) of wood that will achieve the management objectives. Wood in the channel can create a variety of conditions and habitats such as: 1) preventing channel and bank scour, 2) creating water velocity conditions that result in deposition of channel bed materials of varying diameters, 3) creating a variety of water velocity areas that are more conducive to spawning and/or rearing habitat, 4) providing a "substrate" that can be used by aquatic macroinvertebrates and periphyton to establish populations, and 5) provide overhead cover to protect juveniles from predators. Cederholm et al. (1997) provides an excellent summary of the points outlined above.

In some situations, logs have been placed perpendicularly to the channel across smaller streams (< 60 ft. width) to create scour pools which provide both spawning and rearing habitats for salmonids. In Western North America, this type of application has been greatly reduced in recent years because of concerns about long term maintenance costs. While extremely effective at providing desired habitats, current practice is to limit this type of application to relatively stable stream channel conditions.

Two examples of the types of applications currently being employed are shown in Figure 3.6-A and B and Figure 3.7-A and B [***figures deleted here for copyright reasons; see original public comment for figures***].

EPA Response: See response to Comment 7.76.

7.81 3.3.3.2.2 Selected Examples

Phase I of the Resurrection Creek, near Hope, Alaska, Restoration Project was started in 1992 by the Chugach National Forest in attempt to improve fish habitat conditions in a stream that has been placer mined for nearly 100 years. The objective was to improve juvenile salmon rearing habitat in a 3 mile reach by reducing the amount of coarse-bottomed riffle area by creating more pool habitats using a variety of techniques. A pre-project evaluation demonstrated that juvenile rearing habitat was the predominant limiting factor. As of the date of the report cited (1994), 36 structures had been installed, with more scheduled for the summer of 1994. Several single boulder and boulder clusters were installed using boulder 3-5 ft. in diameter. Two upstream Vshaped rock weirs were installed to increase pool habitat area and create a plunge pool downstream of the structure. Several individual log barbs (logs placed at an upstream angle and keyed into the bank were installed to increase pool habitat area and help stabilize the stream bank. Several root wads were placed into the channel and anchored to adjacent boulder placements.

High flows moved a number of the boulder structures and removed some of the individual boulders in the V-shaped weirs. The Forest Service recommends that larger boulders be used for similar situations. The wood structures remained in place and provided additional rearing habitat. Post-project monitoring of these structures had fry densities comparable to natural pools. The rock structures were unable to be monitored because of the small size of the pools created and the water turbulence. Additional work was planned for 1994, but no subsequent monitoring information is readily available from the Forest Service. Only costs for equipment rental is available and totaled less than $9,000 (Parry and Seaman 1994).

Phase II of the Resurrection Creek Restoration Project was undertaken in 2005 by the Chugach National Forest as part of a continuing effort to restore fish habitat to the creek which has been and continues to be altered by placer mining. The 2005 project site is in the lower reaches of Resurrection Creek near Hope, AK on the north side of the Kenai Peninsula. The project improved fish passage and restored aquatic habitats a 1-mile reach of Resurrection Creek, which had been dredged during the early days of Alaska's Gold Rush, to near-natural condition. Large tailings piles were re-distributed, creek meanders were restored, an effective flood plain was established, and the stream was converted from approximately 99% riffle (with some upstream fish passage impediments) to a series of pool-riffle sequences mimicking a natural alluvial stream. Among other things, channel length was increased by 15%, percent riffle was decreased to 53%, percent pools was increased from 1% to 21%, percent runs and glides were increased from 0% to 26%. Off-channel habitats were also established (Figure 3.8) [***figure deleted here for copyright reasons; see original public comment for figure***].

Other project objectives were to increase spawning habitat from 160 yd^2 to 2,000 yd^2 per mile, increase side channel flow through off-channel habitats from 1% to 20% of nominal stream flow, increase large woody debris pieces (cover habitat) from 8 pieces to 330 pieces per mile and implement riparian area and flood plain rehabilitation.

Post-construction monitoring was carried out by University of Alaska graduate students. Whereas little spawning activity was observed prior to rehabilitation of the 1-mile reach of Resurrection Creek within the Phase I area, monitoring during July and August demonstrated extensive use by four species of salmon (Figure 3.9) [***figure deleted here for copyright reasons; see original public comment for figure***].

The Municipality of Anchorage completed a realignment of South Fork Little Campbell Creek in 1988. The project involved realignment of a 725 ft. reach of channel that had been previously channelized into a flat bottomed channel with two 90-degree bends. This previous alignment resulted in flooding of the nearby school playground and a reduction in habitat use by coho salmon and other resident fish species. The new channel followed a more natural meander pattern and the bottom was re-contoured into a series of pools and riffles. Stream banks were graded to permit flood flow passage, but were sloped to encourage the development of riparian vegetation. Bottom substrate added consisted of 4-5 inch diameter stones which were intended to serve as spawning habitat. A graded mixture of substrate sizes containing some fine particles were not added to the stream. Unfortunately, the 4-5 inch substrate proved too large to accommodate spawning and the lack of fines in the bottom substrate encouraged siltation. As a result, the anticipated habitat values were not achieved and an unknown upstream sediment source only contributed to the problem. While the community planning and implementation effort was judged a success, the amount of suitable fish habitat created was negligible. Over $1 million dollars were expended. No pre-project or post-project monitoring data are available (Parry and Seaman 1994).

Smith and Brannon (2008) describe an engineered channel in Washington state that contains many of the "complexity" elements that have been discussed earlier for boulders and wood placement in general (Figure 3.10) [***figure deleted here for copyright reasons; see original public comment for figure***]. They found that juvenile coho salmon reared in the engineered channel exceeded the values for a variety of reference streams for a number of common growth and survival parameters (e.g., condition factor, length, weight, smolt rearing capacity). More detailed information on this study is presented in Table 3.2 [***table deleted here for copyright reasons; see original public comment for table***].

A summary listing of selected habitat improvement projects completed in western North America using large wood elements and some with combinations of wood and boulders is presented in Table 3.2 [***table deleted here for copyright reasons; see original public comment for table***]. There are many examples of evaluations of various habitat improvement projects using wood in the literature. The majority of these projects show that fish production generally increases by a factor of 2-5 routinely. Most of the failures occurred in the late 1970s to mid-1980s and resulted primarily from not correctly identifying the limiting factor for the fish populations of interest, inadequate evaluation of the stream substrate or bank stability to prevent serious scour problems, inadequate maintenance, and inadequate engineering design/size of materials necessary to withstand flood flows (Frissell and Nawa 1992; Chapman 1995).

EPA Response: See response to Comment 7.76.

7.82 3.3.3.3 Reconnection of Existing Side Channels and Off-Channel Habitats to Main Channels and Creation of New Side Channels and Connected Off-Channel Habitats

3.3.3.3.1 General Description

Secondary channel or off-channel habitat improvement or creation for the purposes of enhancing fish production can assume a wide variety of configurations, depending both on the habitat development objectives (i.e., spawning, rearing, overwintering) and conditions present in the available landscape (WDFW 2012). Existing abandoned channels and cut-off oxbows in flood plains of alluvial streams can be re-connected to their parent system with either inflow or outflow channels or both. The site specific configuration will depend on the amount of groundwater infiltration and upwelling and additional inflow needed to achieve the desired flow characteristics. Reconnection of abandoned channels and cut-off oxbows can add large amounts of high quality rearing, overwintering and spawning habitats. Reconnected, low water velocity habitats are especially valuable where existing stream reaches are dominated by relatively uniform high-velocity habitats. Uniform, high-velocity habitats often occur where rivers have been channelized or rip rapped to protect shoreline developments or highway/pipeline alignments, but these conditions also occur naturally. Groundwater-fed channels and channel/pond complexes can be excavated in alluvial floodplains without relying completely on abandoned channels. These excavated habitats provide quality habitats, especially where groundwater aquifers are close to the ground surface and/or copious channel flows can be used to provide flow to the excavated areas. Abandoned flood plain gravel mines or borrow pits, can be connected to natural channels to produce productive off-channel rearing and overwintering habitats.

Understanding and taking advantage of the local land form has been found to be critical to the success of developed secondary channel or off-channel habitats. Some of the most successful off-channel habitat developments have relied wholly or in part on groundwater to develop appropriate flows in the new channels or channel/pond complexes. The schematic (Figure 3.11) and aerial photograph (Figure 3.12) [***figures deleted here for copyright reasons; see original public comment for figures***] depict examples of how local landform can stimulate hyporheic (groundwater) flow that can be captured by new channel excavation or reconnection of abandoned side channels and oxbows.

Simple groundwater-fed side channels (Figure 3.13) [***figure deleted here for copyright reasons; see original public comment for figure***] generally consist of an infiltration pond or region, often protected from flood damage by a stabilized rock berm, and a long channel connected to the parent stream at its down-gradient end. Channel margins are generally protected or stabilized with coarse rock which can also provide cover for rearing juvenile fish.

Chum and sockeye salmon are the species most commonly associated with secondary channel or offchannel habitats for spawning (Slaney and Zaldokas 1997) and coho for rearing and overwintering and occasionally spawning (Figure 3.14) [***figure deleted here for copyright reasons; see original public comment for figure***] (Sheng et al. 1990). Chinook salmon juveniles often use off-channel areas for rearing and overwintering as well (Buell, 1991; Melville and McCubbing 2009). These fish appear to be attracted to secondary channels by groundwater infiltration, especially in winter when groundwater is typically several degrees warmer than water in the main channel (Bachen 1984, Sheng et al. 1990, Guillermo and Hinch 2003, Jones et al. 2003, WDFW 2012, Morley et al. 2005). Early in the history of off-channel salmon habitat development, it was found that habitat productivity could be further enhanced if additional habitat elements supplying cover (e.g., large woody debris, boulder clusters, and coarse rock channel margins) were supplied (Lister et al. 1980, Slaney and Zaldokas 1997, WDFW 2012). Eventually, elaborate pool/channel complexes with additional habitat elements were designed and became the norm in areas where local landform could accommodate such developments.

Connection of developed flood plain habitats to parent streams can involve both upstream and downstream ends through diversion of some of the flow of the main stem stream into the secondary channel or can rely solely on groundwater infiltration, with a single connection at the down-gradient end. Although the former approach often involves formal headworks which must be protected against flood and ice damage, and has maintenance and especially sediment accumulation disadvantages, the latter approach avoids these difficulties to a large degree. In settings with high sediment loads and heavy ice accumulations, surface inflows to developed flood plain habitat areas should generally be avoided. A generalized small intake design schematic is shown in Figure 3.15 [***figure deleted here for copyright reasons; see original public comment for figure***]. Intakes such as this are generally connected to a buried pipe and fitted with a flow control such as a wheel-operated knife gate. Operation of surface flow intakes, especially those containing metal components, can be problematic in winter where air temperatures routinely drop well below freezing for extended periods.

Spawning success, including egg-to-fry survival rates has been found to be higher in developed secondary channels than main channel areas. Bustard (1986) studied relative chum egg-to-emergence survival rates for four groundwater-fed side channels, two associated with coastal (maritime) and two with interior (cold) winter areas. He reported 30-34% survival for cold winter channels and 46-60% for maritime winter channels, both rates being extremely high when compared to natural spawning areas, usually in the 5-7% range (Lister et al. 1980). A Washington Department of Fish and Wildlife study calculated chum egg-to-fry survival rates of 60.8%, 37.6% and 78.4% for three re-excavated side channels, with relatively low spawner densities, on the East Fork Satsop River, WA (WDFW 1986).

Marshall (1984) reported on chum egg-to-fry survival in two groundwater-fed spawning channels, the Worth Creek Channel in the Norrish Creek drainage near Mission, BC (Lower Fraser Valley) and the Upper Paradise Channel in the Squamish River drainage, BC. He found survival rates of 22% for the Worth Creek Channel and 30% for the Upper Paradise channel. When results from these two channels were combined with those from five additional sites, average chum egg-to-fry survival rates were over 16%, more than twice the average reported by Lister et al. (1980) for natural spawning areas throughout British Columbia.

Bonnell (1991) investigated groundwater-fed secondary channels constructed for chum salmon spawning and found that fry survival was inversely related to the number of spawners (spawner densities > ~ 0.5 females/m^2) and varied directly with intragravel dissolved oxygen concentration. Egg-to-fry survival rates generally ranged from 10% to 48% (average about 20%), with fry production rates between 100 and 600 fry/m^2 at female spawner densities below approximately 0.5 females/m^2. Bonnell also found that fry production rates tended to decline significantly from four to eight years after construction, suggesting the need for maintenance, such as scarifying spawning areas to clear them of accumulated organic material and fine sediment.

Reconnected secondary channels and oxbows and developed channels that rely at least in part on groundwater to develop outflow generally provide warmer water for overwintering juveniles and often cooler water for summer rearing, often an added benefit, especially in arctic or sub-arctic areas (Slaney and Zaldokas 1997). Overwintering habitat for salmon species with extended stream rearing juvenile life stages (coho, Chinook) can be extremely important in arctic and sub-arctic regions, especially where deeper, low velocity habitat features are rare (Cederholm and Scarlett 1991). Groundwater-fed secondary channels with deeper water and elements that increase habitat complexity incorporated into their design provide ideal overwintering habitats for these fish. Bustard (1986) found that overwinter survival of juvenile coho was directly proportional to the percent of side channel area remaining wetted (range: 0.9% to 44.7%) at the end of winter, with survival approaching 60% (range: 33.7% to 59.8%) in the channel with the most late-winter wetted area.

Bachen (1984) found that winter temperatures in a groundwater-fed channel flowing into the Chilkat River near Haines AK, used for spawning by chum and coho salmon and rearing by coho salmon and Dolly Varden char, were as much as 6^{o}C warmer than the parent stream. Morley et al. (2005) in a study of 11 constructed secondary channels with added cover elements and 11 control areas found that the constructed channels supported about twice the number of coho/m^2 in summer and nearly four times the number of overwintering coho/m^2 than the control channels. Guillermo and Hinch (2003) studied two constructed side channels in British Columbia (Upper Mamquam Channel along the Mamquam River; Upper Paradise Channel along the Cheakamus River), one receiving mostly surface flow and the other receiving mostly groundwater flow. Both channels were treated by adding large woody debris as cover in certain sections. Results indicated that addition of cover elements increased winter carrying capacity and smolt output in the surface-fed side channel, but did not benefit the groundwater-fed side channel. This is an important finding, since it has significant cost implications for design of groundwater-fed or surface water-fed secondary channels. Water temperature appears to be the primary factor driving the differences between the results from the two channels. Adding cover to surface flow fed channels, whose water temperature is controlled by air temperature, appears to be more beneficial than adding cover to groundwater fed channels (Tobe 2005).

The productive capacity of reconnected secondary channels and oxbows can be significantly enhanced through the addition of habitat complexing agents such as large wood or boulders, especially if the developed habitats are fed by surface flow (see above). This is particularly important for optimizing overwintering habitat for juvenile coho and Chinook salmon.

Developed or reconnected secondary channels can vary in length from a few hundred meters to several kilometers for more elaborate complexes, depending on the prevailing landform and proximity of potential secondary channel elements (e.g., several oxbow or abandoned channel segments aligned within the floodplain). The sizes of particular elements (e.g., ponds, flowing channels) can influence the relative productivity of complex secondary channel developments. Rosenfeld et al. (2008) comprehensively reviewed data from published sources in an effort to determine the influences of design features on productive capacities for juvenile coho salmon. They found that coho parr (rearing juveniles) were more abundant in stream-type habitats during the growing season than in pond-type habitats, and that constructed habitats supported greater densities of parr than nearby natural habitats. They also found that smolt densities and output and smolt weights were greater for pond-type habitats than channel-type habitats, suggesting that overwintering in ponds was beneficial when it comes to overall production. When comparing outputs of habitat elements according to size, they concluded that the optimum pond-type or stream-type element size is 5,000-10,000 m^2.

Keeley et al. (1996) regressed smolt production on pond area and stream area sizes and concluded that 10,000 m^2 was optimum for ponds but found no significant relationship for stream-type habitat elements. Reeves et al. (1989) suggested that natural beaver ponds less than 500 m^2 provided better overwintering conditions than larger ponds, but these data may be less relevant for constructed or re-connected habitats.

Keeley et al. (1996) and Koning and Keeley (1997) developed empirical equations for calculating the production of coho smolts from developed ponds and flowing channels based on a large number of production and monitoring studies. These equations are:

Log_{10} smolt number = 0.51 $\log_{10}$ pond area (ha) + 3.47

and

smolt number = 0.69 smolts/m^2 <u>secondary channel</u> area.

One aspect of secondary channel development not frequently discussed in the technical literature is the need for maintenance, especially with regard to beaver activities. Depending on their size, developed secondary channels can provide excellent opportunities for beaver invasion, which can, in some cases, impair access into the habitat intended for fish. Although beaver impoundments can and do provide good habitat for rearing juvenile salmonids and other fish species, beaver dams can also deter overall production. For this reason, beaver management (see Subsection 3.3.2.1 above) should be considered an important aspect of secondary channel development where these animals are present (Foy and Logan 1997, Slaney and Zaldokas 1997, WDFW 2012).

<u>EPA Response:</u> See response to Comment 7.76.

7.83 3.3.3.3.2 Selected Examples

In 1991, as part of the mitigation requirements for the Bradley Lake Hydroelectric Project near Homer, Alaska, the Alaska Energy Authority converted four former borrow pits on the Martin River Delta into rearing ponds targeting coho salmon. In addition, a 2,800+ ft. long spawning channel was constructed adjacent to the 30 acres of ponds. Minnow trapping in the summer of 1993 captured two age classes of juvenile coho salmon, but the monitoring trip was too early in the summer to determine if coho salmon were using the spawning channel. A review of Google Earth satellite photos in July 2010 clearly show the ponds and spawning channel are still in existence, but no additional monitoring information is available (Doug Palmer, U.S. Fish and Wildlife Service, Kenai Fish and Wildlife Office, pers. comm. July 2010).

In 1987, the Alaska Department of Transportation and Public Facilities constructed a series of 8 rearing ponds, on Box Canyon Creek, as mitigation for construction a coal loading facility near Seward, Alaska. These ponds were connected to an existing ½ acre pond and each other by a series of 25 ft. long constructed riffles. The ponds were 100 ft. long and 6 ft. deep. Early monitoring found juvenile coho and Chinook salmon and Dolly Varden char. However, the real success is the use of the connecting riffles by spawning salmon. Chinook, coho, sockeye, chum, and pink salmon have all been documented using the area. Additional work on a nearby road was planned for 1994 with improvements to this pond series included as mitigation for this new work. Improvements were to include resloping some of the original banks to encourage riparian vegetation growth and placement of woody debris in order to improve biological productivity and increase rearing habitat effectiveness. Cost of the original project was about $25,000, but no additional monitoring data are available (Parry and Seaman 1994).

The City of Seward Alaska constructed two 600 ft. long spawning channels in areas adjacent to Fourth of July Creek that had a copious groundwater supply as mitigation for construction of the Seward Marine Industrial Center. The channels were completed in 1982, and pink salmon were documented spawning immediately after construction. Floods damaged much of the area in late 1982. Because the channels were constructed near or at tidewater, the downstream end of the merged channel was closed by storm surge and resulting beach berms which prevent salmon access. Groundwater flows were less than anticipated, but the channels had less silt than adjacent Fourth of July Creek. After all of these problems, the City of Seward abandoned this project and no further monitoring was conducted. No cost estimates were provided (Parry and Seaman 1994).

The USDA Forest Service constructed two adjacent spawning channels at Mile 25.25 of the Copper River Highway near Cordova, Alaska in 1987. The objective of these channels was to provide spawning habitat for coho salmon to help support the local commercial fishery. The channels were constructed in known groundwater upwelling areas with a placed sorted bottom substrate of uniform size. Counts of adult spawners ranged from about 100 to a peak of 550 in 1991. Over time, sediments have accumulated in the “clean” gravels placed in the bottom of the channels, reducing groundwater inflow and reducing egg to fry survivals. As of 1994, the fry production rate was highly variable, ranging from 2,000-50,000, but appeared to decline after 1990. No additional monitoring data are available. Cost of the project was $22,000 for construction of the 22,000 ft^2 channel habitat (Parry and Seaman 1994).

A 1,500 ft. long by 20 ft. wide spawning channel for chum salmon was constructed by the Northern Southeast Regional Aquaculture Association near Haines, Alaska in 1989. The channel was excavated out of native materials on a nominal 1% gradient with some variation in bottom contour to provide varying water depths. All bottom materials were from the excavation area and were not sorted or washed. The original objective was to provide 3 to 7 cfs of groundwater inflow. After construction, flow has been measured at 13 cfs. The channel, up to 1994, had been judged a success with approximately 5,000 chum salmon spawning in the newly constructed channel (Parry and Seaman 1994). No information on spawning has been obtained, if it exists, since the 1994 report.

There are many examples of constructed or reconnected secondary floodplain channels and oxbows for salmon habitat enhancement and rehabilitation in British Columbia and the Pacific Northwest. One of the most comprehensive examples is a large complex of efforts constructed over a 25-year+ span from 1982 to 2007, with additional elements currently in the planning and implementation stages, on the lower Cheakamus River north of Squamish, BC. This complex of elements has been named the Dave Marshall Salmon Reserve after a pioneer in the development of groundwater-fed secondary channels for salmon. Figure 3.16 shows the layout of various elements [***figure deleted here for copyright reasons; see original public comment for figure***].

Funding has been obtained from a variety of sources, including BC Hydro as mitigation for the Daisy Lake hydroelectric diversion, the Canadian government and, following a train derailment and sodium hydroxide spill in 2005, from Canadian Northern Railway. Early monitoring of the Upper Paradise Valley Side Channel, one of the first components of what would become the Dave Marshall Salmon Reserve (Foy 1985) determined that the carrying capacity of the channel was 3.1 coho smolts/m^2 (4.4 g/m^2 biomass). This was 5.2 times the carrying capacity (7.2 times the biomass) of natural streams of similar wetted area in the region as determined by Marshall and Britton (1990). According to monitoring data for 2000 through 2008, the main elements of this complex produced annual averages of approximately 250,000 chum fry, 60,000 pink fry, 100,000 Chinook fry, 2,000 Chinook smolts (data for 2000-2003 only), 70,000 coho smolts and 4,000 steelhead smolts (data for 2000-2003 and 2008 only; Melville and McCubbing 2009).

The Cheakamus River km8 Side Channel Rewatering project was constructed in 2008 at the upper end of the Dave Marshall Salmon Reserve. This project involved deepening, widening and bank stabilization of an ephemeral side channel of the Cheakamus River, adding boulder and large wood habitat complexing agents and installation of a small, submerged supplemental intake structure to provide sufficient flow in the channel during the start-up phase (Figure 3.17) [***figure deleted here for copyright reasons; see original public comment for figure***]. The km8 Side Channel is 590 m long with an average channel wetted width of 7.4 m (ranging from 5.4-11.3 m, Cheakamus River discharge ~50 m^3/s). The average depth in September 2008 was 0.64 m, ranging from 0.28 m to 1.47 m. Twelve holding/rearing pools greater than 20 m^2 in size and another 15 ranging in size from 2 to 5 m^2 were excavated in the channel. Residual depths in the larger pools were typically 0.5-.2 m. Residual depths in small pools were generally $\leq$ 0.5 m, with no residual depths $<$ 0.2 m. One hundred eleven habitat complexing features were installed in the side channel, at a frequency of approximately one structure per 5.1 linear meters of channel. Habitat features included 71 woody debris structures, 37 boulder clusters and two boulder riffles.

The Gorbuscha East Channel was added to the Dave Marshall Reserve in 2003 and added 3,225 m^2 of salmonid habitat (Figure 3.18) [***figure deleted here for copyright reasons; see original public comment for figure***] (BC Hydro Fish and Wildlife 2003). The Mykiss Side-Channel, within the Dave Marshall Reserve, which was undertaken in 2004, supplied year-round flow to a partially excavated 300 m-long channel, which produced approximately 2,500 m^2 of new habitat for Chinook and pink salmon and juvenile steelhead trout (Halvorson 2004).

Another complex of flood plain habitat developments is located along the Chilliwack River, BC, between Chilliwack Lake and Cultus Lake in the lower Fraser River Valley. Nineteen habitat restoration projects focusing primarily on off-channel salmon habitat have been implemented (Figure 3.19) [***figure deleted here for copyright reasons; see original public comment for figure***]. The combined efforts have restored or developed over 50,000 m^2 of secondary channel stream habitat and over 200,000 m^2 of pond habitat.

One portion of the Chilliwack River restoration program, the Centennial/Bulbeard channel and pond complex, was completed in 1998 (Figure 3.20) [***figure deleted here for copyright reasons; see original public comment for figure***]. This complex has headworks, which supplies a controlled 1.1m^3/sec inflow from the Chilliwack River main stem. This complex incorporates development of 80,000 m of pond habitat and 15,000 m^2 (1.5 km) of stream habitat. The habitats developed provided for spawning for chum and coho salmon and rearing and overwintering for coho salmon. Monitoring during the second year after completion of the Centennial/Bulbeard complex demonstrated the production of approximately 30,325 coho smolts, most from the Bulbeard portion which contains the most pond area (Cleary 2001).

Another portion of the Chilliwack River off-channel habitat development complex is the Anderson Creek channel rehabilitation project completed in 1995 (Figures 3.21 and 3.22) [***figures deleted here for copyright reasons; see original public comment for figures***]. This project corrected a highway culvert passage problem and reclaimed an old meander channel for fish production at the same time. A new culvert was installed to carry part of the Anderson Creek flow to the old channel, creating a 1.5 ha pond and 200 m of inlet and outlet stream spawning and rearing habitats. Part of the old channel was deepened to provide overwintering habitat for juvenile coho and deter beaver dam construction (Foy and Logan 1997). Additionally, anadromous fish access was provided to upper Anderson Creek. Monitoring showed use of deeper areas for overwintering, good benthic invertebrate food production in the inlet and outlet streams (Slaney and Zaldokas 1997).

Four restored secondary pond and channel habitat development sites (Anderson Pond, Bulbeard Pond, Peach Channel and R4 Channel) and three natural off-channel sites along the Chilliwack River were monitored for coho production in 1997 and 1998 (Blackwell et al. 1999). Smolt outputs were highly variable (<2 to >50 per 100 m^2), but the restored habitats produced coho smolts at rates comparable to natural off-channel habitats preferred by this species. They concluded that newly reconnected channels may take at least one year of “seasoning” before full coho smolt output potential is realized. Blackwell et al. (1999) found that average smolt weight was inversely proportional to number of smolts per unit area, suggesting density-dependent competition in some ponds.

Cleary (2001) looked at production of coho smolts produced by developed off-channel habitats in the Centennial/Bulbeard complex in a different way. Using analyses of coho smolt production in 22 natural streams in British Columbia from Marshall and Britton (1990) and equations developed by Keeley et al. (1996) and Koning and Keeley (1997), Cleary (2001) calculated the expected output of the 3 km reach of the Chilliwack River paralleling the Centennial/Bulbeard complex should be approximately 5,700 smolts (i.e., 1,900 smolts/km). Monitoring data suggest that this complex produced approximately 30,300 smolts (i.e., 10,100 smolts/km), over 5 times the expected production of the main Chilliwack River channel paralleling the off-channel complex.

Foy (2006) performed population estimation sampling of the Wingfield Creek Project and the Thompson Park Project as well as an untreated reach of Ryder Creek, all part of the Chilliwack River floodplain restoration complex. He found coho smolt production rates in the developed habitats averaged 1.62 smolts/m^2, 157% of the production rate for untreated habitat in Ryder Creek.

Bachen (1984) monitored a 450 m long (~2,750 m^2) excavated groundwater-fed chum spawning channel in the outwash area of the Chilkat River near Haines, AK and reported the use of this habitat by about 700 and 450 spawners, respectively in the first two years following construction. In the second year, 97,444 fry were detected during outmigrant monitoring, yielding an egg-to-outmigrant survival rate of 22-24% based on estimated egg deposition. Bachen also reported winter water temperatures about 6°C higher than the Chilkat River itself and use of the spawning channel by rearing coho salmon and Dolly Varden char, especially in areas where coarse "armor" rock had been used to stabilize the channel banks. A borrow pit developed during construction of the Chilkat spawning channel filled with water; this pit was connected to the channel and provided with cover to enhance rearing habitat for juvenile coho. Food organism production was reported to be high and rearing coho growth was reported to persist throughout the winter, attributed to the warmer water and abundant food supply.

Much less formal but still effective habitat development sites have been monitored for effectiveness in terms of fish production. For example, Bryant (1988) monitored four gravel borrow pit ponds developed for road construction by Alaska Department of Transportation and Public Facilities on the outwash of the Yakutat forelands. These ponds had been connected to adjacent streams by artificial channels a decade or more earlier. Three of the four ponds supported significant populations of juvenile coho salmon (2,000- 8,000 fish; varying by pond and season); the fourth pond, with no contemporary well-defined channel, supported only a few fish. On a unit area basis, two of the ponds with areas of 10,010 m^2 and 7,644 m^2 supported an average of 2.9 and 3.3 juveniles/m^2, respectively. The third, much larger pond (34,954 m^2) supported 0.12 juvenile fish/m^2. These findings suggest that a well-defined connection may be important for the exploitation of off-channel rearing habitats by juvenile salmon; a point emphasized by WDFW (2004), and supports the notion of a point of diminishing returns with respect to off-channel pond size on the order of 10,000 m^2.

The ADFG's Habitat Division has a long history of developing fish habitat from gravel borrow pits created to support development in specific areas of the State or at specific isolated sites. The key to making this type of project successful is providing access, as appropriate, for fish to be able to move between active stream channels and the pit, contouring the pit shoreline to provide a shallow littoral area to promote biological productivity and provide for vegetation growth, ensuring that the pit has sufficient winter water depth to maintain suitable living space, and ensuring that pit water quality is adequate to support fish life. This type of project can also be successful in situations where a stream access connection is not possible. In these cases, the pit must provide suitable spawning and rearing conditions for the species of interest. There are numerous examples of borrow pit development in Alaska. Excellent examples are documented in Hemming (1988), Hemming (1990), Hemming (1991), Roach (1993), Hemming (1994), and Parry and Seaman (1994).

<u>EPA Response:</u> See response to Comment 7.76.

7.84 3.4 Water Chemistry Enhancements

3.4.1 General Description

This subsection discusses the opportunity to enhance a suite of water chemistry parameters to increase the biological productivity of the three primary watersheds in and near the deposit area. This suite of parameters has been divided into two groups. The first consists of “basic” parameters and includes alkalinity, hardness, and total dissolved solids (TDS). The second group includes nitrogen and phosphorus and is referred to as “nutrient” parameters. Some of the literature, related to marine derived nutrients (i.e., nutrients supplied by anadromous fish carcasses), also include considerations of carbon (C), but while it constitutes another potential measure, C levels have not been evaluated at this time.

The two groups of parameters are discussed separately below. It is important to separate these two groups for discussion because one or the other or both may limit biological productivity in a stream. For example, a stream may have sufficient nutrient levels [i.e., nitrate nitrogen (NO_{3}-N) and orthophosphate (PO_4)], but the alkalinity and hardness are sufficiently low to limit primary productivity and ultimately fish production (e.g., Cada et al. 1987). In other instances, low levels of nutrients have been shown to limit primary productivity and ultimately fish production (e.g., Perrin et al. 1987). A preliminary review of the water quality chapter of the EBD’s water quality data indicates that both conditions occur in the three primary watersheds associated with the deposit area and most likely both groups of water chemistry parameters are limiting at most sampling sites (PLP 2011).

The sequence of how fish production may be limited by these factors is as follows:

- Low concentrations of the basic parameters and/or nutrient parameters limit the production of algae/chlorophyll a. (Perrin et al. 1987; Wipfli et al. 1998).
- Low levels of algal production decreases the production of aquatic macroinvertebrates and the level of habitat complexity, which can increase the amount of invertebrate drift. (Hinterleitner-Anderson et al. 1992; Lee and Hershey 2000).
- Low levels of aquatic macroinvertebrate production can reduce overall fish production, reduce the growth rates of individual fish, and/or result in fish movements away from low production areas. (Larkin and Slaney 1997; LTER 2009).

The goal of this particular mitigation approach is to increase the biological productivity, as appropriate, in those aquatic habitats not lost by mine development. The authors believe it is possible to increase the productive capacity of the remaining aquatic habitats so that net fish production may equal or exceed pre development levels. This increase in productive capacity may be partially or completely realized by increasing the basic and/or nutrient parameter concentrations through a combination of water management, specific actions to increase one or more parameter concentration(s), nutrient additions at the appropriate places and times, and/or a combination of habitat creation in association with manipulation of certain water chemistry parameters.

EPA Response: See response to Comment 7.76.

7.85 3.4.2 “Basic” Parameters: Alkalinity/Hardness/Total Dissolved Solids

3.4.2.1 Background for the Mine Site Area

Since the main ore body is located at the geographic headwaters of the three primary watersheds (NFK, SFK, and UT) and the geology of this area is both porous and relatively recent, there has been little opportunity for natural surface waters in these watersheds to develop levels of alkalinity, hardness, and total dissolved solids that support a robust level of primary productivity. A preliminary examination of PLP water quality data from selected main stem sites combined for the period 2004-2008 shows that main stem surface waters in the mine area and downstream have what are considered low concentrations of these three parameters (PLP 2011).

The summary analysis presented in the EBD shows that the surface waters associated with the mine area watersheds are generally very soft, lack buffering capacity (low alkalinity concentrations), and the fundamental concentrations of ions needed to support a robust biological community starting at the primary production level. For example, a number of the alkalinity measurements for the NFK, SFK, and main stem Koktuli River (KR), respectively are below the state water quality minimum standard of 20 mg/l. The notable exception is UT where essentially all of the data exceed the minimum standard. However, nearly all of the concentrations of alkalinity for all four locations are less than 50 mg/l (PLP 2011). The same pattern is present for the hardness and TDS concentrations leading to a conclusion that the area is dominated by “soft” water in general, which is limiting primary productivity.

Scarnecchia and Bergersen (1987) found a significant relationship between conductivity (strongly correlated with TDS), alkalinity, hardness, and two other non-chemistry variables, and trout annual production and biomass in 10 streams in northern Colorado. Four of the 10 streams had alkalinity and hardness concentrations > 50 mg/l, which compares with less than 2% of the concentrations in Table 3.5 exceeding this level. The same pattern was shown for TDS. Their data shows decreasing levels of trout annual production and biomass in streams with lower concentrations of alkalinity and hardness and lower conductivity readings. These authors also cite five studies from North America and Northern Europe that showed increased fish and/or benthic organism production in streams with higher levels of conductivity and calcium concentration (alkalinity) (McFadden and Cooper 1963; Egglishaw 1968; Le Cren 1969; Mortensen 1977).

LaPerriere et al. (1989) studied algal and primary productivity in 15 subarctic streams in north central Alaska between Fairbanks and the Canadian border. They found a significant positive relationship between maximum standing crop of benthic algae, measured as chlorophyll a, and mean summer alkalinity concentration in five clear water streams. They also found a similar significant relationship for sestonic chlorophyll a concentration for 10 clear streams, but not for the five brown water streams in the study area. They concluded that the organic nature of these latter streams give “false alkalinity” readings because of the chemical nature of the water in this type of stream. They found a highly significant relationship between total phosphorus (summer means) and sestonic chlorophyll a concentrations for the 13 streams sampled in 1979. When data from two additional streams were added to the analysis in 1983, the relationship between total phosphorus (summer means) and sestonic chlorophyll a concentrations became non-significant. However, a separate analysis of just the brown water streams again showed a significant relationship between total phosphorus (summer means) and sestonic chlorophyll a concentration.

Koetsier et al. (1996) examined the relationship between water chemistry and habitat parameters and benthic macroinvertebrate density (number/m^2) and drift biomass (mg/m^2), and benthic organic matter (BOM) biomass (g/m^2) from six streams in the Salmon River basin in Idaho. They found a significant positive relationship between alkalinity concentration and production of macroinvertebrates, and subsequent drift biomass, and

BOM. The authors cite three studies that showed a relationship between alkalinity and increased periphyton and macrophyte production and cite five studies that show an increase in fish production as a result of increasing primary productivity leading to increased benthic macroinvertebrate production. They also cite four studies in which the authors of those studies identify an “alkalinity threshold” of either 20 or 50 mg/L, which resulted in low benthic densities or a “physiological constraint” on some invertebrate taxa, particularly genera of Ephemeroptera (mayflies) and Plecoptera (stoneflies), which are major food items for young salmonids. The alkalinity data in the EBD clearly indicate that the surface waters represented are extremely low in buffering capacity and are limiting primary productivity in the watersheds (PLP 2011).

Bailey (1974) reviewed the primary factors influencing trout stream productivity and recommended concentrations to obtain maximum benthic macroinvertebrate production and thus fish production. He recommended alkalinity concentrations should be greater than 55 mg/l, hardness should be greater than 125 mg/l, and total dissolved solids (reported as conductivity) greater than 128 mg/l to support a healthy, productive stream. Wurts (2002) recommended optimum alkalinity concentrations of 50-150 mg/l in fish production ponds.

Cada et al. (1987) examined the relationships among water select water chemistry parameters, benthic macroinvertebrate biomass, and trout diets and growth at eight sites in four streams in the southern Appalachian Mountains. Three of the four streams (7 of 8 sites studied) all had alkalinity and hardness concentrations of less than 15 mg/l, with conductivity values less than 18 μS/cm (approximately 20 mg/l TDS). One stream had mean concentrations of alkalinity, hardness, and conductivity of 44 mg/l, 51 mg/l, and 110 μS/cm (approximately 66 mg/l TDS) which are at the upper end of PLP’s data for these parameters (PLP 2011). What this study showed was a reduction in trout growth rate during the midsummer to early fall time period, despite having suitable stream temperatures. The authors attribute the lower growth rates to cropping of periphyton by benthic macroinvertebrates at such high rates that the macroinvertebrate community could not be sustained or increased over the summer/fall time period as would normally be expected. The decrease in macroinvertebrate levels resulted in a flat growth rate of trout in these streams. They also report this situation has been documented at other locations in North America. Almodovar et al. (2006) report a significant positive correlation between alkalinity and brown trout production in Spain and other European counties. These studies are quite relevant as a preliminary evaluation of the growth patterns of resident salmonids from the Pebble Project area strongly suggests a similar growth pattern (PLP 2011).

<u>EPA Response:</u> See response to Comment 7.76.

7.86 3.4.2.2 General Description of the Technique

A technique that could address the issue of low levels of alkalinity, hardness, and total dissolved solids in Pebble mine area surface waters is the addition of limestone ($CaCO_3$) to increase the buffering capacity of the water. Variations on this technique, mainly limestone particle size, have been used extensively in Eastern Canada and the U.S. to add buffering capacity to surface waters that have a low pH resulting from acid runoff and acid rain. These areas also had high concentrations of aluminum (Al) which were adversely affecting fish distribution and population levels.

The technique originally started in Scandinavian countries in the 1930s by adding spawning sized gravel pieces of limestone into Atlantic salmon streams. This method was extremely cost effective and required no maintenance. However, because of the low stream pH and high concentrations of AL found in these waters, precipitates formed on the limestone rocks, coating them, and thus reducing the ability of the rock to release calcium ions into the water. Subsequent refinement of the technique has resulted in particle diameter being reduced to crushed-sized or smaller sand-sized particles being applied to a stream. In Sweden, smaller particle sized limestone was added to wetland areas in a watershed to reduce the acidity of waters with a resulting increase in alkalinity and biological productivity (Hasselrot and Hultberg 1984; Clayton et al. 1998). Zurbuch (1984) reviewed the use of this technique in West Virginia and concluded that larger particle sizes could be effective if the introduced limestone was of sufficient size that the stream would cause the particles to move, thus exposing new sides without a precipitate present. A note of caution is required here because many of the streams treated with this technique had low pH values in the 4-5 range. An evaluation of the potential to form precipitates on larger sized limestone pieces placed in the water should be completed, based on each individual watershed's water chemistry. Particle size will have a major influence on limestone renewal interval, distance between treatment sites, and maintenance requirements.

Subsequent to these initial efforts using larger sized particles, particle size has decreased to where the current practical size is sand sized down to < 30 μm (Rosseland and Skogheim 1984). Experiments conducted in Eastern Canada showed statistically significant increases in pH, total inflection point alkalinity as $CaCO_2$, conductivity (μS/cm), calcium, and magnesium concentrations downstream of a crushed limestone bed installed in the stream bottom (Gunn and Keller 1984; Lacroix 1992).

<u>EPA Response:</u> See response to Comment 7.76.

7.87 3.4.2.3 Selected Examples

Most of the literature relating to alkalinity and liming describe various techniques for treating acid runoff from specific sites, whole watershed applications to treat acid rain related or natural soil acidity problems, liming of naturally soft water lakes to improve productivity, or the use of anoxic limestone drains (ALD) to treat concentrated acid mine runoff. All of these techniques result in an increase in alkalinity, hardness, and TDS downstream of the treatment point. Limestone particle size varies among techniques from 150 mm down to < 30 μm. Treatments include: 1) running an entire stream through a rotating drum system containing fine limestone particles, 2) placing various sized particles directly in a stream bed, and 3) distributing fine limestone particles over a wetland adjacent to the stream and letting natural runoff and seepage deliver higher alkalinity water to the stream channel.

These types of applications are currently used in the major government programs over various parts of the world. Sweden and Norway have active programs today that started in the 1930s. The United States and Canada still have active programs to deal with acid runoff in the eastern portions of both countries. Active evaluations of effects are ongoing in the Appalachian Plateau of the U.S. (McClurg et al. 2007).

Two other techniques to raise alkalinity, and other key water chemistry parameters as well, are not well described in the literature. The first is a variation on a limestone application observed by Randy Bailey in 1973. This technique involved placing wind rows of large limestone chunks (150-250 mm) along a stream channel that was a natural soft water stream. The treatment consisted of approximately quarter mile long wind rows on both sides of the channel. While no water chemistry or macroinvertebrate samples were collected, Bailey and graduate school colleagues did sample the fish populations both upstream of and within the treatment area. Electrofishing upstream of the treatment area produced few rainbow, brown, and brook trout with a maximum size of about 150-200 mm in length. Sampling in the lower 1/8 mile of the treated area produced large numbers of trout with fish of all three species in the 3-5 pound range. The difference in populations and production was remarkable.

The second technique consists of pumping groundwater of higher alkalinity to reduce pH levels and increase key water chemistry parameters. In an experiment using this technique in Pennsylvania, pH, total dissolved aluminum, and alkalinity all showed statistically significant increases (Gagen et al. 1989). Of particular interest was the fact that alkalinity concentrations increased from below a detection limit of <0.05 mg/l to 1.8 mg/l, an increase of 38 times.

Given the information presented in the sections above, there is an opportunity to increase stream productivity in one of two ways. The addition of limestone in some form at the appropriate locations could increase the concentrations of biologically key water chemistry parameters. The second opportunity could result in the discharge of higher alkalinity water into fish producing streams through a water management program. It is clear that increasing key water chemistry parameters (nitrogen and phosphorus additions as nutrients are discussed immediately below) would increase the primary production, benthic macroinvertebrate populations, and fish production, if sufficient nutrients are also available. Also, increasing the concentrations of these water chemistry parameters to improve biological productivity results in no deleterious effects on the biological ecosystem and can reduce the potential toxicity of certain metals listed in EPA's Aquatic Life Criteria.

<u>EPA Response:</u> See response to Comment 7.76.

7.88 3.4.3 "Nutrient" Parameters: Nitrogen and Phosphorus

3.4.3.1 Background for the Mine Site Area

The discussion above focused on the basic parameters that are necessary to support certain levels of primary productivity. However, having concentrations of these parameters at levels necessary to support robust levels of primary productivity in a stream may be an insufficient condition in and of itself. The second part of the primary production equation must include a consideration of the basic nutrients, particularly NO_3^-, N, and PO_4. Either nitrogen or phosphorus levels may limit primary production or they may be co-limiting (Stockner and Ashley 2003). Cederholm et al. (1999) displayed the food web pathways in which nutrients (defined as carbon (C), nitrogen (N), and Phosphorus (P)) are delivered from spawning anadromous fish through various pathways to support the biological productivity of the stream (Figure 3.23) [***figure deleted here for copyright reasons; see original public comment for figure***].

There is a substantial body of literature on the use of nutrient addition (primarily N and P, with some studies documenting C additions) to improve the biological productivity of lake and stream systems (Perrin et al. 1987; Raastad et al. 1993; Larkin and Slaney 1997; Wipfli et al. 1998; Cederholm et al. 1999; Stockner 2003). Canada has been the world leader in evaluating the effects on biological productivity of adding nutrients to lake and stream systems with Slaney et al. (2003); Stockner (2003); and Ward et al. (2003) providing concise summaries of several programs, while Quamme and Slaney (2003) evaluated varying concentrations of nutrients on stream insect abundance.

Two key factors determine whether or not nutrient(s) are limiting in a particular stream or location within a watershed. First is the existing absolute concentration of the nutrient(s) of interest during the growing season for the target organisms. The second is the ratio of N:P, which is critical in determining which parameter is limiting or whether both are co-limiting.

Slaney et al. (2003) characterized the nutrient concentrations in the Keogh River on northern Vancouver Island prior to nutrient enhancement as:

> "Nutrient concentrations in spring to summer are extremely low [emphasis added]:orthophosphorus, < 1 mg/L; total dissolved phosphorus, 5 mg/L; nitrate nitrogen, usually < 15 mg/L."

However, Koch and Hainline (1976) evaluated benthic macroinvertebrate populations at 11 stations along the Truckee River in California which drains Lake Tahoe, flows down the eastern slope of the Sierra Nevada mountains, through Reno, Nevada and terminates at Pyramid Lake in western Nevada. At those stations (6) upstream of a major population center (Reno) and not heavily influenced by groundwater containing large quantities of septic tank effluent, their data show annual average NO_3-N and PO_4 concentrations of about 0.3 and 0.02 mg/l, respectively. This approximately 90 km reach of stream is considered very productive and supports a robust trout population (Scoppettone and Bailey 1983).

Ashley and Stockner (2003) recommend concentrations of soluble reactive phosphorus (SRP = orthophosphate) in the 0.003-0.005 mg/l range, approximately ½ of the reported nuisance level in their paper. Bailey (1974) recommended PO_4 concentrations of < 0.01 mg/l as optimum for controlling algal growth, but did indicate that levels up to 0.07 mg/l could be acceptable in certain situations, particularly where nitrogen is limiting at this concentration of orthophosphate. Quamme and Slaney (2003) evaluated varying concentrations of total phosphorus up to 0.01 mg/l and found the greatest aquatic insect increase at this level. The concentrations in these three references are significantly less than those cited by Slaney et al. (2003).

Ashley and Stockner (2003) recommend concentrations of dissolved inorganic nitrogen [ammonium, NH_4^+ + nitrite, NO_2 + nitrate, NO_3; collectively DIN (dissolved inorganic nitrogen)] of 0.03-0.05 mg/l as a minimum target level to ensure a DIN to SRP ratio of 10:1 on an atomic weight basis. Bailey (1974) recommended NO_3 concentrations of < 0.10 mg/l to support appropriate biological productivity, but also realized the importance of maintaining the appropriate N:P ratio to prevent overstimulation of algae growth.

The characterization of Slaney et al. (2003) of nitrate concentrations of < 15 mg/l as extremely low should be reviewed in light of current knowledge. A critical factor when dealing with N:P concentrations in aquatic systems is identifying the limiting nutrient(s) and maintaining the appropriate ratio. Sterling and Ashley (2003), citing Borchardt (1996), state:

"Streams are considered N-limited when the N:P atomic weight ratio is less than 10:1, co-limited when N:P is between 10:1-20:1, and P limited when N:P is greater than 20:1.["]

EPA Response: **See response to Comment 7.76.**

7.89 Concentrations of nitrogen and/or phosphorus that are high relative to the needs of a desirable biological community can result in a number of changes in the aquatic habitat(s) or biological community that are deemed negative. The classic example is a discharge from a wastewater treatment plant that puts excessive amount of ammonia, nitrate, or orthophosphate into a receiving water. Excessive concentrations of these constituents result in direct mortality to fish (ammonia) or blooms of attached algae that alter stream habitats and may cause dissolved oxygen concentration sags during night time hours, resulting in fish kills (Lee and Hershey 2000). Having a stream choked with filamentous algae may force a shift from dominance by one fish species to another. In Fraser Lake, Alaska the Alaska Department of Fish and Game implemented a fertilization project to enhance overall lake productivity. While they determined that smolt production did increase, they also found that the primary phytoplankton response to increased nutrient levels was a species that was generally inedible by desirable zooplankton (Kyle 1994).

Three important lessons have been learned by the multitude of experiences in altering the nutrient chemistry of aquatic habitats:

- Detailed pre-project information on the biological species composition of the water body and completion of a low level nutrient analysis are essential to understanding the ecosystem proposed for alteration.
- An assessment of the spatial and temporal requirements needed to achieve the management objectives.
- A determination of the desired ratio of nitrogen to phosphorus desired in this water body.
- Maintaining the proper ratio is critical to achieving the biological response and preventing unwanted shifts in habitat quantity and quality. It is important to note that the concentrations which produce the desired level of primary productivity are orders of magnitude below any human health criteria (see Sterling and Ashley (2003) and Ashley and Stockner (2003) for detailed discussions.

In summary, there is clearly an abundance of evidence in the literature that demonstrates the linkage between these general water quality parameters/nutrients and aquatic production. Since these topics were not considered by EPA in the BBWA2, it seriously undermines that reports credibility, and especially its negative conclusion about the applicability of mitigation measures. By ignoring these demonstrably successful mitigation techniques, the credibility of the BBWA2 is scientifically diminished.

EPA Response: **See response to Comment 7.76.**

7.90 Section 7 Relevant Examples of Large, Successful Fish Habitat Mitigation Programs in the U.S.

EPA is undoubtedly aware of other major large scale fish habitat mitigation programs along the West Coast of North America. British Columbia has a well documented program of fish habitat improvements, spanning decades. The Fish and Wildlife Program of the Bonneville Power Administration has spent billions of dollars in mitigating hydropower development impacts to anadromous and resident fish in the Columbia River Basin. This program was initiated in the early 1980's. Of more recent vintage are the Central Valley Project Improvement Act and the CALFED Bay/Delta programs in the Central Valley of California. These programs have spent a few billion dollars on ecosystem restoration activities aimed at protecting and recovering anadromous and resident fish populations. These three programs are briefly discussed in more detail below.

7.1 Central Valley Project Improvement Act

The Central Valley Project Improvement Act (CVPIA) passed by Congress in 1992 added protection of fish and wildlife resources as a primary purpose of the Central Valley Project (CVP). The CVP was constructed in the 1930s by the federal government to provide a reliable agricultural water supply to farmers in the Central Valley of California. Three major dams dominate the infrastructure of the project. Shasta Dam, which is located at the northern end of the Sacramento River Valley, is a high dam without fish passage facilities and blocks anadromous fish access to hundreds of miles of habitat formerly used by three races of Pacific salmon and steelhead trout. Folsom Dam is located on the American River, near Sacramento and blocks salmon and steelhead trout access to many miles of former anadromous fish habitat. Friant Dam is located near the southern end of the San Joaquin River Valley and blocks anadromous fish access to former high elevation spring Chinook salmon habitat. In addition, the minimum flow releases from Friant were insufficient to maintain a wetted river channel for over 100 miles downstream of the dam. Construction of these dams and associated infrastructure resulted in major impact to anadromous fish resources in California's Central Valley.

In passing the CVPIA, Congress added fish and wildlife resource protection as a primary purpose of the project. Major provisions of the act included: a land retirement program which required marginal farmland from receiving project water, the dedication of 800,000 acre feet of project water yield being dedicated to fish and wildlife purposes, and an annual allocation of $50 million for ecosystem restoration actions. These restoration actions have included providing fish passage improvements, habitat restoration, creation of new habitat areas, providing cold water to lower water temperatures in downstream areas. This program has been highly successful and is continuing with a significant amount of restoration work still to be accomplished.

EPA Response: See response to Comment 7.76.

7.91 7.2 CALFED Bay/Delta Program

The CALFED Bay/Delta Program is a companion program to the CVPIA. This program is a joint state/federal effort to address four major issues in the Central Valley of California. The four major functions of the program are to:

- Improve flood protection in the Sacramento/San Joaquin River Delta through a levee rehabilitation program,

- Improve the water supply reliability to both agricultural and domestic water users. The State Water Project (SWP), which exports water from the Delta to Southern California, provides domestic water to approximately 20 million residents,
- Improve the domestic drinking water quality of that water exported through the SWP and,
- Restore the ecosystem of the Central Valley, to the extent practical, by mitigating for impacts caused by construction and operation of the SWP and CVP.

The program has gone through several administrative configurations since its inception in 1994. The program has developed a plan which addresses the four program areas and the voters of California have approved $3 billion in bonds to begin implementing the approved plan. Full cost of implementing the plan was estimated at $8 billion, but actual costs are expected to be much greater.

<u>EPA Response:</u> See response to Comment 7.76.

7.92 7.3 Bonneville Power Administration Fish and Wildlife Program

The Northwest Power Planning and Conservation Act of 1982 directed the Bonneville Power Administration (BPA) to increase the reliability of electrical power it marketed to Northwest customers and to mitigate the impacts of construction of the federally owned dams in the Columbia River system which produce hydroelectric power that BPA markets. The focus of the fish and wildlife program has been to provide fish passage improvements at a variety of project dams, implement a massive ecosystem restoration and habitat creation program covering four states, providing a major source of funding to support the region's hatchery mitigation programs, and providing funds to implement the variety of actions required under the biological opinion developed under the auspices of the Endangered Species Act for continued project operations.

As of 2010, BPA has expended $11 billion dollars through their fish and wildlife program. The annual budget for the program is currently $700 million encompassing some 750 individual projects. While some of the budget does fund research, the vast majority of the funding supports ecosystem restoration and management efforts. Also, while BPA's program is the largest in the region, other agencies such as the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation also contribute significant funding outside the fish and wildlife program.

Fish and wildlife agencies in the West have been successfully implementing these programs for decades and at a geographic scale and budget scope much greater than anything even contemplated for a project the size of EPA's mine development scenarios. There is technical knowledge and expertise to implement any mitigation program required for the project as described in the BBWA2. Restoration and mitigation programs like that needed for EPA's mine development scenarios are being carried out every day at other locations in the West.

<u>EPA Response:</u> See response to Comment 7.76.

7.93 2. External Peer Review of Wobus et al., 2012: "Potential Hydrologic and Water Quality Alteration from Large-scale Mining of the Pebble Deposit in Bristol Bay, Alaska"

<u>Peer Reviewers</u>

- Michael N. Gooseff, Ph.D. Pennsylvania State University
- Andrew M. Ireson, Ph.D., University of Saskatchewan
- Thomas Meixner, Ph.D., Associate Professor and Hydro-chemist, Department of Hydrology and Water Resources, University of Arizona
- John D. Stednick, Ph.D., Professor, Forest, Rangeland and Watershed Stewardship, Colorado State University

Summary

- Lack of data leading to uncertainty
- The authors make a number of assumptions that make their results subject to scrutiny
- Conclusions are weakly supported by evidence provided
- Questionable credibility of models used

Specific References

"The conclusions are weakly supported by the evidence provided." – Andrew M. Ireson (pg. 5) "Quantitative model results are not presented and some of the comments read like editorial opinions rather than reporting scientific results." – John D. Stednick (pg. 5)

"The oversimplification of the dynamics of copper is bothersome, especially coming from a consulting group known for its toxicology work." – John D. Stednick (pg. 11)

"'Without ongoing active management, these changes in streamflow and water quality would likely result in adverse effects on aquatic biota, ranging from reductions in habitat quantity and quality to acute or chronic toxicity to aquatic organisms.' This statement is from the Conclusion section (page 39). Presumably, this is a reference to salmonid habitat, but habitat was not included in the modelling effort. None of these observations are defended in the report and suggest a lack of objectivity. This lack of objectivity tempers the study results and leaves me questioning other results." – Thomas Meixner, (pg. 12)

EPA Response: We have removed references to Wobus et al. (2012) from the final assessment. This report was used only to support our analyses, and its removal has not changed the assessment's findings.

7.94 b) Woody and Higmall, 2011 – "Groundwater as Essential Salmon Habitat in Nushagak and Kvichak River Headwaters: Issues Relative to Mining"

Summary

- Conclusions are not well supported by the data collected
- Additional literature review and a much more extensive field effort would be required to more clearly and quantitatively define the relationships between groundwater and fish habitat in the proposed mine development area

Specific References

"With one exception, it does not arrive at any specific conclusions; it only says that, based on the available literature, there is potential for impacts. The exception is on page 11 regarding outcomes of the Prospect (the paragraph starting with "Multiple pathways" …). This paragraph makes some fairly specific predictions, as opposed to the rest of the paper, which is only discussing plausible relationships. The level of prediction here is beyond that of the rest of the paper, and, although plausible, seems to go beyond the conclusions possible from this general overview." – Dennis L. Scarnecchia (pg.15)

"Overall, the use of the fisheries literature appeared appropriate in terms of presenting possible concerns, but not necessarily specific outcomes. The third objective of the paper was to identify potential risks and it does that. With the one exception above, it qualifies its concerns appropriately with words such as "potential," "can," and "may," recognizing that more detailed studies are clearly needed. The paper is not very well organized and would have benefitted from more peer review." – Dennis L. Scarnecchia (pg.16)

"This report describes observations made during a one-day (March 11, 2011) survey of streams in the headwaters of the Nushagak and Kvichak Rivers in the Bristol Bay region, Alaska. This survey identified areas of open water on ice-covered streams as evidence of potential warmer groundwater upwelling and, in turn, potentially good fish (salmon) habitat." – William J. Wilson (pg.16)

"The conclusions in this report, however, are not supported by the information provided. This report strays from the purpose as outlined in the title to a series of hypothetical and often random statements about mining impacts, concluding that a specific development, the Pebble Prospect, has the potential to "significantly impact" fish without providing in this report data or information on the mine development plan, locations of specific mine facilities, mitigation measures to be employed, and many other unknowns." – William J. Wilson (pg.16)

"Although the conclusions on the Prospect are not listed in the conclusions section, some specific outcomes are listed here that are not fully defended based on more general content of the paper." – Dennis L. Scarnecchia (pg.17)

"The conclusions of the report are not well supported by the data collected during the field trip described in the report." – William J. Wilson (pg.18)

"This report was to have reported on this field effort, and then describe how the observations made during that field effort relate to evaluating issues relative to mining. While the report presents some water quality issues associated with mining that explore how groundwater may present opportunities for exchange of water from the mine area and streams that may harbor fish, it does so via a series of hypothetical statements about the proposed mine development without including a detailed development plan that describes how the ore body will be penetrated and extracted. It seems premature to make such statements in the conclusion of the report (page 11) without background information on the mine Development plan." – William J. Wilson (pg.18)

"The methodology for detecting groundwater presence represents a weakness in my opinion. The authors relied on visual assessments of open water during March 2011 to indicate groundwater presence." – Michael R. Donaldson (pg.19)

"As such, the methods used for assessing groundwater presence may not be very accurate depending on environmental conditions at the time of the study." – Michael R. Donaldson (pg.19)

"The figure provides a nice first step, but it appears as though more data are required in order to develop a more quantitative relationship between groundwater input and salmon habitat. Even though the data were not presented in a quantitative manner, this information is important and certainly provides evidence of groundwater input in spawning habitats. However, I think revised methods and additional data collection should be considered in order to arrive at a more accurate determination of groundwater upwellings throughout the region." – Michael R. Donaldson (pg.19)

"It is not a field study or a lab study, and not very methodological. The most critical methodology that is not analyzed in any detailed way is the assumed linkage between open water areas and presence of groundwater. The authors provide some evidence in support of this assertion in terms of air temperature data, and it is clearly plausible that there is a relationship between open water areas and presence of groundwater. However, open water as opposed to frozen over can also be associated with factors, such as river gradient and velocities." – Dennis L. Scarnecchia (pg.20)

"A notable weakness of the methodology is the very limited field study – one day." – William J. Wilson (pg.21)

"Of most concern is the unsupported conclusion of the report that is discussed above under 'General Impressions'." – William J. Wilson (pg.21)

"Overall, the science in the paper regarding salmon is used appropriately, but little specific field information is available to predict specific outcomes." – Dennis L. Scarnecchia (pg.24)

"Only a single field trip is described, and that effort was a single day in the field completing aerial surveys of over 175 miles (or more?). The study has limited application to impact assessment since it does not document actual fish presence in areas identified as open water and potential fish habitat." – William J. Wilson (pg.24)

"Overall, this study is interesting and relevant, but limited in scope and too general in nature to contribute to quantitative assessment of development impacts." – William J. Wilson (pg.24)

<u>EPA Response:</u> We acknowledge the limitations of this study and similar aerial surveys conducted by PLP contractors, but both are valuable sources used to illustrate the potential for groundwater-surface water interactions and controls on ice cover in area streams.

<u>Natural Resources Defense Council (Doc. #5436)</u>

7.95 The unavoidable impacts of three "perfectly performed" mine scenarios with no accidents, leaks or failures, in which 0.25, 2.0, and 6.5 billion tons of ore are extracted over the course of 20, 25, and 78 years, respectively, include:

- Loss of 24, 56, or 90 miles of streams, constituting 4%, 9%, and 14% of total stream length within the mine footprint;

- Loss of 5, 15, or 22 miles of documented anadromous waters (2%, 7%, and 11% of total anadromous fish stream length), known to support spawning and rearing habitat for coho, Chinook, and sockeye salmon and Dolly Varden;
- Loss of 11.5 to 42 miles of headwater streams supporting habitat for nonanadromous fish species;
- Altered groundwater-surface water hydrology between the main channel and off-channel habitats, which are critical to juvenile salmonids, nutrient processing, and export rates of resources and materials for aquatic ecosystems;
- Loss or substantial change of riparian floodplain wetland habitat;
- Streamflow reductions causing adverse effects on habitat in 9.3, 16, and 34 miles of streams;
- Erosion of population diversity essential to the stability of the overall Bristol Bay salmon fishery;
- Leakage sufficient to cause toxic levels of copper in 38 and 51 miles of stream under the Pebble 2.0 and 6.5 scenarios, respectively.

Because EPA evaluated only the components of a mine that have the potential to adversely affect aquatic resources regulated under the Clean Water Act, the cumulative footprint of a large-scale mine at the Pebble deposit would likely be much larger than the described scenarios. For example, by adding mining and processing facilities, drainage management structures, other storage and disposal facilities, and other operational infrastructure – as described in NDM's Wardrop Report – the footprint of Pebble 2.0 would increase from 9.7 to 36 square miles, the mine site would contain more than 12 miles of main roads (as well as numerous pit and access roads), and the net power generation would exceed by more than 100 times the current maximum electrical load of the largest population center in the Bristol Bay watershed. Clearly, even these "unavoidable" effects would alter Bristol Bay completely and irreparably. Yet, a mine without failures is simply not a realistic possibility. Failures "always happen in complex and long-lasting operations," EPA explains, "even if their magnitude is 'uncertain.'" [Atkins, et al. 2012] And once failures are incorporated into the analysis, long-term environmental damage could be "catastrophically damaging to fisheries." EPA's conclusions regarding impacts from failures of a tailings dam; product concentrate, return water, or diesel pipelines; roads and culverts; or water collection and treatment include:

- Loss of more than 18 miles of salmonid stream and associated wetlands for years to decades (a highly conservative estimate of what would more likely extend well over 90-185 miles in the Bristol Bay Watershed);
- Acute and chronic toxic exposure to fish and invertebrates;
- Impeded fish passage in 11 to 21 salmonid streams;
- Wastewater treatment plant releases ranging from short-term and innocuous to long-term and highly toxic to fish and invertebrates.

<u>EPA Response:</u> Comment noted; no change required.

<u>Wildlife Forever Fund (Doc. #4201)</u>

7.96 The EPA's assessment scales did not include the salmon's migration pattern into the ocean, and beyond, to where they are key members of complex upland ecosystems. It did not include the people outside the Bristol Bay region who rely on eating the wild salmon, which is more nutritious than farmed or hatchery salmon. It did not include the calculation of the loss to the world of this huge area of wetlands which absorbs and sequesters carbon better than dry land areas and which may well have other superior qualities and advantages for our inter-related ecosystems, as yet undiscovered.

<u>EPA Response:</u> These issues are outside the scope of this assessment, as described in Chapters 1 and 2.

<u>Kachemak Bay Conservation Society (Doc. #4284)</u>

7.97 KBCS believes that the loss of habitat around the hydrologic drawdown zones in the vicinity of each mine pit needs to be determined and the habitat effects on the numerous species of these areas should be quantified. What will be the specific impacts on the 29 fish species, 40 terrestrial and more than 190 avian species, both in and near the drawdown zones? What ecosystem connectivity will be lost or altered and how will that affect adjacent ecosystem functionality? KBCS believes the size, location and ecological affects in the mine areas is unacceptable. The sheer magnitude of the mining operation and associated infrastructure; electric generation and delivery operations, roads, bridges and gravel pits, fuel storage and use, housing for an estimated 1000 workers, administrative buildings, the port at Cook Inlet, over one hundred miles of piping, plus the mining and ore management will replace and destroy the existing ecological system. All physical, chemical, hydrologic, biological and wildlife components of the operations sites will be altered and likely impacted for thousands of years. KBCS believes these impacts can neither be fully reversed, post mining, nor contained during development and operation. KBCS believes the impacts of the Pebble mine operation to the upper Bristol Bay watershed is unacceptable. The proposed mine operations would use all of the water from the upper reaches of Talarik Creek and the Koktuli River. (See Ground Truth Trekking website; Pebble Mine: Copper, Gold Prospect). The downstream mining effects on the multiple fresh water and ocean subsistence, commercial and sport fisheries of the Bristol Bay region must be recognized and quantified. These ecological affects are unacceptable.

<u>EPA Response:</u> Impacts to endpoints other than those defined in Chapter 2 are outside the scope of this assessment.

<u>Kachemak Resource Institute (Doc. #9123)</u>

7.98 There is no way to calculate these harms; and if there were, there is no way known to mitigate for even the habitat lost or blocked by development in the footprint of large mines and their infrastructure. Mitigation for extensive destroyed or disturbed salmon habitat is untried, unsure, and unlikely to be successful with extant technology. And it would never be an alternative to natural habitat protection for achieving escapement goals and sustaining harvestable surpluses.

EPA Response: The challenges associated with proposed mitigation measures are now fully described in Appendix J.

American Fisheries Society (Doc. #3105)

7.99 The 1:100,000 NHD maps underestimate stream length and density in stream-rich regions such as sub-arctic Alaska (see Hughes et al. 2011. Strahler order versus stream size. Journal of the North American Benthological Society 30: 103-121).

The NWI maps underestimate wetland area in sub-arctic Alaska, where much of the terrain is wet when it is not frozen. Also, it is extremely difficult to estimate topographic watersheds in such areas, thereby confounding relationships between streams and the land uses affecting them (see Hughes, R.M., and J.M. Omernik. 1981. Use and misuse of the terms, watershed and stream order. Pages 320-326 in L.A. Krumholz, ed., The Warmwater Streams Symposium. Southern Division American Fisheries Society, Bethesda, MD).

EPA Response: Limitations of the NHD and NWI databases and underestimation of stream and wetland features are discussed in Box 7-1.

P. Walsh (Doc. #4398)

7.100 Secondly, I think your assessment of the mine footprint is too small. Indeed, there will be the most obvious effects in the vicinity of the mine itself, but the ecological effects of mining mishaps will extend further downstream than the assessment considers. The range of Pacific salmon, and all of its ecological connections, will feel the effect. Large scale mining here has global consequences. I find the indirect effects section to be similarly understated.

EPA Response: We believe that the mine size scenarios are reasonable. The possibility that effects of a tailings spill could extend all the way to Bristol Bay is considered in Chapter 9 of the assessment. The assessment provides our best estimate of potential downstream affects, but as described in the uncertainty analysis, questions remain.

The Wilderness Society (Doc. #5486)

7.101 The information presented in the Assessment is a reasonable overview of the biological, hydrological and geologic resources in the Bristol Bay Region. Not everything can be known that is needed to understand the current and future status of salmon and their habitat, and the assessment likely represents the best available science given the immense scope of characterizing a watershed. The mining scenarios also appear to be reasonable, although uncertainty in future development makes it impossible to know the exact footprint of mines and associated infrastructure. Refusal of industry to share data they have collected or developed and which is needed to characterize both the natural environment and proposed mining projects makes it difficult if not impossible to assess resource development projects in a way that can bring consensus about reasonable impacts. Further, lack of expertise among permitting agencies and the public makes it impossible to fully assess the quality and integrity of mining plans without expert, unbiased peer review. But in the end, science often plays a small role in decision-making.

EPA Response: Comment noted; no change required.

J. M. Robbins (Doc. #4199)

7.102 Third, we already know that tracing the reach of the groundwater affected by the Pebble mine is unknown. In fact, most of the science in this report is based on assumptions in which event the writers placed little confidence. To quote a few examples: (…)

p. 7-33. 7.3 … Streamflow alterations resulting from mine operations were estimated

p. 7-48 7.3.1.4 … This period is projected to last from about 20 years for the Pebble 0.25 scenario to about 300 years for the Pebble …

p. 7-50. 7.3.2.1 … Given the high likelihood of complex groundwater–surface water connectivity in the deposit area, predicting and regulating flows to maintain key ecosystem functions associated with groundwater– surface water exchange would be particularly challenging.

… assuming that groundwater sources and flowpaths are not also altered by the mine footprint. This assumption is questionable…

p. 7-51. 7.3.2.3. There is limited information describing potential surface water – groundwater interaction in the mine scenario watersheds…

(…) Therefore, the report is incomplete as it lacks information relevant to reasonably foresee significant adverse impacts on the human environment: i.e., water. 42 CFR 1502.22. Seepage of toxic and hazardous substances from this mine development is mentioned numerous times in the EIS. How much seepage and of what hazardous/toxic material is ill-defined. This commenter suggests that none is the appropriate amount. The environmental consequence of altering, depleting, polluting and using water is inadequately addressed in the statement.

EPA Response: Uncertainties are described in Sections 7.2.5 and 7.3.4. Chemical contamination is considered in Chapter 8.

7.103 First, the document mentions a 2006 water appropriation permit submitted by Northern Dynasty. (On information and belief, that permit was one of two that were submitted.) That permit seeks to appropriate the entire watershed for the upper Talarik River estimated at 29 cfs or 18,792,000 gallons a day. This is just surface water in streams.[15] The EIS calculated drawdown of ground water flowing into the mine pit at rates of at least 16,830 gpm or 24,235,200 gallons a day (Box 6.2, EIS[6]). What is the effect of this type of water use on the existing aquifer or aquifers intersected by the pit? Will it be permanently impaired or destroyed? Will land overlying the aquifer(s) be subject to subsidence and to what extent? How will the aquifer(s) that extend beyond the alleged limits of the cone of depression be affected by this perpetual drawdown of this volume of groundwater from this portion of its system?

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[5] Streams are watered in part from groundwater as well as surface runoff, so technically the appropriation permit impacted groundwater as well.

[6] According the EIS the analysis results were based on an assumption that the drawdown was only 100 m but that the results (quoted above) were not very sensitive to this assumption. The writer herein assumed that the assumption therefore is unreliable and that the figures would likely be substantially higher.

Importantly, what is the cost to the people of the United States, not to mention Alaska, of the loss of this volume of fresh water for a resource that is removed from this country? Is the environmental, social and health cost greater to the American public than the economic gain to foreign corporations such Anglo American and Northern Dynasty?

EPA Response: We were unable to quantitatively characterize effects on groundwater-surface water interactions, which is acknowledged in the assessment.

Alaska State Legislature – Representative A. Josephson (Doc. #5320)

7.104 I urge the state, and if not the state, then our federal government, to listen to the citizens of Bristol Bay and to science. The law, which our Governor should know he is not allowed to violate, includes Clean Water Act Section 404(c) which requires the protection of salmon, wild trout, wildlife, and jobs in Bristol Bay.

For context, former Governor Frank Murkowski relaxed our previously strict clean water standards, and this coming year state legislation to allow an unjustifiable amount of water to be taken out of wild salmon and trout streams, House Bill 77, is poised to pass the Alaska State Legislature. It passed the Alaska House in March, 2013, and is one committee away from a Senate Floor vote when the Legislature reconvenes in January, 2014. The bill will allow damage to fisheries like those at Bristol Bay and favors projects like Pebble. The Administration opposed amendments I and others filed, that failed, and that would have required that water not be taken out of fishing streams in amounts that damage fish habitat and survival. Instead, the Commissioner of the Alaska Department of Natural Resources is left with the discretion to remove damaging amounts of water. This kind of history and policy-making illustrates the State of Alaska's unwillingness to protect its salmon streams and related watersheds.

Under Pebble's plans up to 6.84 billion gallons of surface water and 4.7 billion gallons of ground water will be taken out of the Upper Talarik Creek drainage. At least 12.03 billion gallons of surface water and 2.8 billion gallons of ground water will be removed from the South Fork of the Koktuli River, and at least 8.02 billion gallons of surface water and 0.2 billion gallons of ground water will be removed from the North Fork of the Koktuli River. That is a total of 35 billion gallons. Under the plan a dam to hold back tons of toxic sludge is also planned. At some point, whether in ten years or one-hundred, that dam wall will likely start to breach, seeping toxins into this watershed.

EPA Response: The tailings dam failure analysis (Chapter 9) and seepage analysis (Chapter 8) characterize these risks.

7.105 I hope you will first give the Governor a chance to do the right thing and honor Alaska's formerly responsible mining history, and stop this above ground project as proposed. If the Governor fails, then the EPA will have to do his work, under federal law, and protect the citizens of the state of Alaska by using Clean Water Act section 404(c) to do what our Governor should have done years ago.

For context, Governor Parnell has changed this state's formerly responsible mining history by allowing a coal mine to move forward in the permitting process which would remove eleven miles of Middle Creek, a major tributary of the Chuitna River, a stream identified by the Alaska Department of Fish and Game as “significant to salmon” (In late February, 2013 a superior court judge in a lengthy opinion, found the Alaska Department of Natural Resources failed to honor and protect existing water rights property interests of fishermen in the Chuitna drainage:: further evidence that the administration refuses to protect salmon habitat). Restoration attempts would not happen for thirty years, but regardless you cannot reconstruct a wild salmon stream. Naturally, the local village of Tyonek overwhelmingly opposes this project. The Governor has had the opportunity to send the Canadian company’s plan for coal export back to the drawing board, but has not acted. We have a Governor who is willing to trade a fisheries resource for mining by foreign companies that damage our fisheries resources.

EPA Response: Comment noted; no change required.

Alaska State Legislature – Representative L. Gara (Doc. #5618)

7.106 I urge the state, and if not the state, then our government, to listen to the citizens of Bristol Bay and to science. The law, which our Governor should know he is not allowed to violate, includes Clean Water Act section 404(c) which requires the protection of salmon, wild trout, wildlife, and jobs in Bristol Bay.

For context, former Governor Frank Murkowski relaxed our previously strict clean water standards, and this coming year state legislation to allow an unjustifiable amount of water to be taken out of wild salmon and trout streams, House Bill 77, is poised to pass the Alaska State Legislature. It passed the Alaska House in March, 2013, and is one committee away from a Senate Floor vote when the Legislature reconvenes in January. The bill will allow damage to fisheries like those at Bristol Bay and favors projects like Pebble. The Administration opposed amendments I and others filed, that failed, and that would have required that water not be taken out of fishing streams in amounts that damage fish habitat and survival. Instead, the Commissioner of the Alaska Department of Natural Resources is left with the discretion to take out damaging amounts of water.

Under Pebble’s plans up to 6.84 billion gallons of surface water and 4.7 billion gallons of ground water will be taken out of the Upper Talarik Creek drainage. At least 12.03 billion gallons of surface water and 2.8 billion gallons of ground water will be removed from the South Fork of the Koktuli River, and at least 8.02 billion gallons of surface water and 0.2 billion gallons of ground water will be removed from the North Fork of the Koktuli River. That is a total of 35 billion gallons. Under the plan a dam to hold back tons of toxic sludge is also planned. At some point, whether in ten years or one hundred, that dam wall likely will start to breach, seeping toxins into this watershed.

EPA Response: See response to Comment 7.104.

7.107 I hope you will first give the Governor a chance to do the right thing and honor Alaska’s formerly responsible mining history, and stop this above ground project as proposed. If the Governor fails, then the EPA will have to do his work, under federal law, and protect the citizens of the state of Alaska by using Clean Water Act section 404(c) to do what our Governor should have done years ago.

For context, Governor Parnell has changed this state's formerly responsible mining history by allowing a coal mine to move forward in the permitting process which would remove eleven miles of Middle Creek, a major tributary of the Chuitna River, a stream identified by the Alaska Department of Fish and Game as "significant to salmon". Restoration attempts would not happen for thirty years, but regardless you cannot reconstruct a wild salmon stream. Naturally, the local village of Tyonek overwhelmingly opposes this project. The Governor has had the opportunity to send the Canadian company's plan for coal export back.

EPA Response: Comment noted; no change required.

Society for Freshwater Science (Doc. #5375)

7.108 In addition, although the Assessment does discuss the decreases in water quality, destruction of wetlands, dewatering of streams, alteration of stream flows, and increasing sedimentation likely to be caused by the development, it does not describe the potential ecological implications of these impacts. Changes in flow, increases in sedimentation, and wetland losses, likely will reduce the ability of the affected aquatic ecosystems to store and export carbon, resulting in carbon losses into the atmosphere. Altering water quality, flow, and sediment also will decrease overall aquatic biodiversity, potentially resulting in decreased ecosystem stability and resilience. These cumulative impacts likely will exacerbate changes to the affected ecosystems that are already expected due to climate change. The ability of these systems to support biodiversity and provide valuable ecosystem services will be severely compromised by this proposed development.

EPA Response: Cumulative impacts are discussed in Chapter 13, but scope is limited to endpoints specified in the assessment.

Stratus Consulting (Doc. #5433)

7.109 Previous comment, 2012 Watershed Assessment: "The final Watershed Assessment should describe in more detail how changes to seasonal or daily flows may be more significant than the changes in annual averages that are currently described."

2013 Revised Watershed Assessment: As in the previous version of the Watershed Assessment, EPA characterizes hydrologic impacts of mining using a relatively straightforward conceptual model of the system, in which flow reductions are proportional to the fraction of upstream area covered by mine infrastructure. EPA acknowledges in this draft that this approach provides only general estimates of streamflow reductions: "We were unable to anticipate changes to the streamflow regime beyond simplistic alterations in flow magnitude, yet it is very likely that other aspects of the flow regime would be modified as well, depending on how flows respond to water management at the mine site" (pp. 7–58). Given reasonable assumptions about potential locations of future mine facilities and water management strategies, EPA has used an acceptable approach to estimating the general hydrologic impacts of mining. However, until a water management plan becomes available, EPA cannot estimate more extreme changes in flows that might occur during different seasons throughout the year. If a more quantitative assessment of changes in streamflows is needed after proposed mine water management plans become available, EPA may need to develop a more detailed modeling approach than they have conducted to date.

Previous comment, 2012 Watershed Assessment: "[A] large-scale mine at the Pebble deposit would substantially alter the relative contributions of groundwater and surface water entering streams at different locations during different times of the year. Because the resulting changes in thermal regime could be an extremely important impact of the mine on salmonids, EPA should more fully explore ways to quantify these impacts."

2013 Revised Watershed Assessment: EPA acknowledges throughout the revised Watershed Assessment the importance of groundwater – surface water connectivity to factors such as stream temperature, and provides substantially more discussion of this topic than in the previous draft. This discussion acknowledges that mine-induced changes in groundwater flows could exacerbate impacts to aquatic habitat by changing the seasonal distribution of stream temperatures. However, because there is no water management plan available, EPA is still unable to quantify the impacts of this interconnectivity for the mine impact scenarios: "Projecting specific mining-associated changes to groundwater and surface water interactions and corresponding effects on surface water temperature in the mine area is not feasible at this time" (pp. 7–57).

<u>EPA Response:</u> These remain important uncertainties, and are detailed in Chapter 7.

<u>National Mining Association (Doc. #5557)</u>

7.110 Not only do the comments of the peer reviewers therefore call into question the use of the Earthworks report itself, they also underscore the pervasive point that an accurate assessment of the potential impacts of mining near Bristol Bay must be undertaken after a realistic and specific mine plan that has been developed by qualified mining engineers and experts is complete. As one peer reviewer put it, "while it is appropriate to consider potential environmental issues and problems associated with mining when making a decision with respect to Bristol Bay, such decisions should be made based on the site-specific conditions, along with appropriate risk management analysis." [<u>Footnote</u>: Findings of Robert Kleinmann, *id*. at 20.] That reviewer explained that "actual environmental impacts are dictated by many factors that, in addition to climate and distance to down-gradient streams, rivers, and wetlands and groundwater, include site-specific geology, mitigation measures, pollution abatement strategies, monitoring requirements, degree of corporate and regulatory oversight, etc." [<u>Footnote</u>: *Id*. at 24.] EPA should therefore wait to conduct its review of any proposed mining operations near Bristol Bay until a CWA permitting process has been initiated and all relevant information can be accurately assessed.

<u>EPA Response:</u> The assessment used site-specific data provided by the PLP's Environmental Baseline Document and the site-specific preliminary mine plan provided by Northern Dynasty Minerals in Ghaffari et al. (2011). The reviewer cited had reviewed the Earthworks document, not the assessment.

Chapter 8: Water Collection, Treatment, and Discharge

<u>G. Y. Parker (Doc. #5615)</u>

8.1 "Non-acid generating" waste rock - Recommended Mitigation: Because non-acid-generating waste rock is what is left when acid-generating waste rock is separated out, the result is that inevitably some “non-acid generating” waste rock, as noted in the assessment and the Waldrop report, will contain some acid-generating material. To mitigate, a liner and other protections will probably be necessary for the storage of the so-called “non-acid-generating” waste rock.

Recommended Restriction for a § 404(c) Determination: All waste rock dumps must be lined and have redundant water collection systems to ensure backup for collecting seepage to groundwater and runoff.

<u>EPA Response:</u> Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions. However, lining of the waste rock piles was not proposed by Ghaffari et al. (2011) and is not included in our scenarios. It is certainly possible to design and construct additional mitigation measures to reduce the likelihood or severity of potential adverse effects.

8.2 Recommended Mitigation: Process “potentially acid-generating” waste rock with ore so that none is stored on the surface for long term, as proposed in the assessment. Potentially acid generating waste rock should be stored on a liner with redundant water collection systems while awaiting processing.

Recommended Restriction for a § 404(c) Determination: No long term storage of potentially acid-generating waste rock on site. The definition of long term should be based on the estimated time for acid generation from waste rock and the site and, given the uncertainty of methods used for predicting acid generation, should include a significantly protective margin of error.

<u>EPA Response:</u> Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.

8.3 Tailings -- Recommended Mitigation: liner with redundant water collection systems under tailings, water collection system down valley. Absent a liner, leachate would eventually flow through cracks in underlying bedrock and emerge at unknown locations. Pyritic tailings would eventually produce acid unless water was retained in the TSF, which will not be possible in perpetuity.

Recommended Restriction for a § 404(c) Determination: No storage of pyritic tailings, however, staging for shipping off site allowed.

<u>EPA Response:</u> See response to Comment 8.2.

8.4 Waste water treatment failures.

Recommended Mitigation: (1) Redundant water treatment systems; (2) Shut the beneficiation mill and other sources of effluent down in the event of a bypass; and direct bypass; and direct bypass to storage of sufficient capacity to store all bypass effluent in the system; (3) Best available technology.

Recommended Restriction for a § 404(c) Determination: Prohibition on mixing zones in anadromous waters.

<u>EPA Response:</u> See response to Comment 8.2.

8.5 Perpetual Care. Recommended Prohibition: As noted in the assessment, perpetual care has not been proven reliable, and given the limited lifetimes of human institutions, continued monitoring and maintenance after closure of a metallic sulfide mine to control acid mine drainage and other contamination become increasingly unlikely as time from closure increases. However, the Because of their importance for salmon, other fish and wildlife and public uses of fish and game, the Kvichak and Nushagak drainages, with substantial wetlands, are not the place to experiment with perpetual water treatment. Therefore, a § 404(c) determination should include an express prohibition of discharges that result in the need for perpetual water treatment. Perpetual treatment should be defined as open ended, where demonstrated and routinely used methods cannot predict the end of the need for treatment. Also, as noted above, perpetual care and maintenance would be needed for any artificial enhancements of aquatic systems for fishery productivity and should be included in a ban on facilities requiring perpetual care because they would be contrary to the requirement that compensatory mitigation be self-sustaining.

EPA Response: See response to Comment 8.2.

Bristol Bay Native Corporation (Doc. #5438)

8.6 *Impacts from Routine Operations*. In response to peer review requests that the watershed assessment include not only catastrophic wastewater pollution events, but also day-to-day routine contamination stressors, the Revised Assessment now contains an improved analysis of routine operation impacts, including leachate/leaks of toxins from wastewater containment facilities and nonpoint runoff sources, wastewater treatment plant failures, road culvert failures, and truck accidents. In so doing, the Revised Assessment adopts a more realistic discussion of waste rock leachate through a routine operations scenario rather than the unrealistic “no failure” scenario utilized in the Draft Assessment. [Footnote: Compare Draft Assessment, at ES-14 (discussing the failure/no failure dichotomy, with “no failure” defined as the default day-to-day mode of operation) with Revised Assessment, at ES-15 (discussing routine operations outside of a failure/no failure dichotomy with the routine operations including assessment of leaching/leakage of wastewater containment facilities, wastewater treatment plant failures, culvert failures, and truck accidents)].

This is a significant improvement to analysis of leachate escapement and is a useful starting point to analyze wastewater capture and treatment requirements. Indeed, as EPA’s revised analysis shows, even routine large-scale mining operations with wastewater collection and treatment cannot operate without degrading water quality and causing direct negative impacts on salmonids downstream. [Footnote: See Revised Assessment, at ES-15 (explaining that leachate from routine operations, particularly copper concentrations, would “be sufficient to cause direct effects on salmonids” in up to 35 miles of streams and beyond the mine footprint in the 6.5 billion ton scenario).]

EPA Response: Comment noted; no change required.

8.7 *Wastewater Capture*. The Revised Assessment better utilizes advanced modeling to detail wastewater capture and treatment under routine operation scenarios. As noted by the peer reviewers, EPA’s analysis in the Draft Assessment was cursory, and its calculations failed to include catchment and treatment of acid rock leachate. In the Revised Assessment, EPA greatly improved its analysis of this ongoing water quality threat by modeling capture of leachate from cone-of-depression wells as described in the Wardrop Report.

Utilizing this modeling, EPA concludes that "greater than 99% capture efficiency would be required to prevent exceedance of the copper criteria for the South Fork Koktuli River under the Pebble 6.5 scenario." Without this capture efficiency, negative effects on aquatic life beyond the mine footprint would occur, including fish aversion and avoidance on up to 35 miles of streams, "rapidly induced death of many or all fish" in up to 7.5 miles of streams, and death or reduced reproduction of the primary juvenile salmon food source (aquatic invertebrates) for up to 51 miles of streams. Importantly, EPA notes that a 99% capture efficiency would "require technologies beyond those specified in …the most recent preliminary mine plan." Indeed, the Revised Assessment assumes a leachate capture efficiency of only 50%. These modeling results are, yet again, conservative because the Revised Assessment uses average projected leachate concentrations and continues to use narrow assumptions to assess the risks and feasibility of treating massive seasonal flows and volumes of wastewater.

Despite these conservative assumptions, the Revised Assessment properly concludes that even long-term, non-catastrophic wastewater capture utilizing the best mining technology cannot avoid negative impacts to aquatic habitat.

<u>EPA Response:</u> Comment noted; no change required.

8.8 *Topic*: Wastewater Treatment

BBNC's 2012 Comments and Technical Submissions: Wastewater Treatment and the 'No Failure' Scenario: "The Draft Assessment does not squarely address the challenges of constructing and operating a modern day mine that could possibly meet the 'no failure' scenario with respect to wastewater treatment."

BBNC submitted detailed technical comments by William M. Riley, detailing various shortcomings with EPA's "No Failure" scenario as a means of assessing impacts with respect to wastewater treatment and reclamation. (BBNC Comments Part I, Attch. D)

Revised Bristol Bay Watershed Assessment: The Revised Assessment now focuses on the day-to-day routine impacts of toxic leachate from wastewater containment facilities and nonpoint runoff sources. (Revised Assessment, at ES-15)

BBNC's Response to the Revised Bristol Bay Watershed Assessment: The Revised Assessment adopts a more realistic discussion of waste rock leachate through a routine operations scenario rather than the unrealistic "no failure" scenario utilized in the Draft Assessment. BBNC welcomes this improved analysis of the day-to-day routine impacts of large-scale metallic mining on water quality and the resulting direct negative impacts on downstream salmonids.

The Revised Assessment properly concludes that long-term, non-catastrophic wastewater capture attempts utilizing even the best mining technology cannot avoid negative impacts to aquatic habitat.

<u>EPA Response:</u> Comment noted; no change required.

8.9 *Topic*: Wastewater Treatment

BBNC's 2012 Comments and Technical Submissions: Wastewater Treatment and Seasonal Fluctuations: "[T]he water balance significantly underestimates the volume of contaminated wastewater that would require treatment during operation and post-closure, as it does not account for extreme events such as peak storm runoff… [T]he Draft Assessment does not adequately address the fact that the enormous amounts of wastewater could be discharged only during the five months of the year when receiving waters are not frozen, greatly increasing the magnitude of the water management challenge." (BBNC Part I Comments, at 3-4)

Revised Bristol Bay Watershed Assessment: The Revised Assessment continues to include more limited assumptions of seasonal flow variations, such as assessing how large snowmelt flows would impact wastewater treatment facilities and increase nonpoint source runoff. (Revised Assessment, at 8-4, routine operation wastewater volume calculated on a yearly, non-seasonal basis)

BBNC's Response to the Revised Bristol Bay Watershed Assessment: Despite these conservative assumptions used to calculate required wastewater capture efficiency, the Revised Assessment properly concludes that even long-term, non-catastrophic wastewater capture utilizing the best mining technology cannot avoid negative impacts to aquatic habitat.

<u>EPA Response:</u> Comment noted; no change required.

8.10 *Topic*: Wastewater Treatment (cont.)

BBNC's 2012 Comments and Technical Submissions: Tailings Leachate: "The Draft Assessment does not address the porous nature of the surficial deposits and fractured bedrock in the project area as well as other information that places in serious doubt the ability of a conventional, unlined tailings impoundment to capture toxic tailings leachate before it enters the local groundwater system." (BBNC Part I Comments, at 3)

Revised Bristol Bay Watershed Assessment: The Revised Assessment better utilizes advanced modeling to detail wastewater capture, treatment, and leachate potential under routine operation scenarios. By utilizing modeling to assess these parameters, the Revised Assessment adopts a more realistic discussion of waste rock leachate through a routine operations scenario rather than the unrealistic "no failure" scenario utilized in the Draft Assessment.

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC welcomes EPA's approach to assessing tailings leachate contamination and points out that, as EPA's revised analysis shows, even routine large-scale mining operations with wastewater collection and treatment cannot operate without degrading water quality and causing direct negative impacts on salmonids downstream.

<u>EPA Response:</u> Comment noted; no change required.

8.11 *Topic*: Wastewater Treatment (cont.)

BBNC's 2012 Comments and Technical Submissions: Water Quality Criteria: "In addition to the unprecedented quantity of contaminated water that would require treatment (over 130 million gallons per day), State of Alaska water quality criteria (WQC) would have to be met end-of-pipe without the benefit of dilution (all other Alaska hardrock mines rely on dilution to meet WQC).” (BBNC Part I Comments, at 3-4)

Revised Bristol Bay Watershed Assessment: The Revised Assessment contains considerable more attention to leachate contamination and the impacts of this on water quality. Utilizing modeling, EPA concludes that “greater than 99% capture efficiency would be required to prevent exceedance of the copper criteria for the South Fork Koktuli River under the Pebble 6.5 scenario.” (Revised Assessment, at ES-15)

BBNC’s Response to the Revised Bristol Bay Watershed Assessment: BBNC thanks the EPA for this additional analysis and would like to point out the Revised Assessment’s conclusion that even long-term, non-catastrophic wastewater capture utilizing the best mining technology cannot avoid negative impacts to aquatic habitat.

EPA Response: Comment noted; no change required.

8.12 *Topic*: Wastewater Treatment (cont.)

BBNC’s 2012 Comments and Technical Submissions: BBNC Recommendation: “We recommend that in the Final Assessment EPA at a minimum acknowledge that the result of this approach is an understatement of both the water management challenge and the potential for water management failures associated with its hypothetical mine scenario.” (BBNC Part I Comments, at 4)

Revised Bristol Bay Watershed Assessment: The Revised Assessment largely removes the failure/no failure dichotomy and adopts an approach to modeling wastewater contamination that better shows the challenges of water management and the potential for non-catastrophic failures.

BBNC’s Response to the Revised Bristol Bay Watershed Assessment: BBNC thanks the EPA for its updated approach to its analysis of wastewater treatment and management. This strengthens the conclusion that even the best wastewater capture technology will not prevent exceeding the copper criteria for the South Fork Koktuli River under the Pebble 6.5 scenario.

EPA Response: Comment noted; no change required.

8.13 In the peer review report, multiple experts questioned the acceptability and practicality of development and operation of a mine that will require perpetual treatment after closure. Specifically, the peer reviewers rightfully questioned the practicality of monitoring and managing waste rock and tailing storage facilities for tens of thousands of years. In response, the Revised Assessment addresses perpetual treatment and monitoring as it relates to: the tailings facility (including dams), the structural integrity of all mine infrastructure, perpetual wastewater collection and treatment systems, and overall uncertainties associated with long-term mine waste management. Indeed, the Revised Assessment’s discussion of the uncertainties associated with perpetual treatment admits “[t]he response of the current technology in the construction of tailings dams is untested and unknown in the face of centuries of extreme events …” Further, the Revised Assessment concludes that “[e]ven if the mining and mitigation practices described in the mine scenarios were performed perfectly, an operation of this size would inevitably destroy or degrade habitat of salmonids.”

BBNC agrees with EPA's characterization that perpetual treatment of mining wastes is untested and not worth the risk to such sensitive waters and fishery resources.

<u>EPA Response:</u> Comment noted; no change required.

8.14 *Topic*: Post-Closure Reclamation

BBNC's 2012 Comments and Technical Submissions: Long-Term "No Failure" Scenario: "The Draft Assessment does not squarely address the challenges of constructing and operating a modern day mine that could actually meet the 'no failure' scenario with respect to reclamation. Post-closure, aquatic habitats would have to be recreated on an unprecedented scale and waters within the reclamation area would have to meet water quality standards." (BBNC Part I Comments, at 4)

Revised Bristol Bay Watershed Assessment: The Revised Assessment largely removes the failure/no failure dichotomy.

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC would like to point out that the Revised Assessment's treatment of uncertainties associated with perpetual treatment admits "[t]he response of the current technology in the construction of tailings dams is untested and unknown in the face of centuries of extreme events …" BBNC agrees with EPA's characterization that perpetual treatment of large-scale metallic hardrock mining is untested and not worth the risk.

<u>EPA Response:</u> Comment noted; no change required.

8.15 A better discussion of fish habitat degradation from routine mining activities, including an improved analysis of both the direct and indirect effects on salmonids from copper leachate. For instance, under the 6.5 billion ton scenario leaching during standard operation will directly impact salmonids in up to 35 miles of streams beyond the mine footprint and will indirectly impact up to 51 miles of streams beyond the mine footprint.

<u>EPA Response:</u> Comment noted; no change required.

<u>Northern Dynasty Minerals Ltd. (Doc. #3650)</u>

8.16 4. Seepage Rates would Never be Permitted: The 2013 draft BBWA assumes the seepage collection and pump-back system surrounding Pebble waste rock sites will only capture 50% of the water that contacts waste rock outside of the mine pit drawdown zone, with the balance being released to groundwater. Any design that achieves only 50% capture of seepage could not be permitted in Alaska or the United States if it was shown that such a practice would allow water that exceeds water quality standards to enter the environment. (…) Engineering solutions certainly exist to achieve significantly greater than 50% seepage recovery at Pebble, including low permeability cutoff walls, groundwater extraction wells, and groundwater monitoring wells, particularly given local bedrock conditions and its location in the upper reaches of several watersheds. These engineering controls can be designed to achieve near full capture of groundwater within a target zone, and can be made more robust in areas where monitoring indicates that capture efficiency is not sufficient.

<u>EPA Response:</u> This point is made in Section 8.2.4 of the assessment, which begins: "The high metal concentrations in the South Fork Koktuli River due to PAG waste rock

leachate suggests that mitigation measures should be considered beyond those described in this scenario or the Northern Dynasty mining case (Ghaffari et al. 2011)." The assessment assumptions are based on the plan in Ghaffari et al. (2011) and our judgment of its likely efficiency. Complete capture of groundwater flows with wells in soils similar to the thick, highly permeable sand and gravel overburden at the site would require closely spaced wells and high pumping rates and would often result in losses between the wells. Ghaffari et al. (2011) show seepage cutoff walls around approximately 15% of the mine pit and waste rock pile perimeter. The assessment provides sufficient detail to allow the reader to assess the sensitivity of the results to different amounts of uncontrolled leachate.

8.17 2.7 Escape of Leachate from Waste Rock Piles is Overpredicted

The 2013 Assessment includes a new analysis of leachate generation from waste rock piles that was not discussed in the 2012 report, presented as follows:

> "The mine scenarios (and the plan put forth for Northern Dynasty Minerals in Ghaffari et al. 2011) do not include liners for the waste rock piles. Instead, leachate within the pit's drawdown zone would be captured and pumped to the WWTP. Outside the drawdown zone, half the leachate would be captured by extraction wells or other means and the rest would flow to surface waters. This is considered reasonable given the likelihood that water would flow between wells and below their zones of interception in the relatively permeable overburden materials and upper bedrock. Wells would not catch all flows from the mine site given its geological complexity and the permeability of surficial layers. As a result, 84% of PAG leachate and 82% of total waste rock leachate would be captured by the pit and the wells for the Pebble 2.0 mine." (Pg. 8-12)

The statement that half (50%) of the leachate from waste rock outside of the leachate zone will escape and flow to surface waters is unsubstantiated. While the 2013 Assessment references the Wardrop (2011) (i.e., Ghaffari et al., 2011) report, it fails to include the discussion in the report where it is stated that a low permeability cutoff wall will be installed around the waste rock piles and extraction wells will be installed within the cutoff wall to capture water and leachate infiltrating below the waste rock piles. This system can be optimized by adding wells, increasing pumping rates, and/or installing cutoff walls deeper in order to achieve significantly more than 50% capture. In tandem with proper management of potentially acid generating (PAG) waste rock to maximize its placement within the drawdown zone, the capture of PAG waste rock leachate can be close to 100%.

<u>EPA Response:</u> This comment is consistent with statements in Section 8.2.4 that additional mitigation would be required.

8.18 Geosyntec Section: 3.1

2012 Geosyntec Comment: A review of the water collection and treatment system failures in the 2012 Assessment show how both the language and the evaluations associated with the assessment are often misleading, and generally exaggerate the impacts of system failures, as well as the likelihood of potential failures.

The first inadequacy is the lack of a clear definition of what constitutes a "failure" of the water collection and treatment system. The examples and language used throughout the document suggest that the temporary loss of a system component is considered a “failure” and the report presents such a failure as a virtual certainty. The report overlook the fact that failure of a minor system or component (e.g., a mechanical pump breakdown or an electrical instrumentation failure) can be quickly and relatively routinely addressed, and is thus unlikely to cause a release of hazardous substances or result in any material environmental impact. Also, no distinction is made between a minor release that causes no environmental impacts outside of the site boundaries and a major release that could result in potentially environmentally significant impacts beyond the site.

How 2013 Assessment Responds to Comment: The 2013 Assessment reorganizes the work relating to water collection and treatment, although no clear definition of “failure” is provided in the revised report.

8-1 “In addition, we evaluate a WWTP failure scenario, in which the system releases untreated wastewater. This failure represents one potential failure among many accidents and failures that could occur.”

8-19 “There are innumerable ways in which wastewater treatment could fail under the mine scenarios in terms of failure type (e.g., breakdown of treatment equipment, ineffective leachate collection, wastewater pipeline failure), location, duration, and magnitude (e.g., partial vs. no treatment). Box 8-1 presents an example wastewater collection failure, and mechanisms of treatment failure are discussed in Box 8-2. To bound the range of reasonable possibilities, we assess a serious failure in which the WWTP allows untreated water to discharge directly to streams. This type of failure could result from a lack of storage or treatment capacity or treatment efficacy problems. Chronic releases would occur during operation if a lengthy process were required to repair a failure. We evaluate potential effects of this type of failure using the following assumptions.”

Discussion on Adequacy of 2013 Response: As with the 2012 Assessment, the 2013 Assessment is inadequate as there is no clear definition of what constitutes a “failure” of the water collection and treatment system. The examples and language used throughout the document suggest that failure modes are “innumerable” and the release of untreated water is a certainty. Enumerating and assessing potential failure modes, and developing an appropriate management strategy for each, is expected to be a part of the mine design process.

By presenting a “serious failure” that “allows untreated water to discharge directly to streams”, the Assessment asserts this outcome as a “reasonable possibility”, without any justification. Such an outcome, in reality is of extremely low probability as it would constitute direct violation of wastewater discharge regulations with severe penalties imposed. To call this a “reasonable probability” is a gross mischaracterization of wastewater treatment practices at modern mines.

The Assessment is very misleading in that, taken as a whole, it leaves the reader with the impression that the long-term release of untreated waters and leachates are a certainty, even during routine operations.

<u>EPA Response:</u> Failures that result in violation of permits do occur at mines and their frequency has not been “extremely low.” The phrase “reasonable possibility” is not

specific, but it certainly does not mean "a certainty even during routine operations." A clear definition of failure of the water collection and treatment system has been added to the final assessment.

8.19 Geosyntec Section: 3.1

2012 Geosyntec Comment: The 2012 Assessment repeatedly presents the likelihood of a failure of the water collection and treatment system as having a "high probability" and "certain" events while admitting a lack of "…data on the frequency of failures to fully collect and properly treat waters from mining operations." Hence, the report relies on qualitative probabilities without supporting documentation. Similarly, the report concludes that failures are "highly likely" to result in releases of untreated leachate for up to months at a time. These assumptions are not valid and fail to consider applications of modern process engineering systems used in mining operations today for water collection and treatment.

How 2013 Assessment Responds to Comment: The 2013 Assessment continues to present failure of the water management systems as a certainty. For example:

2-4 "Thus, in this assessment we choose failure rates that are most relevant and interpret them cautiously, using them to provide an upper bound estimate of future failure rates."

8-22 "The USEPA has observed that some operators continue to operate when they know that treatment is ineffective and not meeting standards. Hence, the record of analogous mines indicates that releases of water contaminated beyond permit limits would be likely over the life of any mine at the Pebble deposit. The probability of the specific WWTP failure analyzed here cannot be estimated. It is improbable in that it requires that wastewater not be treated and not be diverted to storage. However, it is plausible that such an event would result from equipment failures, inadequate storage or human errors. It is more likely that a partial failure (e.g., incomplete treatment) would occur, but any one of the innumerable incomplete treatment scenarios is also unlikely. Hence, the WWTP failure scenario analyzed here is a reasonable bounding case."

14-5 "Collection and treatment failures are highly likely to result in release of untreated or incompletely treated leachates for days to months, but the water would be less toxic due to elimination of PAG waste rock."

Discussion on Adequacy of 2013 Response: The original section in the 2012 Assessment has been re-written. The failure rates used are acknowledged as being an "upper bound" or worst-case set of circumstances. By only discussing the "upper bound estimates" the document continues to mislead and exaggerate the most probable, or expected value, of the outcomes.

Treatment failures are presented as a certainty. Similarly, discharges in excess of permit limits are also presented as likely. The Assessment uses the example, without reference, of mine operators who knowingly operate with ineffective treatment. This is another example in the BBWA of exaggerating the probabilities of system failures to raise fears of unavoidable impacts, and emphasizing worst case scenarios that are highly improbable in a modern mine.

<u>EPA Response:</u> The discussion of water collection and treatment failures has been rewritten to clarify the probability of occurrence. However, since this comment and

others from the mining industry have not specified references with alternative probabilities of systems failures, we cannot respond more specifically to this comment.

8.20 Geosyntec Section: 3.1

2012 Geosyntec Comment: The 2012 Assessment states: "Following the termination of mine operations, collection and treatment may cease immediately (premature closure) or may continue for some period (planned closure), but eventually will cease (perpetuity). If the water is nontoxic, in compliance with all criteria and standards, and its composition is stable or improving, the collection and treatment system may be shut down under permit. Otherwise, treatment would continue until institutional failures ultimately resulted in abandonment of the system, at which time untreated leachate discharges would occur." (pg. 6-36)

This statement assumes that institutional controls will fail at some time and management of water residuals would cease, when considering "perpetuity". First, this is a contingency outcome that would be evaluated in the permitting process. All closures, referred to in the report as both "planned" and "unplanned," are planned for during the permitting process. This statement is misleading because it does not differentiate between leachate that is collected during mine operations and that which may be generated during the "in perpetuity" timeframe. If institutional failures result in the eventual abandonment of the water collection and treatment systems, a reasonable expectation is that by this time the site would have executed the closure plan and that the leachate quality would be stable or improving each year. In contrast, the BBWA implies that it is inevitable that untreated leachate will eventually be discharged to the natural environment, resulting in a significant environmental impact. Such speculation on future outcomes is not consistent with accepted risk analysis practice, as a "reasonable" time frame must be considered.

How 2013 Assessment Responds to Comment: The 2013 Assessment continues to assert the eventual release of untreated leachate is a certainty but now makes reference to the fact the water would be less toxic due to the elimination of PAG rock.

8-2 "Following the termination of mine operations, it is expected that water collection and treatment would continue for waste rock and tailings leachates. If the water is nontoxic, in compliance with all criteria and standards, and its composition is stable or improving, the collection and treatment system may be shut down under permit. Otherwise, treatment would continue in perpetuity – that is, until untreated water quality was acceptable or institutional failures ultimately resulted in abandonment of the system. If the mine operator abandons the site, the State of Alaska should assume operation of the treatment system; if both the mine operator and the State of Alaska abandon the site, untreated leachate would flow to streams draining the site."

ES-18, 14-5 "When water is no longer managed, untreated leachates would flow to the streams. However, the water would be less toxic due to elimination of PAG waste rock."

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. The 2013 Assessment continues to refer to the discharge of untreated leachate at some future state as "Certain." (ES-18, 14-5).

If institutional failures result in the eventual abandonment of the water collection and treatment systems, a reasonable expectation is that by this time the site would have executed the closure plan, potentially acid generating (PAG) waste rock would have been processed and tailings placed in the pit below water, many years of post-closure leachate management will have occurred, and the leachate quality would be stable or improving each year.

<u>**EPA Response:**</u> **The revised assessment clarified the long-term status of waste rock leachate as acknowledged in this comment. The scenario proposed in the comment is not inconsistent with the assessment, but other scenarios are also possible. A risk assessment must acknowledge risks that events would not proceed as desired.**

8.21 Geosyntec Section: NEW.

2012 Geosyntec Comment: N/A.

How 2013 Assessment Responds to Comment: The 2013 Assessment incorporates a new evaluation of leachate from the waste rock piles around the mine pit, as follows:

8-12 “The mine scenarios (and the plan put forth for Northern Dynasty Minerals in Ghaffari et al. 2011) do not include liners for the waste rock piles. Instead, leachate within the pit’s drawdown zone would be captured and pumped to the WWTP. Outside the drawdown zone, half the leachate would be captured by extraction wells or other means and the rest would flow to surface waters. This is considered reasonable given the likelihood that water would flow between wells and below their zones of interception in the relatively permeable overburden materials and upper bedrock. Wells would not catch all flows from the mine site given its geological complexity and the permeability of surficial layers. As a result, 84% of PAG leachate and 82% of total waste rock leachate would be captured by the pit and the wells for the Pebble 2.0 mine.”

Discussion on Adequacy of 2013 Response: The statement that half (50%) of the leachate from waste rock outside of the leachate zone will escape and flow to surface waters is unsubstantiated. While the 2013 Assessment references the Wardrop (2011) (i.e., Ghaffari et al., 2011) report, it fails to include the discussion in the Wardrop report where it is stated that a low permeability cutoff wall will be installed around the waste rock piles and extraction wells will be installed within the cutoff wall to capture water and leachate infiltrating below the waste rock piles. This system can be optimized to achieve significantly more than 50% capture. In tandem with proper management of PAG waste rock to maximize its placement within the drawdown zone, the capture of PAG waste rock leachate can be close to 100%. This relatively straight forward approach to enhanced leachate collection is standard best engineering practices, a fact that is ignored in the 2013 Assessment.

<u>**EPA Response:**</u> **Ghaffari et al. 2011 [referred to as the Wardrop (2011) report in the comment] is referenced and the capture system is described. The comment provides no evidence that standard best engineering practices could achieve close to 100% leachate capture with the system described by Ghaffari et al. (2011), particularly given the geology and hydrology of the site.**

8.22 EPA assumes the water treatment plant at Pebble could fail completely, allowing untreated water to flow into nearby streams for weeks or even months without any controls. This analysis overlooks fundamental design considerations for modern water treatment plants that provide operators with the management tools necessary to address loss of power or other malfunctions for extended periods of time without environmental harm.

<u>EPA Response:</u> History has shown that any system can fail, even modern ones.

8.23 Water treatment plans at projects like Pebble are designed in a modular fashion with redundant capacity, so even if one or several modules are incapacitated, the rest of the system continues to treat the volume of water necessary for release.

<u>EPA Response:</u> Designing redundant systems is a good practice. However, redundant systems can and do fail due to coincidence or, more commonly, due to a common mode failure.

8.24 However unlikely, if all water treatment modules at Pebble failed at the same time, surplus water would simply be held in the tailings storage facility until such time as the water treatment plant was brought back on line. Storage of surplus water in the Pebble TSF could carry on for months without creating a risk of over-topping.

<u>EPA Response:</u> The comment does not recognize that detection of treatment failure and diversion of effluent depend on systems that also could fail. In addition, storage of water from an inoperable treatment system would likely cause additional streamflow modifications and subsequent adverse effects.

8.25 Geosyntec Section: 3.3

2012 Geosyntec Comment: The 2012 Assessment states: "During mine operation, collection or treatment of leachate from mine tailings, pit walls or waste rock piles could fail in various ways. This water collection and treatment failure could be continuous (e.g., failure to collect all leachate from the tailings storage facility) or episodic (e.g., failure due to a power loss). In such cases, leachate might enter groundwater and not be collected by the pit sumps or the tailings impoundment's collection system, or could discharge to surface waters directly or through a non-functioning water treatment system." (pg. 6-36)

No supporting documentation or references are listed in the assessment to support the claims relating to water collection and treatment failure. Neither the "continuous" nor the "episodic" failures mentioned represent current "best practices" for operating mines.

How 2013 Assessment Responds to Comment: This portion has been rearranged and re-written in the 2013 Assessment.

8-19 "There are innumerable ways in which wastewater treatment could fail under the mine scenarios in terms of failure type (e.g., breakdown of treatment equipment, ineffective leachate collection, wastewater pipeline failure), location, duration, and magnitude (e.g., partial vs. no treatment). Box 8-1 presents an example wastewater collection failure, and mechanisms of treatment failure are discussed in Box 8-2. To bound the range of reasonable possibilities, we assess a serious failure in which the WWTP allows untreated water to discharge directly to streams. This type of failure could result from a lack of storage or treatment capacity or treatment efficacy problems. Chronic releases would occur during operation if a lengthy process were required to repair a failure. We evaluate potential effects of this type of failure using the following assumptions… Duration of a release could range from a few days to several months, depending on the nature of the failure and difficulty of repair and replacement."

Discussion on Adequacy of 2013 Response: Although a range of outcomes is presented, the relative likelihood of each is not given weight in the Assessment. Based on our experience with industrial facilities, most equipment breakdowns would be resolved within hours, some might require a few days for replacement parts to arrive at the site. The only malfunctions that take months to remedy are those that depend on suitable weather to facilitate the repair; these are quite rare and usually temporary measures are constructed to manage the situation during the interim period.

The scenario described in the 2013 Assessment is considered extremely unlikely given the multiple redundancies that will be incorporated within the treatment plant system design, and the proposed operational approach where untreated water will be stored in the TSF such that if the treatment plant were to go offline, water would not be transmitted to the plant in the first place.

<u>EPA Response:</u> The wastewater treatment failure scenario is described in the assessment as an upper bound case during operation. Contrary to the comment, no particular case in the range from perfect operation to complete failure is given more or less weight.

8.26 Geosyntec Section: 3.4

2012 Geosyntec Comment: The 2012 Assessment states: "Water collection and treatment failures may be acute or chronic. A recent example is the overfilling of the tailings impoundment at the Nixon Fork, Alaska, mine that resulted in overtopping of the dam (Box 6-2)." (pg. 6-36)

The Nixon Fork example serves as a warning of the importance of water management at mine sites. Inadequate or inappropriate instrumentation was used to monitor the level in the tailings impoundment. Staff elected to not monitor the freeboard level as the gage was frozen in ice. Additionally, a major change was made to the production process (moving from batch to continuous operation) without an adequate understanding of the consequences to the site water balance and water management. Note that, as described in Box 6-2, for this release it was found that water from the tailings impoundment was not likely to have reached nearby streams.

How 2013 Assessment Responds to Comment: Box 6-2 was reorganized and renamed to Box 8-1, pg. 8-20. The following concluding statement is added to Box 8-1:

"This case illustrates the diversity of potential failures that can happen and suggests the practical impossibility of predicting all possible failure modes."

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. Water management is an important component of mine operation.

We note however that the addition of the concluding statement is biased in that it indicates that failure modes cannot be predicted. Nothing about the Nixon Fork case indicates a failure mode that could not have been predicted. In reality, the overtopping at Nixon was both predictable and preventable if appropriate effort and oversight had been applied to managing the site's water balance.

<u>EPA Response:</u> The fact is that the accident was not predicted or prevented.

8.27 Geosyntec Section: 3.2.3

2012 Geosyntec Comment: In the 2012 Assessment a fourth timeframe is considered, post closure "in perpetuity," beyond the "limited lifetime of human institutions."(pg 3-5) Consideration of this scenario suggests a broader USEPA policy issue, as there are other facilities, such as closed hazardous and non-hazardous waste landfills, that are intended to remain in perpetuity. Consider the following statements from the 2012 Assessment:

"Further, it is much too soon to know whether mines that are permitted for perpetual water collection and treatment (e.g., the Red Dog Mine in Alaska) can in fact carry out those functions in perpetuity." (pg. 6-41)

"…given the relatively ephemeral nature of human institutions over these timeframes, we would expect that eventually monitoring, maintenance, and treatment would cease." (pg. 7-14)

The report calls into question the ability of the Red Dog Mine operator to meet the obligations of its approved permit for perpetual operation. The ability to operate a water management system for 200 years can only be proven with absolute certainty following 200 years of demonstrated operation. By placing doubt on the ability to operate perpetually, the BBWA creates an unrealistic standard that is impossible to meet.

How 2013 Assessment Responds to Comment: There is no significant change for 2012. The 2013 Assessment continues to call into question the ability to operate any system "in perpetuity".

6-32 "…need to be maintained for hundreds to thousands of years. It is impossible to evaluate the success of such long-term collection and treatment systems … because these timeframes exceed both existing systems and most human institutions…. The uncertainty that human institutions have the stability to apply treatment for these timeframes applies to all treatment options."

8-22 "…it is much too soon to know whether mines that are permitted for perpetual water collection and treatment (e.g., the Red Dog Mine in Alaska) can actually carry out those functions in perpetuity."

13-31 "In light of the relatively ephemeral nature of human institutions over these timeframes, we would expect that monitoring, maintenance, and treatment would eventually cease, leading to increased release of contaminated waters downstream."

14-16 " Human institutions change. Over the long time span of mining and post-mining care, generations of mine operators must exercise due diligence. Priorities are likely to change…"

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. By adding new text in additional locations in the 2013 Assessment that cast doubt on the ability to operate in perpetuity, the Assessment continues to create an unrealistic standard that is impossible to meet. The bias of the report remains clear.

EPA Response: It is not biased to point out that the major features of a mine (pit, waste rock, and tailings) would persist in perpetuity. The record of mining environmental failures and permit violations demonstrates that operation in perpetuity is doubtful, if not "impossible to meet." The comment is correct in stating that the need for perpetual maintenance of perpetual structural integrity is not always considered in cases in which it is relevant. However, it is not new. For example, it has been a consideration in the design and permitting of nuclear waste storage facilities for decades.

The assessment included operational procedures and closure planning to minimize risks of system failures. However, there are no such systems using modern technologies that have existed long enough to evaluate whether they would continue to be monitored and maintained after all initially involved parties were no longer present.

8.28 Geosyntec Section: 3.1

2012 Geosyntec Comment: In Box 4-1 the 2012 Assessment aggregates multiple worst-case failure scenarios into a single release event scenario which unreasonably overstates the probability of release due to a system failure in the water collection and treatment system.

The cumulative effect of four worst-case factors (unlimited oxygen supply, higher concentration of metals in the waste rock, high leaching rates due to small grain size, and high water contact due to the absence of preferential flowpaths) sets an overly conservative bound on the hazardous characteristics of the leachate quality. Use of the additive result of multiple concurrent worst-case factors, represents an unreasonable overstatement of the potential impacts of leachate releases. A risk analysis based on these assumptions cannot be well supported scientifically.

How 2013 Assessment Responds to Comment: The section has been re-written; this Box scenario has been replaced by three additional Box discussions which provide an overview of the use of best management practices, regulations, and financial assurances required:

- Box 4-1 "Reducing Mining's Impact";
- Box 4-2 "Permitting Large Mine Projects in Alaska"; and
- Box 4-3 "Financial Assurance".

Discussion on Adequacy of 2013 Response: The inclusion of discussion of best management practices would help the Assessment to be more balanced except that these Box references are later negated elsewhere in the document. The Assessment later asserts that most mines do not comply with regulations and that in the past financial assurances have been insufficient and that taxpayers have been left with closure costs.

6-36 "In the past, however, financial assurance often has not been adequate, and taxpayers have been left with substantial cleanup costs (USEPA 1997). This may be changing, as agencies update bonding requirements to reflect cleanup costs more accurately, but projecting these costs far into the future is a difficult task."

8-22 “The USEPA has observed that some operators continue to operate when they know that treatment is ineffective and not meeting standards. Hence, the record of analogous mines indicates that releases of water contaminated beyond permit limits would be likely over the life of any mine at the Pebble deposit.”

EPA Response: We are not able to respond to this comment. Passages are quoted from the assessment without any evidence or comment suggesting that they are incorrect.

8.29 a) Kuipers et al., 2006 – “Comparison of Predicted and Actual Water Quality at Hardrock Mines”

Summary

- Not a reliable indicator of the probability of any modern mine having groundwater or surface water quality problems
- Biased case study selection – excluded examples where no impacts had been indicated
- In the majority of cases described, “impacts” were assigned where there was no actual environmental consequence
- Most if not all recommendations included in the report are currently inherent in the permitting process in place in Alaska
- No consideration of monitoring during operations and associated regulatory action that may include further mitigation, contingency plans and bonding

Specific References

“Given that the state-of-the-art has continued to evolve since the report was published in 2006, it is reasonable to assume that most of the recommendations that the authors made in their report should indeed appear in the Pebble Mine environmental impact assessment, regardless of whether or not the authors will have read this report. The industry as a whole has evolved quite a bit during the last decade and mining permits and environmental impact assessments should reflect this evolution.” – Robert Kleinmann (pg. 15)

“The conclusions drawn by Kuipers et al. are correct for the 25 mines they investigated in 2006, but they cannot be used to predict the outcome of future predicted water qualities during or after mining.” – Christian Wolkersdorfer (pg. 7)

“What the report lists are past experience, which cannot be used as a general rule to predict the future development of the mining industry and its potential impacts. The mining industry constantly develops better prediction tools and treatment options. The limitations of the report, therefore, are that they investigated the past and draws conclusions for the future. They do not use comprehensive statistical methods to prove that the 25 case studies presented are really representative for all mines they investigated. …At no place in the report do the authors give proof that… the 25 case studies are significantly representative for all existing and future mines….In no case do the authors provide a degree of evidence that the failures will very likely also occur in a modern mining operation….” – Christian Wolkersdorfer, (pg. 17)

"Because of the lack of statistical proof that the core findings of their presentation are representative for all past and future mines, the value of this report for the EPA assessment is questionable." – Christian Wolkersdorfer (pg. 18)

EPA Response: References to Kuipers et al. (2006) have been removed from the final assessment. This report was used only to support our analyses, and its removal has not changed the assessment's findings.

8.30 b) Earthworks, 2012 – "U.S. Copper Porphyry Mines Report"

Summary

- No modern mine examples – most of the mines considered are old facilities with operations often initiating in the 1880s
- Issues presented relate to facilities designed and constructed before modern environmental regulation, and thus have little relevance to modern operations
- No insight into the causes for the failures presented, leading the reader to erroneously conclude that copper mines cannot be operated on an environmentally sound basis
- It appears that at least one reviewer (i.e., Lopez), only reviewed an executive summary, not the complete report, thus raising significant questions about the thoroughness/appropriateness of the peer review process.

Specific References

"…the report presents what appears to be a thorough list of incidents from 14 copper porphyry mines in the U.S. The conclusion that we can expect a similar or worse track record for a new mine is, however, not supported by the information presented." – David A. Atkins

"I find the report, by its nature, to be very biased. In reality, a similar report emphasizing problems and mistakes could probably be written for most human activities… Such reports, which attempt to paint the world black or white, inevitably come across as one-sided because they are. While it is appropriate to consider potential environmental issues and problems associated with mining when making a decision with respect to Bristol Bay, such decisions should be made based on the site-specific conditions, along with appropriate risk management analysis." – Robert Kleinmann

"What I was asked to review is probably not the full report, but the executive summary (that is the title in the introductory text)." Dina L. Lopez

EPA Response: Although the reviewers noted an apparent bias in data interpretation in the Earthworks (2012) report, the data themselves were not found to be biased. Only the report's data, and not its interpretations or conclusions, were used in the assessment.

The Pebble Limited Partnership (Doc. #5536)

8.31 Leakage during routine operations assumes no seepage control measures in place, a design that would not be permitted.

<u>EPA Response:</u> Seepage control measures are assumed to be in place and are described in the assessment, as in Ghaffari et al. (2011). However, they would not work perfectly.

8.32 Many sections of the Assessment also continue to assume that leachate would migrate from mine tailings to groundwater. The EPA fails to acknowledge that modern control methods are available and could be incorporated in the project design to minimize or avoid this potential concern. Because the Assessment assumes that a project would not implement adequate design or mitigation measures addressing concerns about potential groundwater impacts, the Assessment overstates potential impacts on groundwater quality.

<u>EPA Response:</u> See response to Comment 8.31. The need for additional measures beyond those assumed in Ghaffari et al. (2011) is described in Section 8.2.4.

8.33 Exaggerated Evaluation of Water Use: The additional information included in the Assessment describing water use (i.e., water loss, water quality impacts on stream reaches, drainage of waste rock leachate to streams, and mine site water balance to assessment) and the impact of spills and truck accidents in the potential transportation corridor are grossly exaggerated. The Assessment lacks credible information on the scope and scale of water use and environmental impacts.

<u>EPA Response:</u> The comment is vague and general, so it is not possible for us to respond.

8.34 *Original Draft Location*: Page 4.39, Report Section Identification: 4.4.1, page 4-39

Original Comment from Environ: This section should acknowledge that the assumption that the TSF would be unlined except at the face may not be an accurate assumption.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Some consideration of liners is provided, with the assumption that they become less effective over time; however, effectiveness over time is directly affected by the final design characteristics of the liner system, the level of care and QA/QC protocols applied in liner construction, the management of the tailings facility in actual operation, the results of routine performance monitoring, and many other factors. The reviewer's point was that considerable uncertainty exists with respect to the actual design of there tailings facility, and such uncertainty should be acknowledged.

<u>EPA Response:</u> The scenario design is consistent with Ghaffari et al. (2011). The consequences of the scenario are uncertain, but in terms of the assessment the scenario itself is a given.

8.35 *Original Draft Location*: Page 6.38, Section 6.3.3, Excerpt Sentence 2

Original Comment from Environ: The authors state that Tertiary waste rock leachate would exceed the national ambient water quality criteria for copper, but do not acknowledge that the average copper concentrations would be below Alaska's hardness-based standards for both the criterion maximum concentration and the criterion continuous concentration. It seems that the more site-specific criteria comparison is also important to present.

Recommended Change: Comment reference West et al 2009.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The current draft presents the same information concerning the national AWQA for copper. The comment was not addressed.

<u>EPA Response:</u> The National Ambient Water Quality Criterion for copper is more site-specific than the Alaska standard because it more completely incorporates the water quality of the site. Alaska's standard is simply the old national criterion, so it is not specific to Alaska.

8.36 *Original Draft Location*: Page 6.38, Section 6.3.3, Excerpt Sentence 4

Original Comment from Environ: The statement that acute or chronic toxicity to invertebrates through exposure to Tertiary waste rock leachate could occur at up to two times dilution is not supported. If this statement is supported in a previous section, that sections should be noted and Table 5-14 should be referenced.

Recommended Change: Comment reference West et al 2009.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: This comment is not reflected in the current review draft. The comment stands. The impacts are likely overstated.

<u>EPA Response:</u> The comment is unexplained and unsupported. The assumptions of the assessment are explained, as are the methods used in the calculations. Dilution zones are discussed in 8.2.3.5 of the assessment.

8.37 The Assessment states that it takes into consideration "modern conventional mitigation practices as reflected in published Pebble materials and as suggested in mining literature and consultations with experts" (p. ES-26), but in fact it does not. For example, the Assessment assumes that in the event of a WWTP failure that water would be released directly to streams. This does not reflect international best practice, which would instead route wastewater in the event of a WWTP failure to either the Tailings Storage Facility (TSF) or the Mine Pit. If this best practice measure was incorporated, none of the impacts referenced in Chapter 8 of the Assessment would occur.

<u>EPA Response:</u> The mechanisms to divert flow could fail as well, and that failure is part of the scenario.

8.38 The Assessment makes some strong statements that appear to characterize mining in the worst light. For example, the Assessment states:

> If the mine operator abandons the site, the State of Alaska should assume operation of the treatment system; if both the mine operator and the State of Alaska abandon the site, untreated leachate would flow to streams draining the site (p. 8-2).

This outcome is highly unlikely, as a necessary condition of permitting such a project today would include financial assurance (bonds) to provide for long term management of liabilities associated with early closure (abandonment of the mine).

EPA Response: The assessment does discuss such bonds. We agree that the failure of the State to operate the water collection and treatment system in the short term is unlikely, but the assessment must consider the course of events in perpetuity.

8.39 *Excerpt from Section 8.1 (p. 8-1)*: This failure represents one potential failure among many accidents and failures that could occur. We specify that under routine operations, the WWTP would meet permit limits; in the event of a complete treatment failure, flows would pass through the WWTP at the estimated influent concentrations. These two water collection, treatment, and discharge scenarios bound the likely degrees of water treatment failure, but do not encompass the worst case.

Technical Comment from ERM: Assumes no buffer between plant and discharge and also appears to misunderstand the nature of sequential water treatment processes that would be employed for the water treatment (i.e., the treatment is a series of units to remove the various elements and copper is one of the easiest to remove). Thus the potential for a complete failure of all processing steps is not plausible unless there is a failure in water supply to the plant (i.e., no water to treat so no discharge possible). It also ignores that there would be multiple, parallel treatment trains. The assumptions also ignore that reverse osmosis is typically one of the last steps in the sequence and failure is not through 'breakthrough' where untreated water is released but is fouling of the membrane that prevents any water passing through. Furthermore, however unlikely and as noted elsewhere, per well established best practices untreated waste water would be pumped to the TSF or the pit and not discharged to the environment.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: The assessment describes the treatment failure scenario as unlikely and an upper bound.

8.40 *Excerpt (p. 8-4)*: In addition, because the waste rock piles and TSFs would not be lined, some leachates from both would not be captured and would flow to the three receiving streams.

Technical Comment from KP: Effective seepage control systems are a mandated, integral part of all mines that would be permitted in Alaska. Liners may be included as part of a seepage management system but there will be some seepage regardless of whether or not a liner is in place as liner systems are not 100% effective in eliminating seepage. Alternatively, seepage management systems may include seepage cutoff walls, seepage collection ponds, and seepage recovery wells that are as effective as liners in managing seepage. Standard mining practice and designs include seepage control systems which are monitored and maintained.

Comment Category: Invalid assumption.

EPA Response: The comment does not contradict the assessment, which discusses the fact that liners are not 100% effective and includes a seepage control system that is monitored and maintained.

8.41 *Excerpt from Section 8.1.1.1 (p. 8-11)*: Total leakage amounts for the three mine scenarios are 1.1 x 106 m^3/yr (Pebble 0.25), 2.4 x 106 m^3/yr (Pebble 2.0), and 7.2 x 106 m^3/yr (Pebble 6.5) (Tables 8-1 through 8-3). These estimates are based on a simple assessment of seepage from the TSFs.

Technical Comment from KP: The EPA leakage rate assumption for the tailings leachate assumes that there are no seepage control measures downstream of the main tailings dams. Seepage management systems, which may include seepage collection and recycle ponds, and monitoring wells to collect seepage through the main dams, will be required by State regulators.

General Subject Area: Tailing Storage Facility Depth.

Comment Category: Invalid assumption.

<u>EPA Response:</u> We used the design put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), which assumed the following:

- **A seepage collection system would be installed downstream of these design elements to capture any seepage that migrated through them. Seepage collected in this system would be pumped to either the tailings impoundment or the process plant.**
- **Wells further downstream would monitor the groundwater quality and could be converted into recovery wells, if necessary.**

Hence, in the assessment scenarios there is a seepage collection system for seepage through the dam, but not for seepage through the geological substrate. Further, the monitoring wells are not likely to be effective collection wells for such seepage and would only be used "if necessary."

8.42 *Excerpt from Section 8.1.2 (p. 8-19):* To bound the range of reasonable possibilities, we assess a serious failure in which the WWTP allows untreated water to discharge directly to streams. This type of failure could result from a lack of storage or treatment capacity or treatment efficacy problems. We evaluate potential effects of this type of failure using the following assumptions.

Technical Comment from ERM: The failure mode of direct release is neither sensible nor reasonable failure of the WWTP would typically (and under good management practices) be directed to the pit (or a TSF depending on topographical relief). Even if direct release occurred, the quantity would be significantly smaller, as the practice is to cease processing of water. The failure assumptions are too extreme, being worst case on worst case and also based on failure modes that are not a common basis of design for water treatment plants whether for mining or other industries.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> We agree that the upper bound failure scenario is non-representative of plant operations and characterize it as a serious failure.

8.43 Page: 8-2; Section Number: 8.1; Section title: Water Discharge Sources

Excerpt: Following the termination of mine operations, it is expected that water collection and treatment would continue for waste rock and tailings leachates. If the water is nontoxic, in compliance with all criteria and standards, and its composition is stable or improving, the collection and treatment system may be shut down under permit. Otherwise, treatment would continue in perpetuity – that is, until untreated water quality was acceptable or institutional failures ultimately resulted in abandonment of the system. If the mine operator abandons the site, the State of Alaska should assume operation of the treatment system; if both the mine operator and the State of Alaska abandon the site, untreated leachate would flow to streams draining the site.

Technical Comment Contributed by KP: This implies that mine closure will be inadequate and that the owner will not be responsible for environmental liability. This is not realistic as comprehensive analyses and adequate bonding to reclaim and stabilize the site – including monitoring, maintenance, and upgrading or replacement of treatment systems as new technologies are developed – would be needed before any development could be permitted to proceed.

This also implies that the operator and the State abandon the site, which is not realistic.

Citation/Reference: N/A.

General Subject Area: Closure.

Comment Category: Ignores permitting requirements.

<u>EPA Response:</u> The statement quoted from the assessment does not imply abandonment of the site. It states, as any risk assessment should, that it is a possibility.

8.44 *Page*: 8-22, *Section Number*: 8.1.4, *Section title*: Probability of Contaminant Releases

Excerpt: The USEPA has observed that some operators continue to operate when they know that treatment is ineffective and not meeting standards. Hence, the record of analogous mines indicates that releases of water contaminated beyond permit limits would be likely over the life of any mine at the Pebble deposit.

Technical Comment Contributed by KP: This section is also speculative. It assumes that Pebble will willingly and knowingly violate its discharge permits, and that State agencies will fail to enforce its permits.

Citation/Reference: N/A.

General Subject Area: Water Management.

Comment Category: Invalid statement.

<u>EPA Response:</u> The quotation is taken out of context. The statement in the first quoted sentence is a fact, not a speculation or an assumption. The concluding statement refers to the entire paragraph which includes other evidence that is not quoted.

8.45 *Excerpt from Section 8.2.1.1 (p. 8-24)*: PLP (2011) found that copper levels in some samples from the South Fork Koktuli River exceeded Alaska's chronic water quality standard. However, most of the exceedances were "in sampling locations within or in proximity to, the general deposit location" and the number and magnitude of exceedances decreased with distance downstream (PLP 2011: Figure 9.1-35). Therefore, the stream reaches with significantly elevated copper concentrations would be largely destroyed by the mine scenario footprints and by water diversions.

Technical Comment from ERM: The Assessment documents that PLP found elevated copper concentrations in upper stream reaches. It further acknowledges that those headwaters are in locations under the mine footprint. What the Assessment does not explicitly acknowledge is that these are the very reaches about which concern is expressed. These reaches, with high value fish resources are by current accounts not apparently impacted by the (naturally) elevated copper concentrations.

Citations: PLP 2011 EBD,

General Subject Area: Baseline data representation,

Comment Category: Information is presented out of context or in a misleading way.

EPA Response: The comment does not indicate what context is lacking or how the statement is misleading. The statement that the resources are not apparently impacted by copper is not supported by comparisons of the invertebrate taxa to reference streams.

8.46 *Original Draft Location*: Page 5.49, Report Section Identification: Vol 1 Section 5.3.1

Original Comment from State of Alaska: The biotic ligand model is used to derive criteria on page 5-49 despite not being introduced until page 5-53. The values for copper derived from the biotic ligand model in Table 5-14 and 5-15 do not match the values in Table 5-19. East and West Pre-Tertiary values are swapped. Table 5-19 shows the acute criterion for the biotic ligand model for Pebble West Pre-Tertiary to be 0.43 μg/L. Table 5-15 on Page 5-50 shows it as 0.043 μg/L. All the biotic ligand values derived for copper need to be verified and accurately labeled in Tables 5-14 through 5-16 and Table 5-19. These values are used to derive dilution calculations highlighted on page ES-21. Furthermore, the chronic criteria are 10 and 90 times more stringent for the biotic ligand model than the state's water quality standards for the West and East Pre-Tertiary waste rock respectively. This is a significant difference. The lead in sentence to Table 5-19 should provide table references for the mean chemistries of the waste rock leachates. See comment for pages 5-53 to 5-37.

Recommended Change: Move Tables 5-14 through 5-16 to after Table 5-19 or remove the biotic ligand model derived criteria from Tables 5-14 though 5-16. Provide a footnote for the column header "Average Value" indicating number of leachate tests performed. Review inputs and outputs from the biotic ligand model and correct errors in values and references to East and West Pre-Tertiary waste rock in Tables 5-14, 5-15, 5-16, and 5-19.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The tables have been moved to section 8. The numbers remain the same. It is not possible to determine if the model results were checked as requested.

<u>EPA Response:</u> The biotic ligand model used in the National Ambient Water Quality Criterion for copper is indeed more stringent than the old hardness-based criteria still used by the State of Alaska. Criteria values are different for different waters because their water chemistries are different.

8.47 *Original Draft Location*: Page 5.57, Report Section Identification: 5.3.2.2

Original Comment from State of Alaska: The section on "analogous" sites is too general to be of use in risk determination. It raises the issue of the adequacy of current water quality criteria, but there is not enough information provided on conditional differences between analogous sites and the Pebble Mine site to make any inferences. Water quality, leachate parameters, acidity, water flow, stream substrate, stream invertebrate assemblages, among other conditions all may be different. The research cited in this section also suggests that there may be impacts to stream macroinvertebrates at concentrations below the water quality criteria, but essentially there is no quantification of the potential impact or the level below the criteria that is unacceptable. One article suggests a factor of 10 below the criteria provided acceptable protection. This argument would seem to be more appropriate in setting new criteria, and until such criteria are provided, there doesn't seem to be any basis for requiring concentrations below EPA approved Alaska Water Quality Criteria, apart from an APDES permitting process that takes into account site-specific conditions. No discussion is provided on any "acceptable" level of impacts to stream invertebrate populations while maintaining healthy fish populations. Siltation of the streams with contaminated sediment should be a principal concern in any mine development/permitting and effects determination.

Recommended Change: Further examination of site-specific mine conditions and potential impacts should include stream invertebrate sampling, enumeration, and analysis to establish baseline conditions.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Largely addressed in Section 8.2.2.1.

<u>EPA Response:</u> The assessment is a scientific risk assessment of potential mines, not a criteria-setting document. It includes the best available science, not just criteria values. The comment does not explain why or what contaminated sediments should be the principal concern. Spilled tailings and product concentrate are assessed as potential contaminated sediments in Chapters 9 and 11, respectively.

8.48 *Original Draft Location*: Page 5.57, Report Section Identification: 5.3.2.2

Original Comment from State of Alaska: The "uncertainties" section just states that the existing criterion may not be protective. It does not state that it also may be overly protective, depending on stream conditions at the mine. Invertebrates in many of the streams may already be impacted by naturally high metals concentrations….or the natural intermittent flow regimes of many of the streams and minor tributaries. Sensitive invertebrate species may not be present. Consideration of only the possible non-protective nature of water quality criteria, without discussion of many, many other uncertainties biases the report. Overall, Section 5.3.2.2 is a very simplified assessment of potential impact. Hence the need for site-specific analysis.

Recommended Change: N/A.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The current discussion of Copper Exposure-Response Uncertainties (Page 8-30) presents the same perspective that the copper criteria (water and diet) are likely underprotective, and does not include any consideration that sensitive species may not be locally present or have adapted to the elevated background concentrations related to the natural presence of the copper bearing materials. The section continues to be over-simplified and failures to consider other factors continue to bias the report.

<u>EPA Response:</u> Chapter 8 of the assessment does in fact discuss the possibility that biota at the mine site may be adapted to naturally occurring metals.

8.49 *Original Draft Location*: Page 5.53, Report Section Identification: 5.3.2

Original Comment from State of Alaska: This section is a simple risk-based screening comparing average untreated waste rock leachate metals concentrations to water quality criteria. This assumes 100% exposure of all aquatic species in all streams. The results were a predicted potential for risks due to aluminum, copper, and zinc, with the greatest indicated concern being copper. Using the biotic ligand model significantly increases the predicted risks for copper. The screening concentrations predicted by the biotic ligand model are strongly related to the amount of organic material in the water. The assessment set dissolved organic carbon to 1 mg/L but provided no specific reasoning as to why, other than that dissolved organic carbon is expected to be low and 1 mg/L was the lowest possible in the model calculations. Background levels of dissolved organic carbon were measured in the Pebble Limited Partnership Environmental Baseline Data to be approximately 1.5 mg/L. Regardless, the screening suggests the potential for effects to aquatic life if untreated waste rock leachate were discharged to streams.

Recommended Change: Clearly justify use of 1.0 mg/L dissolved organic carbon. Discuss or provide evidence of how toxicity may change downstream as concentrations of metals decrease and organic matter concentration likely increases. May be able to use data from Pebble Limited Partnership Environmental Baseline Data as dissolved organic carbon was measured, and in the North Fork Koktuli ranged from 0.5 to 4.55 mg/L.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No further justification is provided concerning the use of 1.0 mg/L DOC (which is not the lowest value that can be entered in the model available from HydroQual, which is actually 0.05 mg/L). The exposure conditions related to the development of the BLM values are also not provided in the document, preventing any review or independent evaluation of these numbers used in the calculation of risk quotients.

<u>EPA Response:</u> The water quality parameters used in the BLM models for the leachates, except for DOC, are presented in the leachate chemistry tables (Tables 8-4 through 8-8). The parameters used for ambient waters are in Table 8-10. The explanation of the use of 1.0 mg/L was incorrect and has been corrected in the final

assessment. It is considered a reasonable value given that DOC of the leachate is 0 and the ambient levels are a little more than 1.

8.50 *Original Draft Location*: Page 5.53, Report Section Identification: 5.3.2.2

Original Comment from State of Alaska: This analysis of copper toxicity shows that the biotic ligand model provides a “protective” risk-based screening concentration. This method is likely overprotective as calculated because of the sensitivity of stream invertebrates used to develop the model/criteria. A site-specific investigation could provide a more accurate and meaningful evaluation of water quality criteria that would be protective of aquatic life.

Recommended Change: N/A.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: This comment is not reflected in the current review draft.

EPA Response: The criterion is not based on sensitive species. As explained in the assessment (Section 8.2.2.1), stream invertebrates have been found to be more sensitive to metals than the invertebrates used to derive the copper criterion. Therefore, if anything, the biotic ligand model-based criterion would be underprotective.

8.51 The document takes great effort to reference the PLP EBD report, which shows locations where PLP has identified elevated copper concentrations in headwaters near the Pebble deposit. What is not discussed in the Assessment is that these are the very waters where the Assessment predicts impacts to native fish and invertebrate populations as a result of changes in water quality because of the hypothetical mine scenario. However, these resources do not show signs of impairment from these copper concentrations in the absence of any other input. This shows evidence of naturally-elevated copper (and other metals) levels in the stream reaches near natural deposits, which are apparently not contributing to impairment of the streams.

The EPA relies on the use of the Biotic Ligand Model (BLM) for derivation of water quality criteria. This is the preferred approach, but to fully understand the model output, further review of the model inputs, assumptions, and data are necessary to evaluate the derived criteria.

The Assessment relies on some references that are far reaching. For example the statements related to sub-lethal effects of copper and wide-ranging population level effects are not generally supported in the scientific literature.

EPA Response: The possibility that stream biota may be adapted to elevated metal levels is discussed in the assessment, as is the fact that the streams with significantly elevated copper would be largely destroyed by mining (Section 8.2). The assumptions of the BLM are well-documented in the literature, and the parameters used in this assessment are provided in the assessment.

8.52 *Excerpt from Section 8.2.2.1 (p. 8-27)*: Table 8-11 shows results of benchmark derivation using the BLM approach.

Technical Comment from ERM: While the BLM approach is preferred over the old standard and the USEPA uses it in the derivation of standards in the Ambient Water Quality Criteria document, a more complete review of the BLM approach, assumptions, and input data is required for a thorough assessment.

Citations: USEPA 2007 Ambient Water Quality Criteria.

General Subject Area: Water Quality Criteria.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> The assumptions of the BLM are well-documented in the literature, and the parameters used in this assessment are provided in the assessment.

8.53 *Excerpt from Section 8.2.2.1 (p. 8-29)*: Although effects on fish olfaction have not been shown to affect the viability of field populations, it is reasonable to expect that interference with these essential processes would have population-level consequences (DeForest et al. 2011b).

Technical Comment from ERM: Indirect and sub-lethal effects have not been conclusively shown to influence field populations. The statement that it is reasonable to assume that such a sub-lethal effect would have a wide ranging population-level effect is not substantiated by the majority of toxicology literature.

Citations: DeForest et al, 2011b.

General Subject Area: Water Quality Criteria.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> If organisms fail to reproduce (a sublethal effect), there are inevitable population-level consequences. The comment provides no evidence to support an alternative position.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

8.54 *Original Draft Location*: Page 7.2, Section 7, page 7-2, Box 7.1

Original Comment from Environ: The authors conclude that "the diverse and relatively intensive development makes the Fraser River watershed a poor analogue for the development of mines in the nearly pristine Bristol Bay watershed." Box 7-1 appears to contradict the report's basic premise expressed in Section 1 (Introduction) that a comparison will be made in the report between the Fraser River watershed and the Bristol Bay watershed.

Recommended Change: N/A.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: This text box is still included with essentially the same wording in the current draft as Box 8-4. The analysis therefore continues to incorporate conflicting and potentially inapplicable information.

<u>EPA Response:</u> There is no conflict. The comparison was made and we concluded that the Bristol Bay and Fraser River watersheds are not sufficiently similar to be considered analogous with respect to the potential effects of mining on salmon.

8.55 *Original Draft Location*: Page 6.24, Report Section Identification: 6.1.4.3

Original Comment from State of Alaska: This is the first instance in the report in which an attempt is made to define the hazard quotient. The text defines the hazard quotient as "the relative degree of toxicity of leachate constituent or as an indication of the degree of dilution required to avoid significant toxic effects". This interpretation is somewhat simplistic and does not provide insight into what the value means.

Recommended Change: Provide EPA's definition EPA defines the HQ as the ratio of estimated site-specific exposure to a single chemical from a site over a specified period to the estimated daily exposure level, at which no adverse effects are likely to occur. Provide an interpretation of the HQ as HQs < 1.0 indicate acceptable risks, while HQs > 1.0 indicate unacceptable risks while also taking into consideration the inherent uncertainty in the estimate. Comment reference: Draft Comment Reference: U.S. Environmental Protection Agency (December 1997) Terms of Environment: Glossary, Abbreviations and Acronyms. [online] Washington, D.C. Available from: http://www.epa.gov/OCEPAterms/ [accessed 27 October 2007].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: While some additional guidance on interpreting risk quotients has been provided in the text (Text Box 8-3), this information is incorrect and not based on guidance available from USEPA for the conduct and interpretation of Screening Level Risk Assessments: United States Environmental Protection Agency (EPA). 2001. The role of screening level risk assessments and refining contaminants of concern in baseline ecological risk assessments. Office of Solid Waste and Emergency Response, Publication 9345.0-14, EPA 540/F-01/014. June 2001. United States Environmental Protection Agency (EPA). 2012. Technical Overview of Ecological Risk Assessment. Risk Characterization http://www.epa.gov/oppefed1/ecorisk_ders_toera_risk.htm. Last updated May 09, 2012. Accessed May 6, 2013. Hence, the characterization of risk is incorrect.

<u>EPA Response:</u> Hazard quotients are defined differently in various contexts. This document is not a Superfund screening assessment and the definition is not incorrect for this use.

8.56 *Original Draft Location*: Page 8.1, Report Section Identification: 8.1.1 Routine Operations

Original Comment from State of Alaska: Bullet number 2 of the list at the bottom of page 8-1 and continuing to the top of page 8-2 characterizes a loss of streamflows and then alludes to a reduction in production of salmon and resident species. This allusion is a mischaracterization of the overall assessment of risk, in that loss of fish production was not directly quantified, but the loss was indirectly quantified through potential losses in fish habitat (see section 8.5 concerning uncertainties and use of fish habitat loss as a surrogate for loss of fish production). This mischaracterization needs to be checked throughout the document for consistency.

Recommended Change: Throughout the document, remove all statements that characterize the risk in terms of loss of fish production and ensure all statements of risk are in terms of potential loss of fish habitat in keeping with the uncertainties presented in Section 8.5 – bullet 5.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Revised document states in Chapter 8 pg. 8-55, 3rd full paragraph: 'Because available data do not quantify fish production in the potentially affected reaches, it is not possible to estimate the lost production of salmon, trout, Arctic grayling, or Dolly Varden. However, the semi-quantitative surveys performed for the EBD (PLP 2011) and summarized in Section 7.1 provide some indication of the relative amounts of fish potentially affected.' However, the document continues to use production as a measure. The document needs to capture that uncertainty and address the range of possible impacts. Currently, the document seems to make assumptions that maximize the expected impacts of a project.

EPA Response: The endpoint is production and the assessment estimated the best surrogate metric for production that the available data and current science allow without making unsupportable assumptions. Given that fish production inevitably depends on the availability of habitat, we believe that it is not improper to allude to that relationship. The comment does not state specific "assumptions that maximize the expected impacts of a project."

The Pebble Limited Partnership (Doc. #5752)

8.57 5. The Assessment exaggerates the risk from waste rock storage.

The Assessment's failure to account for mitigation measures to address potential leachate from waste rock piles exaggerates the risk from waste rock storage. As discussed in the comments by the engineers and scientists at Geosyntec:

> The [EPA] statement [at pp. 8-12] that half (50%) of the leachate from waste rock outside of the leachate zone will escape and flow to surface waters is unsubstantiated. While the 2013 Assessment references the Wardrop (2011) (i.e., Ghaffari et al., 2011) report, it fails to include the discussion in the report where it is stated that a low permeability cutoff wall will be installed around the waste rock piles and extraction wells will be installed within the cutoff wall to capture water and leachate infiltrating below the waste rock piles. This system can be optimized by adding wells, increasing pumping rates, and/or installing cutoff walls deeper in order to achieve significantly more than 50% capture. In tandem with proper management of potentially acid generating (PAG) waste rock to maximize its placement within the drawdown zone, the capture of PAG waste rock leachate can be close to 100%.

Geosyntec Consultants, Assessment of USEPA Response to Geosyntec's Comments on the Bristol May Watershed Assessment, at 10-11 (May 22, 2013) ("Geosyntec Comments"). (p. 24-25)

EPA Response: The assessment describes the need for additional mitigation in Section 8.2.4.

8.58 The Assessment exaggerates the risk of wastewater treatment plant failure.

EPA also has made unwarranted assumptions about the operation and potential failures of a wastewater treatment plant ("WWTP") at the proposed mine. The environmental engineers at ERM explain:

> The Assessment states that it takes into consideration "modern conventional mitigation practices as reflected in published Pebble materials and as suggested in mining literature and consultations with experts" (p. ES-26), but in fact it does not. For example, the Assessment assumes that in the event of a WWTP failure that water would be released directly to streams. This does not reflect international best practice, which would instead route wastewater in the event of a WWTP failure to either the Tailings Storage Facility (TSF) or the Mine Pit. If this best practice measure was incorporated, none of the impacts referenced in Chapter 8 of the Assessment would occur.

Another example relates to stream flow modification. The Assessment notes, but the Executive Summary does not, that the extent of stream flow modification is very sensitive to the location of the WWTP (p. 7-59). ERM Comments at 9. The foregoing omissions of engineering management options creates an exaggerated risk scenario for WWTP operation.

<u>EPA Response:</u> The first part of the comment does not recognize that detection of treatment failure and diversion of effluent depend on systems that also could fail. The second part of the comment does not state how acknowledgement of the sensitivity of streamflow modification to WWTP location constitutes an exaggeration of risk.

<u>Weber Sustainability Consulting (Doc. #4319)</u>

8.59 The part played by iron-oxidizing bacteria in copper mine waste rock dumps was studied extensively at Bingham Canyon Mine, resulting in deliberate acid-leaching of dumps. This is a universal phenomenon in sulfide ore deposits, whether copper, lead, zinc, molybdenum, or what other metal. Bacteria as mediators of chemical reactions, particularly *Thiobacillus ferrooxidans*, are very significant in these reactions, whether deliberate or meteoric. They deserve further study at Pebble, please! (Reference: C. Brierley, "Microbiological Mining," Scientific American Aug 1982 Vol. 247 No. 2, pp. 44-53). In our work at Kennecott with redox-manipulating aquatic environments ("wetlands," though no wetlands plants were grown), T. ferrooxidans persisted even after sulfate-reducers had produced enough H_2S to precipitate metals and most sulfate, demonstrating the persistence of this bacillus.

<u>EPA Response:</u> We agree that this is potentially an important point. However, the scenario does not include deliberate acid-leaching of dumps and we have no good information on leaching of the potential waste work beyond the tests reported by the PLP.

8.60 Porphyry copper means acid at least in proportions as great as here at Bingham, which is surely one of the largest and worst in the world (about 2 gallons per pound of copper, by one back-of-envelope calculation).

<u>EPA Response:</u> We are aware of the issues at Bingham Canyon, but chose to estimate acid leaching on a site-specific basis.

8.61 The biogeochemical processes of copper mines are persistent and pernicious, producing acid in copious, strengths, quantities and complexity, particularly bearing selenium, aluminum, copper, cadmium, arsenic, and other metals that are held in solution at pH 2.0 to 4.0. If the geneii is let out of the bottle, getting it back in is nearly impossible. Selenium from waste rock, particularly, is a grave concern for its toxicity, teratogenicity and mutagenicity, possibly causing death, deformation and reproductive failure in all fish species, and with profound effects on amphibians, reptiles and birds in the ecosystem. In both wetlands and streams, selenium probably is one of the greatest concerns accompanying acid formation and consequent metals transport. (References: Zingaro and Cooper, Selenium, 1974; A. Dennis Lemly, Selenium Assessment in Aquatic Ecosystems: A Guide for Hazard Evaluation and Water Quality Criteria, Springer 2002; Lemly, Assessing the Toxic Threat of Selenium to Fish and Aquatic Birds, Ecosystem Monitoring and Assessment, 43: 19-35; Lemly, Environmental Implications of Excessive Selenium: A Review, in Biomedical and Environmental Sciences, 10: 415-435, 1997).

EPA Response: Selenium concentrations are estimated to be low.

8.62 Phytotoxic aluminum tends to be present in great quantities in leachate from waste rock, occurring as aluminum hydroxide, hydroxysulfate, or in complexes that coat rock surfaces, killing plant life at all scales. Aluminum can present a formidable barrier to water treatment, as well as to water management. Here in Utah, the environment is sufficiently nutrient starved that plants often are not in evidence, but when they are, aluminum is a serious challenge. This is especially true when aluminum is at 2,000 ppm or greater, which it is routinely in leach water from waste rock. The following photo of an acidic flow below Kennecott's Keystone Dump prior to cutoff wall construction is a sample of the aluminum hydroxide in extremely acid flows (pH <2.5), in this case with filamentous algae.

EPA Response: Even in the acidic leachate from the Pebble East pre-Tertiary waste rock, the concentration of aluminum is relatively low (0.38 mg/L, Table 8-7).

8.63 Tailings may or may not present the magnitude of biogeochemical threat posed by waste rock dumps, but insofar as they do, then the sulfide minerals that break down to produce acid mine drainage promises to endure and to reduce salmon and trout populations inestimably because of the massive quantities presented.

EPA Response: The tailings are not expected to be acid-generating.

8.64 The physical effects of tailings sedimentation spread among the many rivers and lakes below the Pebble deposit were there to be tailings containment failure due to weather events beyond design parameters, earthquakes, or combined effect of more than one of these events, spells disaster for salmonid spawning in streams. Clean gravels and rock streambeds are crucial to these fish, as we see in trout streams across western America. The immense volumes of tailings discussed in the 0.25, 2.0 and 6.5 versions of the Pebble mine mean little to most people witnessing these phenomena. Perhaps a satellite photo of the Kennecott Tailings Impoundments as of 1999 will communicate what 2.5 billion tons of tailings look like, heaped to about 220' of depth on 5700 acres of the old tailings impoundment (~9 sq.mi.), and about 50' of depth at that point in the expansion, an area of approximately 2240 acres (~3.5 sq.mi.), with the Great Salt Lake at upper left, with its migratory shorebird and waterfowl populations at definite risk from selenium from multiple Kennecott sources.

<u>EPA Response:</u> Comment noted, but we believe that photo would not materially help readers interpret the assessment.

8.65 Exothermic reactions in waste rock may contribute significantly to alteration of temperature in affected streams. The temperature of leachate emerging from the Bingham Canyon Mine's waste rock dumps approaches 80^{o} F, year-round, melting fresh snow from dumps all winter long. We can't guess what Alaska's climate would do to this equilibrium, but suffice it to say that temperatures will be far above normal water temperatures.

<u>EPA Response:</u> Although we addressed thermal effects on streams in Section 8.3, exothermic microbial processes in the waste rock piles were not addressed.

<u>**Center for Biological Diversity (Doc. #2922)**</u>

8.66 Metallic sulfide mines have a poor environmental record especially where the ore body is at groundwater, as the Pebble deposit. Maest et al's (2006) study of recently permitted mines in the U.S. found that sulfide mines are very likely to develop pollution problems. Mines involving metallic sulfides have such a high risk that water quality exceedences are almost certain to occur for acid drainage and contaminant leaching. This analysis found that 85% of sulfide based mines polluted surface water, and 93% of sulfide mines polluted ground water. Significantly, the environmental documents for 89% of the sulfide mines that developed acid mine drainage did not predict that this would occur (Maest et al. 2006).

Any accidents or failures of Pebble Mine operations would greatly increase impacts on the salmon ecosystem and hence on Iliamna Lake seals. Accidents include (1) the release of acid, metal, or other contaminants from the mine site, waste rock piles, and tailing storage facilities (2) the failure of roads, culverts, and pipelines in the transportation corridor, including spills of copper concentrate; and (3) the catastrophic failure of the tailings dam. Evidence from other long-term mines of similar design and scope suggest that one of more of these accidents or failures are likely to occur, and would result in immediate, severe, and long-term impacts on salmon and salmon habitat and production (EPA 2012, 2013).

<u>EPA Response:</u> Comment noted; no change required.

<u>**The Wildlife Society (Doc. #5272)**</u>

8.67 Large-scale mining would jeopardize the entire Bristol Bay ecosystem even without any failures. Mine tailings and impacts from leaching of copper, stream acidification, and dredge and fill activities would impact dozens of miles of streams. Copper leaching alone could directly impact up to 35 miles of river beyond the mine site, and indirectly impact 51 stream miles. All of this assumes a best-case scenario where the mine tailings, which must be treated in perpetuity, are successfully contained. The waste stream from this mine will inevitably damage the salmon and the ecosystem for which they are a keystone species.

<u>EPA Response:</u> Comment noted; no change required.

Natural Resources Defense Council (Doc. #5378 and #5436)

8.68 The 2013 Assessment assumes that mining and road systems will work as planned and that waste storage, treatment plant and transportation corridor spills can be quickly controlled even though the Alaskan environment is notoriously harsh and unstable.

EPA Response: We do not make those assumptions in the assessment, as accidents and failures are evaluated. We assume mitigation measures would be used, note that these measures do not always work as planned, and evaluate potential risks.

8.69 The peer review panel noted that the risks associated with potential spills from "day-to-day" operations – such as risks from water treatment, pipeline and road-culvert failures – deserved more attention in the Assessment. In response, EPA developed a systematic model of potential surface and groundwater contamination from releases, cumulative effects and management problems. The model assumes best management practices and applies both during day-to-day operations and after the mine's closure.

EPA Response: Comment noted; no change required.

8.70 The sources of water discharge under routine operations include effluents discharged from the treatment plant, uncollected leachates from the tailings storage facilities, and waste rock piles. The hydraulic conductivity of the substrate material located near possible dam sites varies greatly, with "localized discontinuities" in the rate of groundwater conveyance resulting from fractured bedrock. This means that even a small number of flowpaths with hydraulic conductivity that is higher than expected could significantly increase the direction and quantity – and therefore the potential adverse effects – of leachate flow.

EPA Response: We believe that assumptions concerning leachate flow are reasonable.

8.71 The waste rock piles in EPA's mine scenarios – based on those described in the Wardrop Report – do not include liners. Given the geological complexity and permeability of surficial layers, in the Pebble 2.0 mine, for example, only 84% of potentially acid-generating leachate and 82% of total waste rock leachate would be captured.

EPA Response: Comment noted; no change required.

8.72 Post-closure risks are also dramatic. After closure under the Pebble 0.25, 2.0, and 6.5 scenarios, the mine pit would fill with water for approximately 20, 80, and 300 years, respectively. Eventually, without collection and treatment, the pit water would be a source of leached minerals to streams. "Pit water composition cannot be predicted with any confidence, but some degree of leaching is inevitable." Post-closure water treatment failures are a challenge because they tend not to be promptly detected and corrected. In addition, because site hydrology and chemistry would change over time, "treatment requirements would change and the responses might be slow."

EPA Response: Comment noted; no change required.

8.73 Exposure response relationships used to screen leachate constituents are considered in detail, as is the toxicology of the major contaminant of concern, copper. [Footnote: Though copper is responsible for most of the estimated toxicity, total metal toxicities, including impacts from aluminum, cadmium, cobalt, lead, manganese, selenium and zinc, are estimated to be significantly higher. EPA ASSESSMENT, supra note 3, at 8-32 to 8-34, 8-38.] Consistent with the structure of the Assessment as a whole, EPA separates its analysis of adverse effects that would result from routine operations, from those produced by failures. All are unacceptable under 404(c) standards. [Footnote: The track record of U.S.-based porphyry copper mines also reveals an industry in which unplanned contaminant release is commonplace. A review of the 14 porphyry copper mines that have operated for at least 5 years in the United States found that all but one had experienced "reportable aqueous releases," with such events ranging from three to 54. Releases of mine water have ranged from chronic uncaptured leachate release to acute events resulting from equipment malfunctions, heavy rains, or power failures. The record of analogous mines therefore indicates that "releases of water contaminated beyond permit limits would be likely over the life of any mine at the Pebble deposit."]

EPA Response: Comment noted; no change required.

8.74 The Assessment reveals that even if the wastewater treatment system operates perfectly for the rest of time – an impossible proposition – water quality would suffer unacceptable adverse effects from copper and other metals that leach from tailings and waste rock, escape capture, and move to shallow groundwater and surface water. These adverse effects under routine operations include:

- Toxic effects from acute and chronic copper exceedances on aquatic invertebrates in 9.3, 39, and 52 miles of streams in the Pebble 0.25, 2.0, and 6.5 scenarios, respectively; [Footnote: EPA Assessment at 8-56. Invertebrates are a food source to immature salmon and all post-larval life stages of resident rainbow trout and Dolly Varden. Effects on invertebrates are therefore "highly relevant" to protecting salmon and other valued fish, and "protection of fish requires protection of sensitive invertebrates." EPA Assessment at 8- 55.]
- Copper concentrations sufficient to cause fish avoidance of 18 (Pebble 2.0) and 35 miles (Pebble 6.5) of streams;
- Copper concentrations sufficient to kill fish in 2.4 (Pebble 2.0) and 7.5 miles (Pebble 6.5) of streams.
- Copper levels in 13.6 miles of the South Fork Koktuli River with direct effects, including death and stream avoidance, to more than 300,000 fish in the Pebble 2.0 scenario.
- 100-fold copper exceedances in the Pebble 6.5 scenario, sufficient to directly affect more than a half million fish through aversion, sensory inhibition, inhibited development, or death in 26 to 31 miles of stream.[146] Under this scenario, copper is estimated to exceed chronic water quality criteria at all stations on the South Fork Koktuli River, two of six stations on the North Fork Koktuli River, and three of seven stations on Upper Talarik Creek. [Footnote: EPA Assessment at 8-38. Cadmium and zinc also exceed chronic criteria, but at fewer stations and by much smaller magnitudes.]

EPA Response: Comment noted; no change required.

8.75 Even absent failure, these effects clearly meet the threshold for 404(c) action. When we add the risk of a Wastewater Treatment Plant ("WWTP") failure, the effects to Bristol Bay are magnified significantly. The number of fish experiencing death or an equally detrimental effect such as loss of habitat from a WWTP failure would range from 10,000 to one million across scenarios. Stream lengths of 30, 62, and 62 miles would have copper concentrations sufficient to directly affect fish in the Pebble 0.25, 2.0, and 6.5 scenarios, respectively. And sensory inhibition or aversion would affect 600,000 to 1.4 million focal fish species. Treatment plant failure in the Pebble 2.0 and Pebble 6.5 scenarios would cause copper levels directly affecting more than a half million of the focal fish, including 25 to 31 miles of "acute lethality to all life stages in most of the reaches." The effects of a plant failure could be most devastating depending on its timing and duration, with the most severe adverse effects if it occurred during the period of salmon return.

EPA Response: Comment noted; no change required.

8.76 The remaining leachate, which would enter in Upper Talarik Creek, would be more than six times the acute lethal concentration for trout in the Pebble 2.0 scenario, and would require dilution by more than a factor of 10 to avoid acute lethality of trout in Pebble 6.5. Some invertebrates would only avoid chronic toxicity with dilution by a factor of 490. [Footnote: EPA Assessment at 8-50. EPA used the mean leachate concentration and assumed complete separation of NAG and PAG rock. If instead 5% of material in the NAG rock pile is PAG rock, as assumed in the Wardrop Report, leachate copper concentration estimates could be too low by factors of 2.8. Id. at 8-60.] As discussed in Section III.B.2.b, using a liner as a "best practice" mitigation measure would be economically infeasible and insufficiently effective to prevent the harm.

EPA Response: Comment noted; no change required.

8.77 A mine design based on conventional practices could be sufficient for a typical porphyry copper mine equivalent to Pebble 0.25, but not for the more likely Pebble 2.0 and 6.5 mine sizes. Even additional "best practice" mitigation measures, such as lining waste rock piles or reconfiguring the piles, raise questions of efficacy. Liners create stability risk, and liner material breakdown and punctures by equipment or rocks can limit their effective life. The cost is also potentially prohibitive. It is also reasonable to ask how a "best practice" can be designed when longer-term behavior of the materials and their distribution within a waste rock pile is not fully understood. Effective mitigation is certainly unlikely in a region for which a Pebble 6.5 leachate barrier or collection system would require *more than 99% effectiveness* to avoid exceeding the copper criteria. For example, even where a waste rock pile is constructed based on sound studies of current risk, the properties of the pile may change over time and breaches may occur. Freeze/thaw cycling in colder climates may cause cracks, channeling, and exposure of surfaces below the cover, which could result in accelerated weathering and leaching of materials. Post-closure, the volume of water requiring treatment would range from 10 million m^3/yr for Pebble 0.25 to over 50 million m^3/yr for Pebble 6.5. There is simply *no precedent* for the long-term management of water quality and quantity on this scale at an inactive mine – let alone at a rate of 99% effectiveness.

EPA Response: Comment noted; no change required.

8.78 (…) To avoid exceeding the copper criteria, a leachate barrier or collection system for the Pebble 6.5 scenario would require more than 99% effectiveness, and predicting pit water quality has a high degree of uncertainty. [Footnote: EPA Assessment, *supra* note 3, at 8-56, 6-33. As described in Section VI.B.2 of our last submission, copper standards and criteria are based on conventional test endpoints of survival, growth, and reproduction. However, as EPA notes, "research has shown that the olfactory sensitivity of salmon is diminished at copper concentrations lower than those that reduce conventional endpoints in salmon." Id. at 8-28. These laboratory-based criteria are therefore not fully protective of the aquatic ecosystems, as field studies of streams contaminated by copper and other metals have shown. Id. at 8-35.] Seepage and leachate monitoring and collection systems, as well as the WWTP, might therefore need to be maintained for hundreds to thousands of years. It is "impossible" to evaluate the success of such long-term collection and treatment systems for mines because "no examples exist." Such long timeframes "exceed both existing systems and most human institutions," and abandonment of the site would leave untreated leachate to flow to the streams draining the site, reaping havoc on the watershed ecosystems.

<u>EPA Response:</u> Comment noted; no change required.

8.79 EPA describes several additional "day-to-day" routine and failure-driven adverse effects that would be expected from mining in Bristol Bay. First, interception of groundwater for mining purposes and release through a WWTP would cause "serious" population impacts by altering the complex ways in which groundwater feeds stream channels and impacting thermal heterogeneity. Alteration of surface-water and groundwater flows from mine development and operation would impact water temperatures. Groundwater-surface water interaction supports thermal heterogeneity, which is closely linked to salmon migration, spawning and incubation. Treated water returning to streams would be expected to have different thermal characteristics than streams.

<u>EPA Response:</u> Comment noted; no change required.

8.80 Northern Dynasty erroneously claims that treated water could be returned to the watershed without compromising the complex groundwater hydrology of the region. The methods they present for doing so are unproven and would be experimental, and their efficacy is not supported by scientific documentation.

<u>EPA Response:</u> Comment noted; no change required.

<u>Wild Salmon Center (Doc. #5782)</u>

8.81 Because we do not believe that billions of tons of toxic waste can be successfully contained to the mine area, we agree with EPA's evaluation of the various tailings dam failure scenarios and perpetual water pollution problems caused by normal mining operations.

<u>EPA Response:</u> Comment noted; no change required.

8.82 Given the engineering limitations of waste rock and toxic wastewater containment, we do not believe that mitigation or "perpetual" wastewater treatment efforts will protect this highly productive salmon ecosystem from widespread toxic pollution. For that reason, we appreciate EPA's assessment of how toxic pollution from metallic sulfide mining can have additional reasonably foreseeable effects on salmon populations in Bristol Bay.

<u>EPA Response:</u> Comment noted; no change required.

American Fisheries Society (Doc. #3105)

8.83 It assumes that wastewater treatment will meet all state and national criteria; it is unclear if that will be via mixing zones and whether those criteria adequately account for sensitive macroinvertebrate species and salmonid behavioral effects (*see* McIntyre et al. 2012. Low level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators. Ecological Applications 22: 1460-1471; Pond. 2010. Patterns of Ephemeroptera taxa loss in Appalachian headwater streams, Kentucky, USA. Hydrobiologia 641: 185−201).

EPA Response: Consistent with the State of Alaska's regulations, the assessment states that no mixing zone would be allowed. However, mixing processes are discussed. Sensitive invertebrates and behavioral effects (which are the result of sensory effects) are also addressed. However, the Pond reference does not address copper.

Center for Science in Public Participation (Doc. #5540 and #5657)

8.84 The assumption that 50% of the leachate would be captured from unlined waste rock piles (Section 8.1) is too optimistic.

Recommendation: provide defensible references for this claim.

EPA Response: This estimate was based on best professional judgment.

8.85 Table 8-9. Estimated concentration of contaminants of concern in effluents from the wastewater treatment plant, tailings, non-acid-generating waste rock, and potentially acid generating waste rock. Values are µg/L unless otherwise indicated.

"Mg" is listed as a contaminant in this table. Is this Mg or Mn, which would be a more typical contaminant of concern (and Mn is not listed in the Table)?

Recommendation: I also suggest including Fe (as well as Mn) in the table.

EPA Response: Elements are included if they were reported in the PLP Environmental Baseline Document.

8.86 8.2.2.1 Copper – Copper Exposure-Response Uncertainties

"… copper concentrations are naturally elevated in the highest reaches of the South Fork Koktuli River so biota in those reaches may be somewhat resistant to copper additions." (p. 8-31)

Analysis of water quality data collected by CSP2 indicates that the extent of naturally elevated copper concentrations are limited.

In addition, it is also possible that the presence of "resistant" biota might suggest the preferential existence of certain species (or conversely the elimination of non-resistant species), rather than the adaptation of existing species to high levels of contamination.

EPA Response: Available data are insufficient to make the suggested distinction.

8.87 8.2.5 Uncertainties

"The tailings test data do not include pyritic tailings, which are strongly acid-generating. This would tend to underestimate the metal content of tailings leachate, but the effects on leachates from a TSF are likely to be small due to the relatively small proportion of pyritic tailings." (p. 8-58)

Pyritic tailings would equal 14% of the mass of the ore mass. It could be argued that this is not a "relatively small proportion" of the tailings.

EPA Response: The "likely to be small" statement has been deleted.

8.88 Attachment C: Notes on Northern Dynasty Minerals 2nd Watershed Assessment Comments.

1. EPA has continued to ignore modern mine engineering practices and regulatory requirements; including,

a. "Seepage Rates Would Never be Permitted" (NDM 2013a)

NDM reviewer Geosyntec asserts the EPA's assumption of 50% capture is too low, and is unsubstantiated. Geosyntec goes on to assert that 100% capture is achievable – but does not substantiate its assertion with references – the same thing NDM/Geosyntec is critical of EPA of doing. EPA has used its "professional judgment" in assuming a 50% capture seepage rate, and lacking good data to substantiate something to the contrary, this assumption is reasonable for the purpose of a risk analysis.

See the comments for B (3) below.

b. "Water Treatment Plant Designed to Fail" (NDM 2013a)

In the Second External Review Draft, the assessment considers risks from routine operation of a mine designed using modern conventional mitigation practices and technologies and with no significant human or engineering failures. The assessment also considers various failures that have occurred during the operation of other mines and could occur in this case, including failures of a tailings dam, pipelines, a wastewater treatment plant, and culverts. (Second External Review Draft, p. ES-11)

EPA Response: Comment noted; no change required.

Moore Geosciences, LLC (Doc. #2911)

8.89 Even though the expanded description of the potential releases to the environment from operations is well founded and complete, some of the assumptions are conservative to the point of underestimating the potential release/concentration of contaminants. One example is the concentration used from various sources of contamination to surface and ground water. The assessment uses mean concentration from various tests to determine source concentration (e.g., leachate) for all calculations and mixing models. The report notes that, "The primary concern during routine operations would be waste rock leachate." (page 8-4). However, the authors have taken a very conservative approach in analyzing these effects that leads to an underestimation of the potential effects. This underestimate results from the authors using average values for leachate tests. This is especially important in heterogeneous systems where, "Actual hydraulic conductivity would likely span several orders of magnitude, from rapid flow in large fractures to essentially no flow in tight formations. Even a small number of flowpaths with higher than expected hydraulic conductivity could significantly affect the direction and quantity of flow." (Report 8-11) Locally high sources could severely impact down gradient systems if they coincide with these high-conductivity pathways. In such cases, there is no reason to expect actual values in water released from storage facilities to be of average concentration. There would be high values and low values, depending on the source material. The high values could potentially have large local effects and also extend well beyond the source – larger and farther than predicted in the revised assessment. The importance of considering the full range in potential source concentrations can be seen in the data from Pebble West Zone waste rock samples. These samples have a mean Cu concentration of 1.6 mg/L (which was used for modeling) but has a very large standard deviation of 3.25 mg/L. Copper values in the original test data from Pebble West Zone samples show that 24% of samples have values from 3.8 to 10.6 mg/L, substantially higher than the mean value used to assess potential damage to downstream aquatic systems (report Table 8.8 and Appendix H, Table 4). Using the mean value could therefore severely underestimate the potential release of toxic metals locally and the extent of contamination down gradient/downstream from the source materials could be greatly enhanced by high conductivity zones. This is especially true considering the large amount of waste material, the complexity of the physical and hydrologic system, the range of conductivity of potential flow paths, and the long time over which leaching will occur. Modeling using the range of values found in leachate tests would better characterize the level of contamination from leakage of mine facilities and waster materials.

<u>EPA Response:</u> It would be possible to estimate higher metal concentrations by assuming extreme conditions. However, the use of average values was judged to be appropriate based on the opportunities for mixing during rock disposal, leaching, groundwater transport, and instream dilution. Our assumptions were sufficient to indicate that the standard practices described by Ghaffari et al. (2011) would not be sufficient to mitigate effects of waste rock leachates.

<u>W. M. Riley (Doc. #3660)</u>

8.90 My one substantive comment concerns the assumption that wastewater treatment during routine operations will normally meet applicable water quality criteria and effluent limits. As shown in Table 8-9, copper influent concentrations of 72/100/150 µg/l (per the Pebble 0.25, Pebble 2.0 and Pebble 6.5 scenarios) would require treatment down to 1.1 µg/l with no allowance for dilution due to the preponderance of anadromous streams that provide for salmon spawning and rearing. Treatment flows are estimated to be 10.2/12.2/49.4 cubic meters/year for the three mining scenarios. However, the Assessment does not take into account that the project area's average temperatures are below freezing seven out of 12 months of the year. So if one assumes that discharge could only occur when streams in the project area are flowing (like the Red Dog mine), say six months out of the year, the flow rate is effectively doubled.

So the key question is, are there wastewater treatment systems anywhere in the world that are currently treating such massive wastewater flows, which are orders of magnitude above any currently operating Alaska mines (all of which rely on dilution), to achieve water quality criteria end-of-pipe and, in particular, a minute copper criterion of 1.1 µg/l? This is a critical question insofar as a prerequisite to issuing a Clean Water Act section 402 National Pollutant

Discharge Elimination System (NPDES) permit is a determination that there is “reasonable assurance” that the proposed discharge will meet applicable WQC and effluent limits. Furthermore, if it is determined that no such comparable wastewater treatment systems are in operation, then the assumption upon which risks are assessed that effluent limits at the Pebble project would be met during routine operations should be carefully re-examined. Also, the document should make clear that the Pebble 0.25 scenario is not considered economically viable and therefore the risks associated with this scenario should be appropriately discounted.

EPA Response: The assumption that criteria would be met is not based on any example of an existing water treatment system. The Pebble 0.25 scenario is included at the suggestion of peer reviewers and is described as relevant to mines other than Pebble.

K. Zamzow, Ph.D. (Doc. #5054)

8.91 The assumption that 50% of the leachate from the unlined waste rock piles will be captured (Section 8.1) should be supported by reference material or further substantiation.

EPA Response: See response to Comment 8.84.

8.92 4. Section 8.1 suggests that a wastewater treatment plant (WWTP) will meet water quality criteria, but Figure 8.1 suggests that even a fully functional WWTP will cause metals and TDS to Increase below the plant.

This is accurate, in that ambient water quality generally has lower concentrations (is better quality) than state water quality criteria, particularly relative to the quality of water in the North Fork Koktuli. It might be good to specifically state that discharge water that meets state criteria will cause metals and sulfate concentrations to increase in the rivers receiving the discharge.

EPA Response: The assessment already relates emissions to background.

8.93 5. The TDS in the tailings leachate (Section 8.1.1.5, Table 8-9, Table 8-16, Table -17) seems low –

> Was the addition of lime in water treatment considered? Generally sulfate is near 2,000 mg/L in tailings water due to the addition of lime during treatment and the solubility limits of calcium sulfate. Why weren’t Tables 8-16 and 8-17 developed for the Pebble 2.0 scenario? Why is selenium not listed in Table 8-15?

EPA Response: The TDS values were based on the results of leaching test tailings. The final assessment mentions the disposal of water treatment wastes in the TSFs and their possible contribution to toxicity.

8.94 Recommendations for Mitigation – Water Treatment:

- Apply a BLM-based criterion for copper and potentially for cadmium and zinc, based on the ambient water quality below the WWTP outfalls. Consider more restrictive criteria than the BLM or Alaska water quality criteria if necessary to be protective.
- Consider at a minimum the additive effects of metals in mixtures.

- Require water quality criteria to be met at the point of discharge (no waivers or mixing zones).
- TDs discharge limits should consider the sulfate likely to be generated from the WWTP process, as well as from waste rock leachate, and be based on relevant testing that includes fish egg fertilization. Limits should consider the particular mix of ions likely to be dominant.
- Regular biological and ecological monitoring should be conducted. Biological monitoring stations should not be eliminated or moved further from the point source of discharge as discharge permits are renewed.
- Wastewater treatment discharge flow should be required to match seasonal flow cycles to prevent higher than natural flows into the system, channelization, and scouring. This should require maintaining capacity for storm water to be collected and meted out, particularly with a view to prevent "common mode" failures.

EPA Response:

- **BLM-based copper criteria were used (see Tables 8-11 through 8-14). Cadmium and zinc levels are low and their BLM models have not been reviewed by EPA.**
- **Additive effects were considered (e.g., see Table 8-18).**
- **This assessment does not set permit requirements.**
- **The toxicity of individual ions in the mixtures was assessed. TDS was also considered, to respond to the State TDS standard.**
- **This assessment does not set permit requirements.**
- **We believe that loss of flow causing habitat loss is a greater issue than increased flows causing channelization and scouring.**

8.95 Recommendations for Mitigation – Waste Rock Leachate Mitigation:

- Permits should presume that PAG will not be completely separated from NAG, and base models of waste rock leachate on this presumption.
- Require liners under the waste rock piles.
- Require lysimeters and temperature monitors to be placed during waste rock pile construction.
- PAG should be processed throughout the mine life and all of it processed at the end of mine life.
- PAG should be surrounded with NAG waste rock.
- Keep PAG rock within the cone of depression.

EPA Response: This assessment does not set permit requirements.

8.96 Sodium Ethyl Xanthate. These comments refer to Sections 8.2.2.5, 8.2.3.2, and 10.3.3.3.

1. It is presumed that a spill of the ore processing chemical sodium ethyl xanthate will result in a fish kill, based on toxicity. Toxicity reportedly ranges from 1 µg/L (Australia and New Zealand, species not noted) to 50 mg/L (rainbow trout). This is a wide difference in toxicities, suggesting that studies with relevant species and life stages should be conducted.
2. The toxicity discussion may want to include the mechanism of toxicity or the effect on aquatic life, for both sodium ethyl xanthate and its breakdown product carbon disulfide. Also, the reference Hidalgo and Gutz 2001 is not a particularly good one for toxicity; better references would be the MSDS sheets and Alto, K S Broderius, and LL Smith, Jr. 1977. Toxicity of xanthates to freshwater fish and invertebrates. University of Minnesota.
3. Is it possible that a spill of xanthate would not result in a fish kill if it occurred in winter onto frozen ground or on top of a frozen stream? Was this assessed?

<u>EPA Response:</u> We consulted Alto et al. (1977), but chose the Hidalgo and Gutz (2001) report, which is an up-to-date review. We agree that additional toxicity data are desirable.

8.97 Comments on Water Chemistry During Mine Operation.

6. Tailings pore water during mining operations is presumed to reflect that shown in humidity cell tests.

This may not be accurate if cyanide is used to remove gold. Cyanide in pore water is associated with keeping copper and other metals in the dissolved form and susceptible to increasing the copper concentrations in leachate (and the nitrogen inputs to receiving waters). The Assessment uses the mean of leachate tests, although these tests showed highly variable chemistry and used non-standard procedures (e.g., larger particle sizes than standard tests).

<u>EPA Response:</u> Cyanide leaching for gold is considered separately. It would not be applied to bulk tailings.

8.98 Comments on Water Chemistry During Mine Operation.

7. The discussion on analogous sites (Section 8.2.2.1) where dissolved copper is present and the combined copper, cadmium, and zinc concentrations affect insects even though concentrations meet water quality criteria is interesting and relevant.

The South Fork Koktuli is not really a “river” at the headwaters in the area of the deposit, it is more an assemblage of tiny tributaries moving toward a low point just above Frying Pan Lake. Some tributaries do have elevated copper, while others do not. 3 Additionally, some of the elevated metal concentrations occur only during the “first flush” at snowmelt or rains. And as with the analogous sites, most of the water in rivers draining the Pebble deposit would see an increase in sulfates and metals even if WWTP effluent met water quality criteria at the point of discharge.

<u>EPA Response:</u> Comment noted; no change required.

8.99 8.2.3.6 Spatial distribution of estimated effects. Under Pebble 0.25 Scenario Routine Operations, North Fork Koktuli, NK199A should be NK119A.

EPA Response: **Correction made in final assessment.**

8.100 Table 8-10. Background concentrations. It would be helpful if the title to this table reflected that this represents routine operations.

EPA Response: **This table reflects current background concentrations, not background concentrations under routine operations.**

J. Bronson (Doc. #5523)

8.101 As part of this, please include the confidence intervals for all of your predictions regarding water quality and the likelihood of adverse events.

EPA Response: **The comment does not specify the sort of confidence intervals desired. Frequentist intervals are not possible given the unique nature of the potential mining activity. Subjectivist (i.e., Bayesian) intervals were judged too difficult to defend.**

Unknown (Doc. #5539)

8.102 See attached file. I took this picture last summer on the shore of Lake Iliamna between Newhalen and Igiugig [**photo deleted from this document; see original public comment for photo**]. As chapter 8 of this document explains, we do not have a comprehensive understanding of the way the water moves in this watershed. It seems to be a very delicate and unique system. More information is needed.

EPA Response: **Comment noted; no change required.**

M. Bronson (Doc. #5641)

8.103 Confidence Intervals. Please consider calculating statistical error bounds for many of your quantitative estimates. For example, provide standard errors (SEs) for mean concentrations of contaminants listed in the tables of Section 8. I understand that non-normal distributions may make normalization necessary first. And I understand that small sample sizes will result in large SEs in some cases. Nevertheless, such error expressions let the reader get a feel for the sources of variability and make comparisons among estimated means in your tables.

Similarly, show confidence intervals for your estimates of frequencies of occurrence. Your risk discussions commonly express predictions of low-frequency events (e.g., 4×10^{-2} events per year). Those predictions are estimates of some index of central tendency based on sampling among past events. Thus, you could calculate their error bounds and show them as confidence intervals, for example, even if they are wide or require normalizing the data first. Your report's Section 8 does a good job detailing sources of uncertainty. However, it is also valuable to show upper confidence bounds for risk estimates because it is those "worst case" likelihoods that are of the most interest to stakeholders.

EPA Response: **The mean leachate concentrations in Chapter 8 are based on the assumption of actual physical mixing of leachates from waste rock samples. Therefore, the leachates of waste rock samples are not independent estimates of a true value, which is the statistical assumption behind confidence intervals. The frequency of occurrence of**

dam failures cited in the comment are not based on frequencies. They are design goals, and thus do not have variances.

8.104 Worst-Case Post-Closure. Add discussions of post-closure worst-case scenarios. Consider addressing the likelihood that contaminants will exceed water quality standards downstream of a Pebble development at any time after mine closure. Account for the eventual deterioration of the post-closure mitigation measures, including dams, their impoundments of acid generating rock, and acid generating waste rock accumulations, as the monitoring and maintenance disappear some time after closure.

Your assessment report, page 8-21, says that the report does not model or evaluate water quality during post-closure because little information on failure rates is available. That assertion dismisses the literature regarding post-closure metal-mine waste and tailings, and the deterioration processes for mine impoundments and diversion structures. Furthermore, Pebble Limited Partnership's own reports (e.g., Wardrop, 2011: p. 54) provide clear enough descriptions to let you apply your general understanding of post-closure deterioration and consequent stream contamination by historical mines to Pebble's proposed project after closure.

<u>EPA Response:</u> More might have been done to model a worst-case post-closure scenario, but we believe the available information is insufficient to model such a case.

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

8.105 The revised Assessment still suffers from attempts to persuade the reader, using pre-regulatory, historic information on mines world-wide, to present worst-case information. Further, the McGrath-area Nixon Fork mine overtopping event, described in Box 8-1, at page 8-20, is still being presented as an example of tailings water release associated with a dam failure, when the cause was due to operation and maintenance error. The revised Assessment does not mention that the issue was immediately addressed by mine personnel, inspected by state and federal regulators, and that no demonstrable damage to surface waters or other receiving environments has resulted.

<u>EPA Response:</u> The Nixon Fork Mine event is presented as an example of overtopping, not dam failure. The point is the occurrence, not who responded or what they found.

<u>Alaska Miners Association (Doc. #2910)</u>

8.106 Error #16: not addressed. The lack of design details makes the EPA's failure analysis meaningless (2012 TR, pages 21-22). The 2012 AMA Technical Review described why the lack of design detail made EPA's 2012 analysis meaningless. It provided examples that illustrated the problem. EPA's 2013 draft did not include any further design details (most likely, because they do not know them, the mine has not been designed). Some designs are more protective than others. EPA's 2013 draft ignored this critique.

<u>EPA Response:</u> Design details are not required. For example, if untreated wastewater is released, the method by which the wastewater should have been treated is irrelevant to the fact that fish will be adversely impacted. Similarly, if treated effluent meets all criteria and standards, it does not matter how that result was achieved.

8.107 Error #17: not addressed. The (lack of) design and the analysis omit prevention and mitigation strategies (2012 TR, pages, 22 – 23). This error is related to the one above. AMA's 2012 analysis provided examples of the type of prevention and mitigation strategies that would decrease the risk. It also indicated that Alaska mines have strategies which EPA's hypothetical mine ignored. EPA's 2013 draft ignored this critique.

EPA Response: The critique was not ignored. In Chapters 6 through 11, the revised assessment contains more consideration of mitigation measures than the original draft assessment. This change was noted by the peer reviewers.

8.108 Error #18: not addressed. The analysis ignores Alaska's record (2012 TR, page 23). EPA predicts a very specific incidence of treatment failure. Yet EPA fails to discuss the fact that Alaska mines do not correspond to their prediction. See also discussion under "Hand picked data sets" on pages 7 – 8.

EPA Response: The specific treatment failures may not have occurred in Alaska, but that does not mean they cannot occur. There are currently no mines of this scale in Alaska.

8.109 Error #19: partially addressed. Assertions about risk are unsupported (2012 TR, page 23 – 24). AMA's 2012 analysis pointed out many assertions about risk in the 2012 document that are unsupported. EPA apparently eliminated some of the offending analysis (without changing the conclusions they contradicted). Some contradictions remain.

EPA Response: Comment noted, but specific contradictions are not identified and thus cannot be addressed.

8.110 Error #20: partially addressed. The conclusions in the Assessment's Executive Summary contradict the conclusions in the body of the Assessment (2012 TR, page 24 – 25). EPA took out the accurate statements in the 2012 draft that concluded that the incidence of water treatment failures could be calculated. Instead, they substituted the legacy data from anti-mining groups described under Error #15, and ignored more geographically relevant, modern-mine date from Alaska and British Columbia, which would have contradicted the conclusion. (We note that Appendix J of EPA's 2013 draft still indicates that failures from properly constructed waste rock piles are unlikely, a fact that contradicts the analysis in the body of the Assessment.)

EPA Response: More relevant mine data are not provided or identified in the comment. Failures of waste rock piles are not part of the scenarios.

8.111 Error #21. A check on conclusions: EPA came to different conclusions for other mine analyses (2012 TR, page 25). EPA's 2013 draft failed to answer why the Watershed Assessment comes to a particular conclusion about water treatment failure, but environmental impact statements that EPA recently wrote comes to different conclusions on the same issue.

EPA Response: The comment does not identify specific environmental impact statements that should be considered, so it is not possible for us to address the comment.

Alaska Community Action on Toxics (Doc. #5541)

8.112 Of course, in the context of a large-scale hard rock mine, waste and water management are of particular concern. EPA clearly acknowledges: Major failure or accident that resulted in long-term disruption of salmon habitat and ongoing toxicity to salmon or their food would significantly affect both subsistence resources and cultural identity. Potential causes of salmon-mediated effects on Alaska Native cultures would differ across the two watersheds. (especially in villages near the mine). (12-7).

EPA Response: Comment noted; no change required.

Alaska Conservation Foundation (Doc. #6803)

8.113 EPA not only clarified and deepened its discussion of Bristol Bay's complex hydrology essential to its productive salmon habitat, it elucidated potential risks from potential failures during mining and post closure. Even with the most advanced technology for water collection and treatment, EPA underscores the high probability of failure and that failure could result in the release of untreated leachates for hours to months. And that in perpetuity, water collection and treatment failures post-closure could lead to indefinite release of leachates into Bristol Bay's waters, impacting Bristol Bay's rivers and salmon habitat for generations, if not permanently.

EPA Response: Comment noted; no change required.

North Coast Rivers Alliance (Doc. #5061)

8.114 Third, the Assessment understates the risks of mining by failing to consider the potential for and effects of foreseeable discharges of mining waste to waters of the United States due to operator error, equipment malfunction, severe weather, earthquakes and other natural and manmade hazards and accidents. Consequently, the Assessment fails to address the virtual certainty that the Pebble Mine will cause large scale and irreversible discharges into Bristol Bay and its tributary watersheds of the many harmful pollutants that are associated with large-scale mining and the related developments it will induce.

EPA Response: The assessment does, in fact, consider the potential for and effects of discharges of mining wastes to waters of the U.S.

Kachemak Resource Institute (Doc. #9123)

8.115 Contingency planning based on risk assessments is inherently a work of fiction. The risk assessment in the present draft is, at best, nebulous. The worst risk cases arising from the variety of possible system failures in large mine infrastructure, would include the sum of all systems failures from water collection and waste water treatment; pipeline failures; tailings dam catastrophic failures; road, bridge and culvert failures; and the cumulative effects of failure events through time-immemorial-reversed to time forward in perpetuity.

EPA Response: Comment noted; no change required.

S. L. O'Neal (Doc. #5528)

8.116 P. 8-28: Why was DOC for BLM set at 1 when that is below the average for all three tributary streams?

EPA Response: The comment confuses DOC levels in streams that were used to determine safe levels in streams and DOC levels in leachate that were used to screen leachate constituents for potential toxicity.

8.117 P. 8-29: It is unclear whether the 20% inhibitory concentration of copper accounts for research indicating olfaction is inhibited at 2-10 parts per billion.

EPA Response: It was set based on the latest research from NOAA, but was adjusted for water chemistry.

8.118 P. 8-31: "On the other hand, copper concentrations are naturally elevated in the highest reaches of the South Fork Koktuli River so biota in those reaches may be somewhat resistant to copper additions."

I am not aware of data to substantiate this statement. Either citation/s should be provided or it should be omitted.

EPA Response: There are no specific data, but acclimation is a common phenomenon. Hence, the cautious statement is justified.

Iliamna Village Council (Doc. #5784)

8.119 Before discussing other geochemical or geotechnical processes involved with the operation of the Pebble Mine, it is useful to discuss the nature of the water resources in the Bristol Bay watershed, especially as they refer to salmon spawning habitat and the survival of juvenile salmon. Chemically, the waters in the two watersheds under consideration in this study are very low in dissolved inorganic substances and natural organic matter. Concentrations of sodium, potassium and calcium ions are very low. Except near some mineral-rich zones, concentrations of metals such as zinc, copper and lead are also very low, as are concentrations of plant nutrient ions such as nitrate and phosphate. The waters are neither acidic nor basic and have pH values very close to neutral (7.0). In other words, the waters are quite pure. All of this is near ideal for salmon spawning and the survival of juvenile salmon. In addition, the temperature of the waters of the rivers and streams of these watersheds is maintained at a fairly constant level due to the influx of groundwater directly into the gravel beds that support salmon spawning. (See below).

These water characteristics have proven to be well suited for the maintenance of a large and sustainable population of especially sockeye, but also chinook, chum and coho salmon. It also supports significant populations of other salmonid and trout species in the two watersheds. However, there is a down side to these characteristics in terms of the potential effects of the introduction of potentially toxic metals into the watersheds. When a dissolved metal ion enters a water body, it can exist in a variety of forms depending on the nature of the water body. Certain water components can react with the metal ions to form "complexes", which are chemically bound species composed of the metal ion and other water constituents. For example, natural organic substances in water form strong complexes with copper, zinc and other potentially toxic metal ions. Other components such as bicarbonate ions, hydroxide ions, and chloride ions can also form such complexes.

Why is this relevant? Interestingly, these complexed forms of copper and other potentially toxic metal ions are not toxic in this form! This is because the metal ions are bound to other components in the water, they cannot be absorbed in the fish gills. So, copper added to many water bodies is immediately rendered non-toxic to fish and other aquatic organisms by the formation of these complexes. It is primarily the free, un-complexed metal ions in water that are toxic. Importantly, in the waters in the Nushagak and Kvichak watersheds, these complex-forming substances are present in extremely low concentrations, causing almost all added copper or other metal ions to exist in their most toxic forms.

In considerations of the effects of the proposed Pebble Mine, copper toxicity is of critical concern. Other toxic metals such as cadmium, cobalt, lead, nickel may be present in water generated through mining activities at the Pebble Mine, but copper is by far the most abundant and also among the most toxic to salmonids. The effects of added copper on fish can occur at many levels. Copper at levels much lower than those necessary to actually kill fish (non-lethal concentrations) can have negative effects on spawning success. One of these is avoidance….fish avoid waters containing toxic metals at concentrations much lower than necessary for mortality. Such low concentrations can also affect the life.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

8.120 Groundwater (water coming up through gravel or porous streambed below the land surface) input into rivers, streams and lakes of the Nushagak and Kvichak watersheds is also critical for successful salmonid spawning. Portions of the Nushagak–Bristol Bay Lowland and Nushagak–Big River Hills areas, including the Pebble deposit area, contain coarse-textured glacial rocks with abundant, high-permeability gravels and extensive connection between surface waters and groundwater. Abundant wetlands and small ponds also contribute greatly to groundwater recharge. This strong connection between groundwater and surface waters helps to moderate water temperatures and streamflows. For example, groundwater contributions that maintain water temperatures above $0^{o}C$ are critical for maintaining winter habitat in streams that might otherwise freeze.

This means that any process that alters the balance of surface water and groundwater inputs into these aquatic systems is likely to adversely influence the suitability of these waters for successful spawning, especially if the influx of groundwater is substantially reduced. Groundwater is of a relatively uniform temperature and groundwater flow helps prevent large water temperature changes as the seasons and water flows change. In the spawning gravels, groundwater moves up from beneath the gravels and maintains flowing, constant temperature water in the spawning beds. This feature of the region, among others, provides ideal spawning habitat. In fact, in Lake Iliamna, sockeye salmon spawn only in areas where groundwater percolates up through the gravel beds, maintaining a constant flow of pure, oxygenated water at a constant temperature.

<u>EPA Response:</u> Doc. #5837 rescinded this comment; no change required.

<u>National Mining Association (Doc. #5557)</u>

8.121 EPA states in the draft assessment that the mine scenarios "would operate under a permit that would require meeting all national criteria and Alaskan standards," and that "the Alaskan Pollutant Discharge Elimination System wastewater discharge permit for a mine would include requirements that all other potentially toxic contaminants be kept below concentrations equivalent to national chronic criteria." However, based in part on the Earthworks report, EPA nonetheless assumes that there will be leakage and discharges that will cause substantial impacts to aquatic life in miles and miles of streams. Likewise, EPA makes assertions such as "copper standards and criteria are based on conventional test endpoints of survival, growth, and reproduction. However, research has shown that the olfactory sensitivity of salmon is diminished at copper concentrations lower than those that reduce conventional endpoints in salmon."

Such assertions amount to the second-guessing of EPA-approved water quality standards, and it is extremely inappropriate for EPA to imply in a draft watershed assessment that state and federal water quality standards are not protective of aquatic life. There are specific regulatory processes – many of which are mentioned by EPA in the assessment – designed to develop water quality requirements. It is improper for EPA to claim that mines meeting those legally developed standards may nevertheless cause unacceptable harm to water quality. Such actions call into further question the validity and scientific soundness of the assessment.

<u>EPA Response:</u> This assessment is based on the best available science. The EPA-approved Alaska standard for copper is based on the old hardness-normalized National Ambient Water Quality Criterion, which has been superseded by the new BLM-based criterion indicating that EPA has already "second guessed" the current Alaska standard. Even the new criterion may not be fully protective, as discussed in the assessment.

8.122 Even more importantly, several of EPA's own peer reviewers call into question the scientific soundness of EPA's use of the Earthworks report in the draft assessment. One peer reviewer stated that he found "the report, by its nature, to be very biased," and criticized that "such reports…attempt to paint the world as either black or white" and "come across as one-sided because they are." That reviewer noted that "most of the report is based on guilt by association." Another peer reviewer pointed out that "an innocent reader might conclude that safe copper porphyry mining operations are not possible" when that is "not the case."

Three of the four peer reviewers also criticized reliance on the report due to its references to older operations and failure to contain important information necessary to meaningfully apply any of its conclusions to the scenarios in the draft assessment. For example, one peer reviewer noted that "most of the mines considered are quite old facilities with operations often initiating in the 1880s," that "the report presents some issues…related to facilities that were designed and constructed before modern environmental regulation, and thus have limited relevance to modern operations," and that "the type of ore processing of the mines evaluated…are different from that proposed in the EPA assessment." That reviewer found that "the implied conclusion that similar or worse accidents and failures will occur at all mines and that accordingly impacts could be severe, is not well supported" and that "the legacy of past operations, age of the infrastructure and type of processing for each mine presented make extrapolation of presented results to other projects difficult. In addition, a release does not always result in environmental impact." Another reviewer pointed out that "incidents are not classified… [and] the authors do not take into account that the mining business is in constant change and each incident results in improvements in engineering technology and in many cases modifications of legislation." He concluded that "just listing failures might result in a bias of the reader, assuming that those incidents never could be avoided," that "this is not the case as many incidents are only of minor importance and modern day mining has more stringent requirements than the older mines investigated," and that "I cannot recommend using [the summary of the report] as a support of the EIS permitting process." Yet another stated that "causes of the problems are unstated and…in a few cases, clear examples of successful mitigation and avoidance…are reported as if they were failures." Even the peer reviewer most supportive of EPA's use of the report stated that "the weakness of the report is that there is not an analysis of the events that could be consider[ed] accidents and those that could be produced by chronic failures, such as bad design…there is no insight into the causes for the failures."

EPA Response: Although the reviewers noted an apparent bias in data interpretation in the Earthworks (2012) report, the data themselves were not found to be biased. Only the report's data, and not its interpretations or conclusions, were used in the assessment. The conclusions criticized in the quotations cited in the comment do not appear in any draft of the assessment. As explained in the assessment, we cannot assume that failures that have occurred in the past are now impossible. It would be irresponsible to ignore the empirical evidence, given the ongoing history of accidents and failures in modern technologies.

Naknek Family Fisheries et al. (Doc. #2823)

8.123 Studies on runoff originating from copper from brake pads on roads in Oregon indicate that salmon are extremely susceptible to minute quantities of copper. Because this is a copper mine being proposed, this should be a huge red flag to the EPA that this is an unsustainable project that will result in depletion of our salmon resources for future generations.

EPA Response: We are aware of those studies and the assessment is consistent with their findings.

C. Borbridge (Doc. #5066)

8.124 I would like more information on the effects of pollutants such as heavy metals and mining related chemicals. I appreciate the information already provided on the effects of copper and various mining activity on the mortality of salmon, but more is needed. In areas with salmon producing waters outside of Alaska industrialization has a wide impact. One of the prominent impacts is a measurable increase in presence of pollutants in the salmon such as mercury. There are two main impacts of mining related pollutants: the impacts from fewer fish and the impacts from the surviving fish having increased levels of pollutants. Both impacts need to be addressed.

EPA Response: The mines are not expected to be sources of mercury or other significantly bioaccumulative chemicals. The possibility of copper and selenium bioaccumulation and the risks that they might pose to salmon consumers are addressed

in Section 12.1. Copper could occur at high concentrations but is minimally accumulated and has relatively low toxicity to mammals and birds. Selenium does significantly bioaccumulate and is highly toxic to birds, but occurs at low levels in test leachates from Pebble materials.

__C. Mebane (Doc. #2927)__

8.125 p. 8-28, regarding copper toxicity modeling using the biotic ligand model, the statement "For the leachates, dissolved organic carbon was set to 1 mg/L (the lowest level accepted by the model)" is not quite correct. In my experience, the model will accept any non-zero value for DOC, and for leachates, I would expect organic sources would be low and DOC values less than 1 mg/L could occur.

__EPA Response:__ **See response to Comment 8.49.**

8.126 p 8-28, the following statement is probably correctly cited but the reference cited seems to have no original data, and is not particularly authoritative: "Rainbow trout is a standard test species that is at least as sensitive to copper as Chinook and coho salmon, brook trout, and brown trout in acute tests (CH2M Hill and The Clark Fork and Blackfoot, LLC 2004)." Suggest revising it to "Rainbow trout is a standard test species that is likely at least as sensitive to copper as Chinook and coho salmon (Chapman 1975, 1978)" (I don't think brook trout and brown trout occur in, or are of particular interest in the assessment area).

__EPA Response:__ **This change has been made in the final assessment.**

8.127 p 8-28, Table 8-13 These extrapolations of potential effects of copper to rainbow trout, which are assumed to be equivalent to salmon, have been extrapolated quite a ways and may not be either reliable or conservative. The root problem may be that they started with the species mean acute values (SMAV) for rainbow trout, which may not have necessarily reflected the most sensitive life stage. Copper (and other metals) and salmonids seem to have a size-sensitivity relationship within the juvenile stages which can relate to bias and lack of conservatism. See Chapman (Chapman 1975, 1978) and USEPA (2001) dealt with this issue in detail on the Clark Fork Montana ecological risk assessment (their appendix A2).

__EPA Response:__ **The extrapolation is acknowledged in the assessment. Rainbow trout are an endpoint species, as well as a surrogate for Pacific salmon species.**

8.128 I suggest deleting Table 8-13, and simply replacing it with the result of Chapman's chronic test with Chinook salmon under conditions of low hardness and low organic carbon (an EC20 of 5.9 µg/L for biomass about 25 mg/L hardness and 1 mg/L DOC (USEPA 2007, table 2)) that seem particularly relevant to water quality in the assessment area. This test has been reviewed and considered reliable in USEPA's (2007) updated copper criteria (their table 2). Because to my knowledge, this is the only chronic toxicity test ever conducted with Chinook salmon and metals, and because it's original "publication" is inconvenient and difficult to locate (Chapman 1975, 1982), we included a table with Chapman's complete results in my subsequent analyses of his data (Mebane and Arthaud 2010). We also analyze a rainbow trout chronic test with copper conducted in low hardness and low organic carbon test waters (25 mg/L hardness, DOC not reported but assumed <1 mg/l), and found almost identical responses, which supports the point about rainbow trout being a reasonable surrogate.

EPA Response: **Table 8-13 is retained in the final assessment, but Chapman's results as reanalyzed by Mebane and Arthaud (2010) have been added to the text.**

8.129 p 8-28, I do concur with the statement that "however, research has shown that the olfactory sensitivity of salmon is diminished at copper concentrations lower than those that reduce conventional endpoints in salmon (Hecht et al 2007)." However, one point of our Hecht et al review was that "conventional" growth endpoints may be more sensitive than commonly realized. In part, this is because results have sometimes been interpreted from rote "standard" statistical tests such as EC20s or the "MATC". At least for length reductions, the toxicity test measurement endpoint most readily related to survival in field studies, fish seldom reach 20% reduction before dying, and thus the endpoint could receive a misleading "greater than" value in compilations.

EPA Response: **We acknowledge that the diminution of sensory acuity occurs at approximately the same concentration of copper as conventional chronic toxicity to early life stages. However, olfactory avoidance occurs at significantly lower concentrations.**

8.130 In Mebane and Arthaud (2010), we extrapolated subtle growth reductions that had been shown in chronic laboratory toxicity tests with Chinook salmon to reduce juvenile migratory survival (which was size-dependent), and further extrapolated the reduced migratory survival to population level changes. It's all somewhat theoretical mathematical ecology, and the system we used for the life histories of Chinook salmon, the Salmon/Snake/Columbia River basin, might not be directly germane to the Bristol Bay watersheds. However, reduced growth is a common finding in long-term exposures of fish with copper, and some mention of the potential biological consequences of reduced growth in fish exposed to only slightly elevated copper concentrations might be considered.

EPA Response: **These findings are included in the final assessment.**

8.131 p 8-28 or 8-29: Another potential effect of low level enrichment of copper is delayed and reduced downstream migration in juvenile salmon. Lorz and McPherson (1977) found concentration-dependent reductions in downstream migration of yearling coho salmon following 6 days of exposure to copper at 5 to 30 μg/L, in low hardness, low DOC test waters in coastal Oregon. Although these studies seem forgotten in the metals-ecotoxicological literature, Lorz and McPherson repeated numerous experiments with various metals. We attempted to summarize and synthesize these on p. 28 and figure A-1 of our Hecht et al (2007) synopsis.

EPA Response: **These findings are included in the final assessment.**

8.132 p. 8-29, regarding dietary exposure to copper: I think the following statement is inaccurate and out of date (emphasis added): "Studies of the tailings-contaminated Clark Fork River in Montana and the Coeur d'Alene River in Idaho have shown that macroinvertebrates can accumulate metals at levels that result in toxicity to fish that consume them (Farag et al. 1994, Woodward et al. 1994, Woodward et al. 1995, Farag et al. 1999)." It's true that these studies showed accumulation and toxicity was correlated with copper. However, in this case correlation was not causation as shown by later studies have demonstrated that the toxicity observed in those studies cited was likely from co-occurring arsenic, and could not be attributed to copper (Hansen et al. 2004; Erickson et al. 2010). This may not change the point of the assessment, since arsenic and copper commonly co-occur together (I didn't try to wade through the rest of the assessment to see if that was expected to be the case in Bristol Bay), but no need to continue repeating the early reports implicating copper caused the toxicity in the mentioned dietary studies, without mentioning the latter studies pinning the effects on arsenic.

EPA Response: This information has been added to the final assessment.

8.133 p8-31 Suggest changing the statement on sensitivity of mayflies as follows, "However, the copper criteria do not include any chronic data for Ephemeroptera ~~in the sensitivity distribution~~ (USEPA 2007)" [Note: edits as shown are intentional and are from original document]: As worded, simply including an Ephemeroptera in the acute SSD for copper probably wouldn't do much because most of the acute test data with copper (and other metals) have produced environmentally exorbitant LC50s that may have little to with true environmental sensitivities of Ephemeroptera to copper (Brix et al. 2011). The problem seems to be inadequate test methods, and those of us who have tested mayflies by collecting late instars in the field and dropping them in an aquarium for a few days of water only exposures are doubtfully reflecting their true vulnerabilities to metals (e.g., Mebane et al. 2012).

EPA Response: These changes were not made, as the statement was correct as written. The point drawn from Brix et al. (2011) is included in the final assessment.

8.134 p. 8-32, Cadmium: The assessment cites some preliminary toxicity values from tests I was involved with, that my co-authors and I have recently updated and corrected. The various tests cited as WE (2002) have been reviewed, corrected and published in the open literature as Mebane et al. (2012) for the acute tests, and Mebane et al. (2008) for the chronic tests. I regret this inconvenience, but think the corrections would be helpful to readers. For consistency with the existing text, I provide "chronic values" which I presume are geometric means of NOECs and LOECs. Awhile this statistical endpoint has been severely criticized in some literature, I presume it was used because alternatives were not available for some data. The following inset is my suggested rewrite changing citations and values, but otherwise keeping the substance. [Note comments in original letter provided in Track Changes and are reproduced here.]

A series of ~~R~~rainbow trout acute median lethal concentration (LC50) values for cadmium from tests conducted over a range of hardnesses of 7 to 32 mg/L ranged from 0.34 to 1.3 µg/L. Mebane 2010; Mebane et al. 2012). ~~An~~ A 53-day early life-stage test of rainbow trout at 21 mg/L hardness gave a chronic value for survival and growth of 0.~~36~~ 88 µg/L, but ~~it had quality control issues (WE 2002).~~ this test was interrupted prior to its intended 60-day exposure (Mebane et al. 2008). A later test without those issues, ~~but without reported hardnes~~at 29 mg/L hardness, gave a higher rainbow trout chronic value of 1.~~5~~6 µg/L (Mebane et al. 2008). Acute tests with mayflies, caddisflies, and stoneflies all gave values that were much higher than the trout values (Mebane et al. 2012). The tests by ~~Windward Environmental (WE 2002)~~ Mebane et al (2008; 2012) were conducted for the State of Idaho to support the derivation of site-specific criteria for the Coeur d'Alene River. BLM-derived acute values for Ceriodaphnia dubia were 37 to 51 µg/L for the three streams draining the mine scenario footprints~~, calculated using the HydroQual~~ (2007) ~~version of the cadmium BLM~~. This is consistent with the relative insensitivity of invertebrates to acute lethality. Although these tests and other tests in the literature show fish to be more sensitive to cadmium than invertebrates in acute exposures, in chronic exposures invertebrates were more sensitive (Mebane 2010). In particular, mortality of the amphipod Hyalella azteca increased at 0.16 µg/L cadmium at relevant hardness (17 mg/L) (Mebane 2010).

EPA Response: These corrections have been incorporated into the final assessment.

8.135 p. 8-33, Cobalt. Environment Canada (2013) just released a Federal Water Quality Guideline of 2.5 µg/L for cobalt for toxicity to freshwater organisms. They wrote "The 5th percentile of 2.5 µg/L calculated from the SSD is selected as the predicted no-effect concentration (PNEC) and the Federal Water Quality Guideline for toxicity to freshwater organisms. The guideline represents the concentration below which one would expect either no, or only a low likelihood of adverse effects on aquatic life."

EPA Response: These findings are included in the final assessment.

8.136 p 8-33, Lead. Same as with cadmium, my co-authors and I have completely reviewed the analytical chemistry, LC50 calculations, and chronic analyses that were previously summarized in Windward Environmental (2002). Correcting the values with our peer reviewed, open publications, but otherwise retaining the text, I suggest the following language [Note comments in original letter provided in Track Changes and are reproduced here.]:

In comparison, a rainbow trout test at hardness similar to the South and North Fork Koktuli Rivers (20 mg/L) resulted in an LC50 of 120 µg/L, and the closely related cutthroat trout produced an LC50 as low as 47 µg/L in hardness 11 mg/L water (~~WE 2002~~Mebane et al. 2012). Tests at similar hardness levels for mayflies, caddisflies, stoneflies, and chironomid midges gave higher LC50s (~~429~~ 253 to greater than 1,255 µg/L) (~~WE 2002~~)(Mebane et al. 2012). This indicates that an endpoint with fish species is more sensitive to lead than aquatic insect larvae, which is consistent with BLM-derived acute values of 523 to 748 µg/L for Daphnia magna. Chronic tests gave values for reduced rainbow trout weight and length of 36.0 and 12.1 µg/L at 21 and ~~26~~ 29 mg/L hardness and for the midge Chironomus tentans of 65.4 µg/L at 32 mg/L hardness (~~WE 2002~~)(Mebane et al. 2008). Note that we use tests performed for the State of Idaho (~~WE 2002~~Mebane et al. 2008; 2012) for cadmium, lead, and zinc, because they are high-quality tests that use species and water chemistries relevant to the Bristol Bay environment.

EPA Response: These corrections have been incorporated into the final assessment.

8.137 p. 8-34, Zinc: Same story as with cadmium and lead. Suggest the following corrections and updates from our data [Note comments in original letter provided in Track Changes and are reproduced here.]:

Zinc, like copper, is a divalent metal and trace nutrient that is a common aquatic toxicant. The national criteria and state standard are based on water hardness (USEPA 1987), but a BLM is available that provides more accurate predictions of acute toxicity, at least for some test species (DeForest and Van Genderen 2012). The BLM-based LC50 estimates for rainbow trout in the South and North Fork Koktuli Rivers are 64 and 63 µg/L, respectively, calculated using the HydroQual (2007) version of a zinc BLM. In comparison, a series of 17 rainbow trout tests at ~~similar~~ hardnesses ranging from 7 to 71 mg/L ranged from 20 to 289 µg/L ~~(16 mg/L) resulted in an LC50 of 117 µg/L (WE 2002)~~(Mebane et al. 2012). Acute tests at 14 mg/L hardness for two mayfly species and a caddisfly species resulted in values greater than 2,926 µg/L, and a stonefly species test resulted in values greater than 1,526 µg/L (~~WE 2002~~)Mebane et al. 2012). These results suggest that an endpoint for fish species is considerably more sensitive to zinc than relevant stream invertebrates in acute exposures. BLM-derived acute values for Daphnia magna were 407 to 502 µg/L for the three receiving streams, calculated using the HydroQual (2007) version of a zinc BLM, which is consistent with the relative acute insensitivity for invertebrates. The chronic value (as an EC20, a concentration causing 20% reduction in survival) from a 69-day, early-life-stage test of rainbow trout in 21 mg/L hardness water was ~~15~~ 147 µg/L (~~USEPA 1986, Eisler 2000, WE 2002~~Mebane et al. 2012).

(It's not clear that the USEPA 1986 or Eisler citations referred to anything in this paragraph. DeForest and Van Genderen Zn BLM is mentioned, but I am assuming the BLM actually used was the HydroQual version? They aren't the same and produce quite different values. Whichever one was used, it should be specified.)

EPA Response: These corrections have been incorporated into the final assessment.

H. Neumann (Doc. #0238)

8.138 The literature shows that copper concentrations in water measured in levels as low as micrograms per liter (?[µ]g/liter) / parts per billion (PPB) adversely effects all species of salmonids, including those found in Bristol Bay waters and watersheds. These adverse effects range from the acutely toxic, to impairment of reproduction processes, to causing the fish to avoid contact with polluted waters. (Baldwin, et al., 2003; Finlayson & Verruea, 1982; Stevens, 1977).

EPA Response: Comment noted; no change required.

K. Nelson (Doc. #3458)

8.139 In WA state, storm water permits now specify a benchmark for copper that is more stringent than most states because the science has traced copper as a significant threat to salmonid species in the Puget Sound. Will a similarly protective standard be considered for the Pebble Mine?

EPA Response: The benchmark used in the assessment is believed to be protective of salmonids and is based on the same science as is used in Washington.

Chapter 9: Tailings Dam Failure

The Pebble Limited Partnership (Doc. #5535)

9.1 The Assessment describes two dam failure scenarios – a partially full dam and a completely full dam. The completely full dam scenario assumes that the TSF is completely full to the crest of the dam. This condition would violate the mine's permit: dams are required to maintain a safe level of freeboard.

<u>EPA Response:</u> Permits notwithstanding, dams, including at least one tailings dam in Alaska, have overflowed. Issuance of a permit does not guarantee compliance with permit terms, and permit terms are not always protective to the degree needed to prevent adverse effects.

9.2 The data sets used to assess tailings dam and pipeline failures are not representative of the state-of-the-practice design, monitoring and regulatory oversight that will be used for a mine project. Throughout the document, the EPA presumes a level of environmental performance by the mining industry that is long outdated and would violate current State of Alaska and federal laws.

<u>EPA Response:</u> The history of tailings dam failures is used to estimate an upper bound on the probability of failure. The assessment states that a dam designed, constructed, operated, and monitored to higher standards would be expected to have a lower probability of failure, and lower estimates are provided. Pipeline failure rates are based on the best available evidence.

9.3 Original Draft Location: Page 6.45: Report Section Identification: 6.5

Original Comment: Only ten lines are dedicated in the text to detailing the effects on wildlife following a failure. This alone should illustrate the lack of data and correct analysis. There are no scenarios for the size of the "projected failure", nor the timing of such failure. Current mining methods and practices have greatly reduced the potential of said failures. The magnitude of said failure would greatly influence an impact analysis on wildlife. Additionally, the conceptual models and the endpoint of such models have not adequately taken into account the diverse habitat range of higher order predators, and a failure that might result in an impact to one stream, may have no significant impact on species who can forage from within a very large home range. Further, the authors state "all terrestrial wildlife in the Bristol Bay watershed depend upon the enhanced aquatic and terrestrial production provided by the marine nutrients that are brought into the watershed by returning and spawning salmon." This a very large, un referenced, un substantiated statement intended to lead the reader to think that if any of the salmon carried nutrients were to be blocked in anyway from reaching these upper streams, then all terrestrial wildlife would be impacted.

Comments Regarding Adequacy of Response in Second Draft: Scenarios for the size of the projected failure and expanded text are added but the comment was not addressed. The assessment of wildlife effects is therefore incomplete.

<u>EPA Response:</u> The timing of failures is not specified because failures, by their nature, are not scheduled. We agree that the magnitude of any failure would influence the magnitude of wildlife impacts. As detailed in Chapter 2, the assessment only considers salmon-mediated effects on wildlife, but we recognize that failures would also result in direct effects. The importance of marine nutrients is a well known phenomenon and is described in multiple parts of the assessment (e.g., Chapter 5, Chapter 7, Appendix A).

<u>The Pebble Limited Partnership (Doc. #5536)</u>

9.4 *Original Draft Location*: Page 4.17: Report Section Identification: 4.3 Mine Failure Scenario

Original Comment: The No Failure impact and effects scenario is likely overly conservative. Full containment and failure-free mining are not likely mine scenarios. Also, combining cumulative risks from the Failure scenario is not likely either. The risk analysis method used in the assessment describes the conceptual model framework identifying an envelope of potential risks, but does not quantify the risks to any degree of certainty. The risk assessment should seek to evaluate risks (and quantify where feasible) and identify the mostly likely mine development and failure scenarios to understand likely impacts, while stating the range of knowable risks.

Recommended Change: Risk should be quantified, and estimated, where feasible (i.e., mine site footprint impacts, hydrologic impacts, dam failure) on elements of the study where this is feasible, and for items where calculation of risks and effects are unfeasible, scale of risk should be assigned (i.e., high probability and small area or low impact). A probabilistic risk based analysis of a likely mine operation and failure scenario would reduce uncertainties leading to underestimates and overestimates of stated risks and impacts.

Comments Regarding Adequacy of Response in Second Draft: Chapter 9, “Tailing Dam Failure” has an expanded treatment of the probability of tailing dam failures, and discussion of uncertainties, but does not include evidence of the suggested probabilistic risk analysis. In addition, in the absence of a specific mine profile to evaluate, this section still basically presents a catastrophic failure of the largest Tailing Storage Facility in order to determine the number of miles of stream that could be impacted. As such, the complete intent of the recommended changes has not been met and the document does not adequately assess the risk of failure nor the risk of consequences of a failure.

<u>EPA Response:</u> The probability of a tailings dam failure was quantified and the consequences have been estimated to the extent possible.

9.5 *Original Draft Location:* Page 4.4: Section 4.4.2, paragraph 1

Original Comment: The international examples of failures are likely not relevant given the differences between US standards and standards in the cited countries.

Comments Regarding Adequacy of Response in Second Draft: These examples are still included in the discussion provided in text box 9-1. Comparison to international mines that may or may not have been constructed to current US standards with current US mitigation requirements is inappropriate and should be removed from the document. These comparisons imply effects that are greater than would likely occur under current US construction, design, and mitigation standards.

<u>EPA Response:</u> The preamble to the examples of tailings dam failure indicates that design, construction and operation methods are expected to differ. However, we would be remiss if we published a risk assessment that did not acknowledge that tailings dams have failed and did not describe potential consequences.

9.6 *Original Draft Location*: Page 4.41, Box 4-4: Aurul S.A. Mine, Baia Mare, Romania, 2000. A 5-km-long, 7-m-high embankment on flat land enclosed a tailings impoundment containing a slurry with high concentrations of cyanide and heavy metals. Heavy rains and a sudden thaw caused overtopping of the embankment, cut a 20- to 25-m breach, and released 100,000 m^3 of contaminated water into the Somes and Tisza Rivers. Flow continued into the Danube River and eventually reached the Black Sea. The contamination caused an extensive fishkill and the destruction of aquatic species over 1,900 km of the river system (ICOLD 2001).

Original Comment: This is an example of poor operation and inadequate regulations for an operation in Romania. The failure resulted from overtopping which caused rapid erosion and failure of an erodible cyclone sand tailings dam. Is EPA implying that the USA standards, regulations and enforcement protocols are comparable to the Romanian 'standards'?

C*omments Regarding Adequacy of Response in Second Draft*: The Baia Mare example is still included in Box 9-1 "Examples of Historical Tailings Dam Failures." The failure was attributable to poor choices of dam materials, improper consideration of maximum precipitation events in the facility design, and the results of an actual maximum precipitation event. It is difficult to find any comparability between Baia Mare and any potential rockfill tailings facility constructed in this watershed and subject to State of Alaska permitting requirements.

EPA Response: See response to Comment 9.5. Box 4-4 (Box 9-1 in the revised assessment) lists failures that have occurred by a variety of mechanisms. We do not contend that a dam failure at the Pebble site would occur by the same mechanism as any particular past failure.

9.7 *Original Draft Location:* Page 4.41, Box 4-4: References to "dam failure" in EPA document: 186 times (including headings, figures, and appendices)

Original Comment: The report places heavy influence on dam failure, and illustrates, that at a minimum, there is a fundamental anti development bias The EPA study relies heavily on the premise that 'it is not a matter of IF but WHEN tailings dam failure will occur'. They attempt to justify this premise by repeatedly asserting that failure 'could' occur and by quoting several technical papers out of context.

Comments Regarding Adequacy of Response in Second Draft: While the text acknowledges that there is no examples of large dam failure, the consequences of such a failure are still presented in the assessment. The assessment needs to incorporate standard risk assessment procedures to characterize the overall risk to the environment.

EPA Response: The assessment accurately describes the history of dam failures and the current state of knowledge. The comment misquotes the assessment, as the "if but when" statement does not appear in the assessment.

9.8 *Original Draft Location*: Page 6.29, Section 6.1.6

Original Comment: Comment: A catastrophic TSF dam failure would seem to be the most significant impact to the environment. However, given the lack of definition of the probability and likely actual size of a potential spill under the hypothetical mine scenario, the conclusions stated in this section are likely overstated.

Recommended Change: Some understanding of the assumptions should be summarized here in summary form to give readers. The text should reflect that under the hypothetical assumptions it seems the described result would occur but under different conditions, a different level of impact would occur.

Comments Regarding Adequacy of Response in Second Draft: No estimation of the probability of occurrence has been incorporated into this text as it is currently presented in the second external review draft. The comment stands.

EPA Response: We agree that if assumptions were different the results would be different, but a spill of only 20% of the volume is not an overstatement. The probability of failure is estimated as a range, which is reasonable given the lack of experience with such large earthen dams, particularly in the sub-arctic. The assumptions are clearly identified in Chapter 9 of the assessment.

9.9 *Original Draft Location:* Page 4.41, Box 4-4: Tennessee Valley Authority Kingston Fossil Plant, Roane County, Tennessee, 2008. After receiving nearly 20 cm of rain in less than 4 weeks, an engineered 18-m-high earthen embankment of a 34-ha storage impoundment failed, producing a 14-m-high surge wave and releasing 4.1 million m^3 of coal fly ash slurry. The release covered over 121 ha with slurry containing arsenic, cobalt, iron, and thallium. Over 2.7 million m3 of coal ash and sediment were dredged from the Emory River to prevent further downstream contamination (AECOM 2009).

Original Comment: Perhaps the intent of this example is to demonstrate that tailings dam failures can also happen in the USA? However the failure of this earthen (fly ash) upstream construction dam that was founded on silt and clay is not comparable to Pebble. The failure was attributed to the foundation, construction rate, construction material and placement method (lack of compaction).

Comments Regarding Adequacy of Response in Second Draft: The Tennessee Valley Authority Kingston Fossil Plant example is still included in Box 9-1 “Examples of Historical Tailings Dam Failures.” As the reviewer notes, this example is not comparable to the type of tailings facility that would be required for a mining project in this watershed.

EPA Response: See response to Comment 9.6.

9.10 *Original Draft Location:* Page 4.46, Section 4.4.2.2: Silva et al. (2008) reported on over 75 earth dams, tailings dams, natural and cut slopes, and some earth retaining structures to illustrate the relationship between the annual probability of slope failure in earth structures and factors of safety. They grouped projects into four categories based on the level of engineering applied to the design, site investigation, materials testing, analysis, construction control, operation, and monitoring of each project.

- Category I: Facilities designed, built, and operated with state-of-the-practice engineering. Generally these facilities are constructed to higher standards because they have high failure consequences.
- Category II: Facilities designed, built, and operated using standard engineering practice. Many ordinary facilities fall into this category.

Original Comment: Silva paper is for earthfill slopes/dams, information is based on 40 years of case studies, engineering practices have changed. EPA seem to base their comments on a hypothetical dam that has been designed to probably fail. They erroneously assume that this could be permitted and allowed to proceed into construction and operation. [T]hey then suggest that this would relate to 'any' dam at Pebble. The Silva paper also defines the category 1 or 2 facilities design criteria more clearly, from which Pebble would be category 1. The annual failure probability of an earthfill slope for a factor of safety of 1.5 (which is the minimum) is 1 in 1,000,000 (i.e., this is implied to be negligible by Silva et al). It is worth noting that it could be argued that the Pebble dams could be designed to a higher factor of safety and thus an even lower probability of failure – if 1 in a million is presented as being negligible how much more negligible should the designs be based on. The Alaska Dam Safety program defines these requirements for any dam developments in the State – does the EPA trump this State regulatory process?

Comments Regarding Adequacy of Response in Second Draft: (Silva et al. 2008) is still used as the part of the failure assessment in Chapter 9. The assessment assumes that the probability of mine failure is similar to that of historical mines constructed to outdated standards. As a result, the assessment overstate likely impacts.

<u>EPA Response:</u> The tailings dam scenario is not "designed to fail," as is demonstrated by the very low estimated probability of failure. The comment presents no evidence that tailings dam failure probabilities are too high and does not suggest a better method of estimating the probabilities.

9.11 *Original Draft Location:* Page 4.47, Chapter 4.4.2.2

Original Comment: The likelihood has been estimated, substantially, from the historic records of dam failures that have been recorded in the years 1960 to 2010. Many of the dams that are included in this failure record were constructed in periods prior to current engineering and oversight. The ability to perform effective analyses must precede the practice of performing such analyses and if we look to when a) the capability and b) the practice of analyses of very important aspects of dam design were developed, we can see that many dams that have failed were not designed with adequate design methods. The flowing times are when the technology and practice became common for critical elements of tailings dam design in North America: Slope stability analyses 1960's Seepage and drainage analyses 1970's Seismicity, foundation soils and tailings liquefaction, and dynamic analyses 1970's and 80's Modeling tools for deformation (FLAC, PLAXIS) Post 1980's Design for Closure and Closure management (not just abandonment) has only been a substantive requirement since the 1990's. In areas other than North America, these technologies and the regulatory oversight and corporate governance that today control the security of dam construction were not applied till substantially later. Thus many of the dams, indeed the vast majority, included in the failure statistics did not include the design, specifications and construction and operation supervision that would be required today for a major tailings dam constructed in Bristol Bay. The site investigation, construction material characterization, design effort and construction supervision that is applied to smaller, lower hazard dams are vastly less than are applied to very large high hazard dams. The engineering man-hours that would be […]

Comments Regarding Adequacy of Response in Second Draft: The current analysis (Section 9) is essentially based on the same level of historical analysis as was presented in first review draft; the reviewer's point on the beneficial effects of "current technology, regulatory control and corporate governance" on potential failure rates is not accounted for.

EPA Response: We state in the assessment that design and construction practices have changed and describe the historical failure rate as an upper bound. However, it is not possible to estimate failure rates from the records of dams that were just completed.

9.12 *Original Draft Location:* Page 4.41, Page 1 and Preface: Stava, Italy, 1985. Two tailings impoundments were built, one upslope from the other, in the mountains of northern Italy. The upslope dam had a height of 29 m; the downslope dam had a height of 26 m. A stability failure of the upper dam released tailings, which then caused the lower dam to fail. The 190,000 m^3 of tailings, traveling at up to 60 km/hour, reached the village of Tesero 4 km downslope from the point of release in 5 or 6 minutes. The failure killed 269 people (ICOLD 2001).

Original Comment: Decant failure causing a raise in the phreatic surface resulting in rotational slips on the downstream slope. The dams were upstream and centerline construction using hydraulically placed cyclone sand material. This is old and poor technology that is not relevant to Pebble.

Comments Regarding Adequacy of Response in Second Draft: Box 9-1 The same information has been retained as in the previous table without additional discussion or qualification. The comment has therefore not been addressed. Comparisons with mines that were developed under outdated standards is inappropriate and tends to overestimate the magnitude of likely effect.

EPA Response: See response to Comment 9.6.

9.13 *Original Draft Location:* Page 4.47, Chapter 4.4.2.2

Original Comment: EPA uses curves from Figure 1 of Silva et al, 2008 to convert the factor of safety associated with the mine scenario tailings dam to an annual probability of failure. The scope of Silva's paper is broad and is intended for a wide range of potential geotechnical applications. The four categories of "Level of engineering" included in the Assessment are abbreviations of the more detailed Table 1 included in the referenced paper. A review of Table 1 indicates that the Class II (Above Average) category is reserved for "above average" geotechnical works in a general sense. For example, Class II structures do not require an investigation of site geologic history, design peer review, full time supervision by a qualified engineer during construction or implementation of a performance program during operation, all of which would be required of any new tailings dam constructed in Alaska. The EPA assumes that the mine scenario tailings dam will be between a Class II and Class I structure and chooses to use the annual probability of failure associated with Class II structures (10^{-4} with FOS of 1.5) for comparison with high historical tailings dam failure rates. Based on Silva's definition, a new large or very large tailings dam constructed in Alaska would almost certainly fall into category 1 (Best). The corresponding annual probability of failure of a Class I structure with a FOS of 1.5 is 10^{-6}.

Comments Regarding Adequacy of Response in Second Draft: Chapter 9 continues to assume the standard of construction would be between "best" and "above average". The analysis does not adequately address the design standards and mitigation that would be required. Therefore, impacts are overstated.

<u>EPA Response:</u> The comment describes use of the Silva categories in the assessment. Information from the State of Alaska suggests that they also consider 10^{-6} probability as negligible and comments from the State have not indicated that they would require higher standards. Therefore, there is no basis for assuming that design standards would be more restrictive.

9.14 *Original Draft Location:* Page 4.41, Box 4-4: Aznalcóllar Tailings Dam, Los Frailes Mine, Seville, Spain, 1998. A foundation failure resulted in a 45-m-long breach in the 27-m-high, 600-m-long tailings dam, releasing up to 6.8 million m^3 of acidic tailings that traveled 40 km and covered 2.6 million ha of farmland (ICOLD 2001).

Original Comment: Foundation failure of the underlying marl (mudstone). Site investigations were inadequate. This is not relevant for Pebble as these geological materials are not present AND because extensive geotechnical investigations have and will be conducted to prove the suitability of the foundations.

Comments Regarding Adequacy of Response in Second Draft: Box 9-1 The same information has been retained as in the previous table without additional discussion or qualification. The comment has therefore not been addressed.

<u>EPA Response:</u> See responses to Comments 9.5 and 9.6.

9.15 The Assessment, especially the Executive Summary, emphasizes the potential impacts associated with a Tailings Dam Failure, and includes a discussion of the probability of a Tailings Dam Failure. The Assessment concludes that the risk of dam failure associated with a Category II facility is approximately 1 in 2,500 and that the risk of dam failure associated with a Category I facility is 1 in 250,000 (p. 9-10 and 9-11). The Assessment does not justify why it includes both the risks associated with Category I and Category II facilities. Presenting the probabilities of both Category I and Category II facilities is misleading because the tailings dam associated with the mine scenario described in the Assessment would definitely be a Category I facility (with the appropriately more robust design requirements). Thus, the discussion of the Category II facility confuses the reader, and overstates this risk (i.e., risk of failure could be 1 in 2,500 rather than 1 in 250,000), leading the reader to the conclusion that a failure is almost inevitable. This analysis also ignores other important factors such as whether the dams in the data set were constructed using upstream or downstream methods, which EPA indicates is an important consideration (p. 4-16). In summary, EPA's presentation implies an unrepresentatively high probability of occurrence for the dam failure scenario, which is important because (as discussed below) the only impacts that the Assessment indicates would extend beyond the Mine Scenario Watersheds are those resulting from a tailings dam failure.

<u>EPA Response:</u> The presentation of two possible categories is clearly described in the assessment. 10^{-4} risks per dam hardly meets the definition of "almost inevitable." The

last sentence of the comment ignores accidents associated with the transportation corridor.

9.16 *Page 9-1, Overview*: A breach of a TSF 1 dam would result in a flood wave and subsequent tailings deposition that would greatly alter the downstream channel and floodplain.

Technical Comment: This kind of introduction to the failure scenarios should be introduced with a contextual statement related to the (very low) probability of a catastrophic event such as the one described. The way it is written, it does not provide that context. Information is presented out of context or in a misleading way.

<u>EPA Response:</u> The probabilities of failure are clearly stated in the assessment, but do not need to be repeated with every conclusion.

9.17 The Assessment offers both earthquakes and overtopping as possible TSF dam failure scenarios, and conveys the false message that failure of a dam is not only possible but probable. The statistics that it uses to support this assertion are based on historical dam failures, which to a large extent are not relevant to modern tailings dams because of improved designs, more stringent regulatory oversight, and higher operating standards. Accordingly, with a non-representative sample, the statistics are meaningless. There is some recognition of this deficiency, and in an effort to address it, the Assessment relies heavily on a paper by Silva et al. (2008) that presents probabilities of failure based on "quantified expert judgment", rather than a rigorous statistical analysis. These probability values are not statistically defensible, and at best can be considered very rough estimates. Though these values may be appropriate for use in a comparative analysis for assessing relative risk, they are not appropriate for assigning absolute risk, as done by the Assessment. The Assessment further underscores the inadequacy of its analysis by quoting probability values for a dam category that could not be permitted in Alaska (state-of-the-practice engineering would be required), and then assigning probabilities of tailings dam failure from all causes by simply prorating the probability of slope failure by the ratio of total failures to slope failure, which is statistically invalid and nonsensical.

<u>EPA Response:</u> The comment suggests no better estimates of failure probabilities or methods to derive them. The comment also makes assumptions about what the State of Alaska would require without any support.

9.18 *Page 9-3, Box 9-1*: Examples of Historical Tailings Dam Failures: The tailings dam failures below illustrate the characteristics and potential consequences of a tailings dam failure. The details of the design, construction, or operation of any tailings dams constructed for mines in the Bristol Bay watershed would not be the same as these mine tailings dams, but these examples demonstrate that tailings dam failures can occur, and illustrate how these failures may affect downstream areas. In addition dams in these failure examples were significantly smaller than the dams in our mine scenarios. Aznalcóllar Tailings Dam, Los Frailes Mine, Seville, Spain, 1998. Stava, Italy, 1985. Aurul S.A. Mine, Baia Mare, Romania, 2000. Tennessee Valley Authority Kingston Fossil Plant, Roane County, Tennessee, USA, 2008.

Technical Comment: These tailings dam failures were discussed by KP in 2012 and are not relevant to the Pebble Project. Although the assessment report states that the Pebble TSF design, construction, and operation would be different than the TSF failures mentioned in

Box 9-1, the implication is that it is still a tailings dam and that all tailings dams have the same general characteristics. The TSF failures identified in Box 9-1 are not relevant to the TSF concept presented in the assessment report. Last sentence implies that larger dams are more likely to fail but does not provide any justification for this.

EPA Response: The comment assumes implications in the assessment that are contrary to the actual text of the assessment.

9.19 *Page 9-4, Section 9.1.1*: Table 9-1. Number and causes of tailings dam failures at active and inactive tailings dams.

Technical Comment: The table includes dam failures from upstream construction dams and water dams. Removing the dam failures from the table associated with upstream construction dams, water dams, and unknown dams reduces the number of dam failures from 135 to 9. Furthermore, all 9 failures were the result of conditions that would not be permitted under the Alaska Dam Safety Program. This is relevant as the Assessment uses the total number of dam failures as part of its probability of failure analyses for the Pebble dam, which is neither an upstream construction dam or a water dam. The sample is not representative of the Pebble dam scenario or the regulatory environment in Alaska.

EPA Response: The probabilities of failure are derived by the method of Silva et al. (2008) and do not use the number of failures from Table 9-1.

9.20 *Original Draft Location:* ES.16: Table ES-1 Summary of Probability and Consequences of Potential Failures. Failure Type: Tailings dam Probability: 10^4 to 10^6 per dam-year = recurrence frequency of 10,000 to 1 million years. Consequences: More than 30 km of salmonid stream would be destroyed and more streams and rivers would have greatly degraded habitat for decades.

Original Comment: Statistics used to imply that failure is inevitable. This is based on a paper by Silva, Lambe and Marr who present a methodology to allow geotechnical engineers to evaluate 'tolerable risk'. They provide a specific example for a tailings dam where 'corporate management wanted to increase the level of safety of the fluid retention system to reduce the risk of release … that could contaminate the pristine river downstream of the mine surface facilities.' They describe this method as a tool to justify increasingly conservative and more costly design solutions to reduce the risk to appropriate levels. Direct extension of the concepts in their paper would lead to the conclusion that the Pebble tailings dams would be designed and constructed to have an extremely low risk of failure. In effect they are indicating that if the consequences of failure are very high then the designs can be adjusted to ensure that the risk of failure is very low. Silva et al do not imply that this tool can be used to assign a probability of failure to a hypothetical structure that has not yet be designed.

Comments Regarding Adequacy of Response in Second Draft: Silva et al. (2008) is still used as the part of the failure assessment in Chapter 9; the reviewer's comment about the intent of this reference (i.e., should not be used to assign a probability of failure to a hypothetical structure that has not yet been designed) has not been addressed.

EPA Response: The comment is incorrect. Silva et al. (2008) clearly states "Fig. 1 shows relationships between factor of safety and annual probability of failure based on actual engineering projects and developed through quantified expert judgment." More

specifically, Silva et al. (2008) explain, "To estimate the annual probability of failure using Fig. 1, the engineer first determines the category for the earth structure under consideration using Table 1 as a guide. With a compatible calculation of factor of safety (see recommendations above), the engineer looks vertically to the appropriate curve, Categories I–IV, and reads the corresponding annual probability of failure horizontally."

9.21 *Original Draft Location:* Page 4.39, Chapter 4.4.2

Original Comment: EPA states, "A tailings dam failures occurs when a tailings dam loses its structural integrity and releases tailings material from the impoundment. The released tailings flow under the force of gravity as a fast-moving flood containing a dense mixture of solids and liquids, often with catastrophic results." EPA lists examples of such catastrophic failures in Box 4-4. EPA then describes failure mechanisms such as overtopping and slope instability and then discusses failure statistics. However, EPA fails to point out that the failure statistics as presented do not distinguish catastrophic failures from relatively inconsequential incidents, thus implying that the failure probabilities are applicable to the uncontrolled release of tailings or otherwise catastrophic failures.

Comments Regarding Adequacy of Response in Second Draft: The document has not been clarified with respect to the uncertainty introduced by not distinguishing between catastrophic failures and relatively inconsequential incidents. Not all releases from tailings facilities are catastrophic events, but the report does not acknowledge the likelihood of release scenarios ranging from the inconsequential to the catastrophic. Therefore, the document fails to adequately address risk and tends to overestimate impacts.

<u>EPA Response:</u> The revised assessment recognizes that less-than-catastrophic failures and accidents are possible. We provide a catastrophic failure scenario as a low likelihood but high impact magnitude possibility to frame the potential risk. Probabilities of failure are provided and discussed in Section 9.1.

9.22 *Original Draft Location*: Page 4.4, Section 4.4.2.1

Original Comment: All of these causes of failure can be avoided through proper design of the project. They should not be assumed. Rather, the document should assume that the mine design will appropriately address the potential for dam failure.

Comments Regarding Adequacy of Response in Second Draft: While the document states that no record of large dam failure is available, the analysis continues to represent the consequence of a catastrophic release of tailings from a dam failure without any downward adjustment of probability due to the application of best design and management practices and an exacting permitting process. The reality is, no large dam can our would be constructed without significant engineering, construction management, QA/QC, and operation controls being in place, all of which would be submit to review and approval as part of the permitting process.

<u>EPA Response:</u> The scenario includes a probability of failure based on a Category I design, the most rigorous requirement. The assessment does not assume that these structures will fail, but does consider potential impacts should a failure occur.

9.23 *Original Draft Location:* ES.15 to ES. 18, Executive Summary, Tailings Dam Failure: The range of estimated probabilities of dam failure is wide, reflecting the great uncertainty concerning such failures. The most straightforward method of estimating the annual probability of failure of a tailings dam is to use the historical failure rate of similar dams. Three reviews of tailings dam failures produced an average rate of approximately 1 failure per 2,000 dam years, or 5 x 10-4 failures per dam year. The argument against this approach is that it does not fully reflect current engineering practice. Some studies suggest that improved design, construction, and monitoring practices can reduce the failure rate by an order of magnitude or more, resulting in an estimated failure probability within our assumed range.

Original Comment: The author clearly states a review of 'similar dams', however similar in this sense refers to 'all tailings dams' and includes tailings dams constructed by the upstream construction method. This is incorrect and misleading. Failure Probability has been extrapolated from a data set that is not relevant to any realistic proposal for development of a tailings dam at the Pebble site. This is also discussed in KP Whitepaper 1.

Comments Regarding Adequacy of Response in Second Draft: The current analysis (Section 9) appears to be based on essentially the same level of historical analysis as was presented in first review draft of the EPA document; no response has been made to address the reviewers comment on the actual relevance of this data set. The dams used to compare potential impacts need to be carefully selected to reflect modern construction standards and typical mitigation requirements. The comparisons lead the reader to assume that impacts of sites constructed using out-moded approaches would be expected at a new site. The analysis is therefore misleading.

<u>EPA Response:</u> The probabilities of failure are based on the method of Silva et al. (2008), not the historical frequencies. Those are presented as background and as a potential upper bound, and that use is appropriate.

9.24 *Original Draft Location*: Page 4.4, Chapter 4.4.2

Original Comment: Comment: EPA implies that because the tailings dam heights used in the mine scenario are very large, the impacts of a failure would be much greater than the historical failure record from much smaller dam failures. Box 4-4 lists four examples of tailings dam failures, including the 2008 flash pond failure at the Kingston Power Plant in Tennessee. All of the dams described are less than 30 meters high, and all have questionable design and operational histories. EPA fails to acknowledge that tailings dam failure statistics are biased by the failure incidents of such small dams, because there have been no catastrophic failure of large dams approaching the scale of the mine scenarios used in the Assessment.

Comments Regarding Adequacy of Response in Second Draft: While the text acknowledges that there is no examples of large dam failure, the consequences of such a failure are still presented in the assessment, extrapolating from the failures of much smaller dams which, as the reviewer pointed out, all have questionable designs and operation histories. It is difficult to find any comparability between these examples and any proposed tailings facility that would be conducted in this watershed.

<u>EPA Response:</u> See response to Comment 9.23.

9.25 *Original Draft Location*: Page 4.44, Section 4.4.2.1

Original Comment: Comment: The Assessment indicates that overtopping is one of the leading causes of inactive tailings dam failures. However, this data is biased because the sample population includes a number of failures of dams with inadequate spillway designs. Any large or very large tailings dam in Alaska must be designed to accommodate the Probable Maximum Flood (PMF) during operations, and safely pass the PMF through a properly designed spillway in closure. Note that the PMF is a misnomer, in that there is no specific probability associated with the event since it represents the result of the most severe meteorological and hydrologic event that is reasonably possible at a given site. The argument that a large or very large tailings dam built in Alaska would be particularly susceptible to failure due to overtopping based on historical evidence of international tailings dam failure incidents is systematically flawed.

Comments Regarding Adequacy of Response in Second Draft: The document now states that "Although a tailings dam failure is a low-probability event, the probability is not zero. Should such an unlikely event occur, it is important to understand the potential impacts on the Bristol Bay watershed." While the text acknowledges that there is a low probability of overtopping leading to failure, the consequences of such a hypothetical failure are still presented in the assessment.

EPA Response: It is entirely appropriate to consider the risks of low probability events in a risk assessment.

9.26 *Original Draft Location*: Page 4.45, Section 4.4.2.2

Original Comment: EPA states, "Low failure frequencies and incomplete datasets also make any meaningful correlations between the probability of failure and dam height or other characteristics questionable. Very few existing rockfill dams approach the size of the structures in our mine scenario, and none of these large dams have failed." Nevertheless, EPA continues in their conjecture to presume that the tailings dam fail during both the operation and post-closure phases of the mine.

Comments Regarding Adequacy of Response in Second Draft: This statement is still included in the revised document; the incongruity between the authors' statement (which acknowledges that no large dams have failed) and the presumption of catastrophic failure in their theoretical dam scenario has not been resolved.

EPA Response: Just because there have been no failures among the few large dams that exist does not mean that a failure is impossible. We do not presume that the tailings dam will fail, but we do describe the probability of such an event and its potential consequences, should it occur.

9.27 *Original Draft Location*: Page 4.45, Chapter 4.4.2

Original Comment: The EPA presents statistics on dam failures and gives an upper bound of one failure per approximately 2,000 mine years. However, the EPA fails to describe whether the respective failures had any adverse impact on the environment. For example, a slope stability type dam failure may be reported, but not necessarily have resulted in any adverse impact on the environment downstream of the dam.

Comments Regarding Adequacy of Response in Second Draft: The report uses the same approach in the second version as the first – assessing probability of failure, assuming it to be catastrophic, and then basing the environmental impact on the size of the TSF1 facility. The use of standard risk assessment approaches to evaluating potential environmental effects would improve the document. As is stands, the document overestimates the likely project effects.

EPA Response: The comment does not state what standard risk assessment approach should be used.

9.28 *Original Draft Location:* Page 6.1, Chapter 6

Original Comment: Current practice across a broad spectrum of engineering and industry for risk management is to conduct a form of risk evaluation referred to as a Failure Modes and Effects Analysis (FMEA). The FMEA process is used to identify and focus in on aspects of the design with the highest relative probability of failure and the greatest consequences. An integral part of an FMEA is the identification of mitigation measures that must be implemented to ensure that any failure modes for which there is a significant consequence and risk are mitigated to the extent necessary to reduce risk to tolerable limits. These aspects are then reviewed in additional detail and measures to mitigate the risk by reducing the probability of failure are designed into the feature. For significant projects, the risk evaluation may be advance to a formal engineering risk assessment that quantifies the risk in more detail. The Assessment fails to recognize these basic risk management tools.

Comments Regarding Adequacy of Response in Second Draft: There is no evidence that FMEA was considered in the second draft of the document.

EPA Response: The comment proposes a method for design, not for estimating the probability of failure of a design.

9.29 *Original Draft Location*: Page 6.4, Chapter 6.1

Original Comment: The dam failure analysis assumes an extreme event while the probable maximum flood (PMF) is occurring, and that the dam failure is the worst possible (a full breach of the dam), and the breach results in loss of the maximum reasonably anticipated amount of tailings (20%). This is at the extreme limit of possible concurrent consequences, and the absolute worst for salmon impacts. The likelihood of the PMF is extremely low. High hazard dams are all equipped to contain or pass the PMF. Hence there is also an extremely low probability that the dam will fail if the PMF did occur. There are also a number of failure consequences other than the extreme consequence of a breach and 20% tailings discharge, should 'a failure' occur. Thus the combination of a failure of this particular type with this particularly severe consequence is a very special case of failure with a probability much, much less than the failure probability derived from historic dam failure records. No examples of [a] failure of a tailings dam constructed by the downstream method with a height of over 150 meter under any circumstances are in recent literature.

Comments Regarding Adequacy of Response in Second Draft: While the current draft does indicate that there is no record of failure for dams of the size evaluated here, it nonetheless presents the same catastrophic failure scenario (full breach) as was evaluated in the first draft. The comment stands. As a result the document continues to overstate likely project impacts.

<u>EPA Response:</u> The assessment clearly indicates that the failure scenario is improbable. Assessing improbable occurrences is inherent to risk assessment.

9.30 *Original Draft Location*: Page 4.46, Section 4.4.2.2

Original Comment: EPA cites ADNR Guidelines for Cooperation with the Alaska Dam Safety Program (June, 2005) (ADNR Dam Safety Guidelines) and references therein to U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, and Federal Energy Regulatory Commission guidelines for designing water retaining dams to safety factors of 1.5 (for slope stability). Box 4-6, Selecting Earthquake Characteristics for Design Criteria, includes general descriptions of earthquake design criteria, and criticizes the ADNR dam safety guidelines as 'inconsistent with the expected conditions for a large porphyry copper mine developed in the Bristol Bay…" Section 13.2.2, Tailings Storage Facilities, of the ADNR Dam Safety Guidelines specifically states, "Complete guidance on tailings dam design and closure is beyond the scope of this document … tailings dams represents certain challenges that require professionals with significant relevant experience." EPA leans heavily on the 1.5 safety factor for estimating failure probabilities and references (Silva, et al., 2008). However, unlike the Assessment, Silva presents a balanced discussion on risk for a mine project, and other engineering features such as dams.

C*omments Regarding Adequacy of Response in Second Draft*: The language from Box 4.6 in the original version has been retained in Box 9.2 pg. 9-9, including the statement regarding inconsistencies with ADNR dam safety standards and expected conditions. The comment does not appear to have been addressed.

<u>EPA Response:</u> We acknowledge that the assessment cites ADNR guidelines, but disagree with the characterization that the assessment "criticizes" the ADNR dam safety guidelines. Rather, the assessment states that the design life for the TSF may be much longer than the return period normally considered appropriate for selecting the MDE for a Class II dam. The comment mentions our discussion of a safety factor of 1.5, but it is unclear whether the comment is suggesting that a higher or lower safety factor would be appropriate. We agree that Silva et al. (2008) presents a balanced discussion of risk.

9.31 *Original Draft Location:* Page 4.47, Section 4.4.2.2

Original Comment: Comment: Dam failure probabilities based on existing and anecdotal information shows a wide range (several orders of magnitude) difference in probability of failure.

Recommended Change: Considering the potential risks involved, the dam failure study should include a site specific dam failure analysis. A stochastic, risk based modeling approach is needed to address risk and uncertainty and incorporating sensitivity analyses of seismicity, soil strength and hydraulic conductivity properties, inflow hydrology, dam breach sizes, hydraulic and sediment transport downstream modeling. The analysis will refine probabilities and estimates of dam failure scenarios and reduce the uncertainty in dam failure orders of magnitude difference in estimated failure probabilities.

Comments Regarding Adequacy of Response in Second Draft: Ch 9 - Data has been added but the analysis remains the same, relying upon data from other mines to make inferences about probabilities of tailings dam failures. There is no discussion about modeling as an alternative. Therefore, this comment has not been addressed. Comparison with mines constructed to outdated standards is inappropriate and tends to overestimate likely project impacts.

<u>EPA Response:</u> The probabilities of failure are based on the method of Silva et al. (2008), not the historical frequencies. Those are presented as background and as a potential upper bound, and that use is appropriate. We state in the assessment that design and construction practices have changed and describe the historical failure rate as an upper bound. However, it is not possible to estimate failure rates from the records of dams that were just completed.

9.32 *Original Draft Location:* Page 14, Appendix I: Data presented indicates that failures peaked to about 5 per year in the 1960's through the 1980's and has dropped to about 2 per year over the last 20 years, with the frequency of failure occurrences shifting to developing countries.

Original Comment: Data set needs to be filtered before making any comparisons to Pebble - see KP Whitepaper 1.

Comments Regarding Adequacy of Response in Second Draft: Comparisons with old dams and dams outside of the U.S. remain in the document. The analysis is therefore flawed by an insistence with comparing the proposed project to other projects that are not comparable.

<u>EPA Response:</u> See response to Comment 9.31.

9.33 *Page 9-9, Box 9-2*: The Initial Application Package for Approval to Construct a Dam submitted by Northern Dynasty Minerals (NDM) to the Alaska Department of Natural Resources (NDM 2006) included a seismic safety and design analysis prepared by Knight Piésold Consulting that identified the following design criteria for the tailings dams at the storage facility.

- OBE return period of 200 years, magnitude 7.5.
- MDE return period of 2,500 years, magnitude 7.8, with maximum ground acceleration of 0.3g, based on Castle Mountain Fault data.

Technical Comment: The values for the OBE and the MDE are the upper limits for a Class II dam in Alaska, as defined by the Alaska Dam Safety Program (ADSP). These design criteria are out of date and are not representative of the current design standards being adopted for the Pebble Project.

<u>EPA Response:</u> NDM (2006) and Ghaffari et al. (2011) are the most recent publicly available documents provided by the PLP or its members. The comment does not state what the current design standards might be or where they might be found.

9.34 *Page 9-9, Box 9-2*: Northern Dynasty Minerals used a deterministic evaluation to select the MDE and MCE, which were deemed equivalent for the preliminary safety design. In the application, NDM reports that the preliminary design incorporates additional safety factors, including design of storage facility embankments to withstand the effects of the MDE and a distant magnitude 9.2 event. Ghaffari et al. (2011) state that an MCE of magnitude 7.5 with 0.44g to 0.47g maximum ground acceleration was used in the stability calculations for the tailings dam design. Although the design specifications proposed in Ghaffari et al. (2011) exceed the minimum requirements for dams in Alaska, the deterministic dataset used is small and contains considerable uncertainties, which could lead to an underestimate of the potential seismic risk.

Technical Comment: The Assessment references preliminary design criteria that are no longer relevant. The current deterministic dataset associated with determining design earthquakes is far more comprehensive.

<u>EPA Response:</u> See response to Comment 9.33. The comment does not provide access or a reference to the dataset and does not describe the implications of its use.

9.35 *Page 9-10, Section 9.1.2*: Combining the required factor of safety with the correlations among level of engineering, factor of safety, and slope failure probability (Figure 9-2) derived from Silva et al. (2008) yields an expected annual probability of slope failure between 0.0001 (Category II) and 0.000001 (Category I). This translates to one tailings dam failure due to slope failure every 10,000 to 1 million dam years.

Technical Comment: The slope failure probability values presented by Silva are based on "quantified expert judgment," rather than a rigorous statistical analysis, so the probability values are not statistically defensible. The probability values can be considered very rough estimates, at best, and though appropriate for use in a comparative analysis for assessing relative risk, as intended, they are not appropriate for assigning absolute risk, as done in the Assessment. Analysis is invalid because the probabilities of failure are not statistically based or rigorously defendable.

<u>EPA Response:</u> The Silva et al. (2008) method is the best available in the literature. The statistical analysis of the history of dam failures is also presented, but we believe it is not as relevant.

9.36 *Page 9-10, Section 9.1.2*: This translates to one tailings dam failure due to slope failure every 10,000 to 1 million dam years. The upper bound of this range is lower than the historical average of 0.00050 (1 failure every 2,000 dam years) for tailings dams. This is partly because slope failure is only one of several possible failure mechanisms, but it also suggests that past tailings dams may have been designed for lower safety factors or designed, constructed, operated, or monitored to lower engineering standards. As shown in Table 9-1, slope failures only account for about 25% of all tailings dam failures with known causes. Thus, the probability of failure from all causes may be about four times higher than dam failures from slope instability alone (an expected annual probability of failure between 0.0004 and 0.000004 or one tailings dam failure every 2,500 to 250,000 dam years), when all potential failure causes are considered, albeit recognizing that the small dataset may not be representative.

Technical Comment: The approach used to assign probabilities of tailings dam failure from all causes is simplistic, mathematically incorrect, and statistically invalid. In particular, dividing probabilities based on "quantified expert judgment" by four to account for failures other than slope failures is nonsensical. Analysis is statistically invalid.

<u>EPA Response:</u> We disagree and the comment does not present an alternative.

9.37 *Original Draft Location:* Page: 6.1, Chapter 6

Original Comment: The EPA assessment appears not to recognize the FMEA process or the benefits and consequences of applying the FMEA process and subsequent requirement for the implementation of the risk reduction measures to reduce risks to acceptable levels. Certainly the generic treatment of a 'mining scenario' which has not been thoroughly tested and optimized through the application of the FMEA and risk mitigation, together with the extreme size and extreme consequences assumed in the assessment results in a biased and unrealistic characterization of the true risk.

Comments Regarding Adequacy of Response in Second Draft: The comment stands. As a result the document continues to overstate likely project impacts.

<u>EPA Response:</u> The FMEA is a design process, not a risk assessment process. It would not provide a failure probability.

9.38 *Original Draft Location:* Page: All

Original Comment: Comment: Throughout much of the document, the normal approach to technical reporting is reversed. Rather than starting a section or subsection with an understanding/discussion of the issues to be addressed then addressing/evaluating the issues before reporting results of the evaluation, the Bristol Bay Watershed Assessment provides conclusive statements in the introduction to many, if not all sections and subsections. In some cases these conclusions are completely unsubstantiated in the following subsections. In other cases, there are some simple to extremely incomplete analyses that appear designed solely to support the conclusions stated in the introductory paragraphs. It is as if the report is written to convince people of the opinions of the authors, without the level of detail or evaluation necessary to support the conclusions. It is disconcerting to see this in a Technical Document from the USEPA.

Recommended Change: Do not rely on the Bristol Bay Watershed Assessment as a technical document. Rather, allow technical documentation to be developed by the applicants with good data and detailed analysis. Use the detailed analysis and evaluation to evaluate the likely impacts of the Pebble Mine.

Comments Regarding Adequacy of Response in Second Draft: A perusal of the 2013 document appears to substiate the commentator's claims in regards to initiating sections with statements of impact (e.g., Section 9.3; Section 10.3). Generally the language of the original draft has been retained despite substantial reorganization. There is nothing in the document that suggests that this comment has been substantially addressed.

<u>EPA Response:</u> This stylistic comment was not incorporated.

9.39 *Page 9-13, Section 9.3*: While a variety of failure mechanisms could cause a failure, this assessment used an overtopping scenario.

Technical Comment: A dam that has the potential for overtopping is not permittable in Alaska. It should be stated in the document that overtopping is not a realistic scenario, but rather a scenario selected simply for modeling purposes to assess the potential effects of a dam breach. The dam will have to provide storage for, or routing of, the design flood event.

<u>EPA Response:</u> Overtopping was described as one possible mechanism. It has occurred in Alaska despite permit requirements, although it did not result in a dam failure.

9.40 *Page 9-13, Section 9.3*: In both cases, we assumed 20% of the impounded tailings would be mobilized (Azam and Li 2010, Dalpatram 2011).

Technical Comment: The volume of tailings released would depend on a large number of factors, and the very approximate nature of the estimate is not conveyed in the text. Uncertainty of the value is not conveyed.

<u>EPA Response:</u> We agree that the estimation of the potential release volume is difficult and inexact. The release of 20% of impounded tailings used in our analyses is well below reports of 30 to 66% in the historical record.

9.41 *Page 9-14, Box 9-3*: The PMF is used to determine appropriate spillway/bypass facilities, or to predict the greatest flood that can cause failure.

Technical Comment: The PMF is not the greatest flood that can cause failure, it is simply the largest theoretically conceivable flood event. Terminology is technically incorrect.

<u>EPA Response:</u> In the final assessment, flooding to generate overtopping is no longer simulated (see Section 9.3).

9.42 *Page 9-14, Box 9-3*: Basin characteristics for the TSF 1 site and the PMP were applied to the SCS Type 1 hydrograph methodology to model data for the probable PMF hydrograph.

Technical Comment: There is no such thing as an SCS Type 1 hydrograph methodology. It is more correctly referred to as the SCS Method, the SCS Unit Hydrograph Method, or the TR-20 Rainfall-Runoff Model. Use of this approach requires the selection of a rainfall distribution, and in this case they appear to have selected an SCS Type 1 rainfall distribution (which is debatable in itself, since they used a less severe and more scientifically justified Type IA rainfall distribution in the 2012 assessment report). Terminology is technically incorrect.

<u>EPA Response:</u> See response to Comment 9.41.

9.43 *Page 9-15, Box 9-4*: If sufficient freeboard is maintained, it would be possible to capture and retain the expected volume of the PMF in the TSF. However, to examine potential downstream effects in the event of a tailings dam failure, we assume that sufficient freeboard would not exist and overtopping would occur. This may be less likely when the TSF would be actively monitored and maintained, but barring human error in the near term, may be more representative of post-closure conditions in the future.

Technical Comment: At post-closure the facility would have a spillway that would safely convey the peak flow of the design flood, so it is not possible that this event would occur as assumed. Ongoing monitoring and maintenance is inevitable and the Assessment Report assumptions of site abandonment is not realistic because it is illegal (and non-permittable). Analysis is inaccurate.

<u>EPA Response:</u> Spillways may become blocked and permits may be violated.

9.44 *Page 9-15, Box 9-4*: Under both dam failure scenarios, results were modeled for 30 km (18.6 miles) downstream, from the face of the TSF 1 dam down the North Fork Koktuli River valley to the confluence of the South and North Fork Koktuli Rivers. The extension of the simulation beyond this point would have introduced significant error and uncertainty associated with the contribution of the South Fork Koktuli River flows.

Technical Comment: The text implies certainty in the presented analysis, where there is very little. This is the only mention of significant error and uncertainty pertaining to the dam breach modeling, and the omission of further discussion implies that the analysis has a reasonably high level of certainty. The uncertainty in the estimation of the peak flows resulting from the tailings dam breach modeling is extremely high. Many key assumptions that the model results are very sensitive to are not discussed, including the size of the dam breach, the rate of breach development, and details of the downstream topography. Uncertainty of the analysis is not conveyed.

<u>EPA Response:</u> The assessment explains that the tailings dam failure scenario is one of many possible failure events. The fact that other failure scenarios would include different parameters is not an uncertainty. However, estimation of the consequences of the scenario is uncertain and that uncertainty is described in the assessment.

9.45 *Page 9-15, Section 9.3.1*: Despite this gage measuring the runoff from a 2,551-km^2 watershed, the peak flow was well below the predicted release from a breach in the Pebble 0.25 TSF, which would drain an area of only 14 km^2.

Technical Comment: Despite indicating in 2012 comments that the drainage area is 25,550 km^2, the Assessment still reports the drainage area as 2551 km^2.

<u>EPA Response:</u> The cited value no longer appears in the assessment.

9.46 *Original Draft Location:* Page 4.6, Section 4.4.2.4, p. 4-60, 2nd paragraph

Original Comment: The document suffers from the lack of sediment transport analysis. Much of the analysis of effects assumes that the deposited sediment would remain in the channel for extremely long periods of time. The material is fine grained and would be expected to be mobilized and transport out rather quickly, although the analyses of impacts assume something quite different. Recommend including an analysis of sediment transport and expected longevity of impacts.

Comments Regarding Adequacy of Response in Second Draft: Similar description is provided in the revised document (page 9-23, last paragraph). A proper sediment transport analysis has not been conducted. The effects of this on the overall conclusions is unknown, but the analysis likely overstates the potential impacts.

<u>EPA Response:</u> The revised assessment includes text acknowledging that a sediment transport model would improve estimates of sediment movement and deposition. However, the conclusion still stands: while in-channel sediment would be transported more quickly, the massive quantities of sediments that would be deposited across the valley floor in the assessment's tailings dam failure scenarios would constitute a long-term source of fine sediment.

9.47 *Original Draft Location*: Page 6.1, Chapter 6.1.2.4

Original Comment: Section 6.1.2.4, Uncertainties, indicates that while it is "certain" that a tailings dam failure would have "devastating effects", the "timeframe for geomorphic recovery" could be "decades". However, given that EPA has assumed that because of the infinite life of the project that the dam has failed, a consistent perspective would be to assume that several decades for recovery from a very low probability event is a relatively short period of time over infinity.

Comments Regarding Adequacy of Response in Second Draft: The comment that dam failures would have "devastating effects" remains in the document, although the analysis does provide a more detailed explanation of how the tailing dam failures assessment was performed is provided. The document does not adequately address risk of failure.

EPA Response: We do not assume that the dam has failed and do not agree that several decades is a relatively short period of time, relative to salmon life cycles or human needs for subsistence and commercial fisheries resources. The time to recovery relative to perpetuity is not relevant to effects on salmon.

9.48 *Original Draft Location*: Page 6.11, Section 6.1.3

Original Comment: Comment: This section provides thresholds for suspended sediment, and thus, is closer to a risk assessment than many other sections of the Bristol Bay Watershed Assessment, comparing site conditions to threshold effect conditions. However, while this Assessment does some modeling of sediment transport, there are no actual modeled suspended sediment concentrations predicted. So, the Assessment lists the threshold values, and then qualitatively estimates that site-specific suspended sediment concentrations would exceed the thresholds. The lack of site-specific values renders the any derived conclusion to be a qualitative comparison that is subject to uncertainty and opinion.

Recommended Change: Calculate estimated suspended sediment loads over time. Provide an analysis of how long and/or how often site-specific suspended sediment loads would be greater than the threshold.

Comments Regarding Adequacy of Response in Second Draft: Section 9.5.1 The suggest analysis has not been performed, and the document continues to rely upon qualitative estimates of the length of time, i.e., reasonable to assume that decades (Section 9.5.1.3). Estimates of impacts made by the analysis therefore lack accuracy and may be overstated.

EPA Response: We still do not believe that available information from the PLP Environmental Baseline Document or any other source is adequate to credibly perform the suggested modeling of tailings transport.

9.49 The evaluation of sediment toxicity relies heavily on benchmarks such as the TEL/PEL values presented by McDonald (2000). Typically, an exceedance of these values would trigger a further site investigation to understand the exact nature of site-specific conditions and the resulting toxicity. These values should be characterized as those that would trigger further work, not conclusions on toxicity themselves.

<u>EPA Response:</u> The TELs and PELs often are used in the manner suggested, to trigger additional toxicological and bioassessment studies of contaminated sediments.

9.50 *Page 9-36, Section 9.5.2.1 Exposure*: The composition of the aqueous phase is uncertain. None of the tests performed by PLP represents the leaching conditions in a tailings impoundment, and no model exists to mathematically simulate the leaching process.

Technical Comment: As the Assessment does not have any evidence of concentration of impoundment water concentrations, the authors were left to speculate on a concentration. Conclusions need to be read in that context. No discussion on the level of certainty of speculated concentrations is used and the reader is left without a complete (or correct) context. Information is presented out of context or in a misleading way.

<u>EPA Response:</u> We disagree with this comment. The assessment is not misleading because the state of knowledge is accurately described.

9.51 *Page 9-46, Section 9.5.2.3 Risk Characterization – Chronic Toxicity from Sediment Chemicals*: Sediment quality guidelines provide another line of evidence to assess risks from tailings after a tailings dam failure. Table 9-9 shows that tailings would be expected to cause severe toxic effects on the organisms that live in or on them. Notably, copper concentration would be 4.5 times the PEC; chromium and nickel concentrations would also exceed their PECs. The sum of TEC quotients of 32 implies that tailings would need to be diluted by 32 parts clean sediment to one part tailings before toxic effects would be unlikely (below the TEC). Because the Bristol Bay watershed is relatively undisturbed, background levels of total suspended solids are low (Table 8-10), so the time required to achieve that degree of dilution would be very long.

Technical Comment: This section overstates the conclusions. Typical sediment investigat[i]ons relying on comparison to benchmarks such as TELs/PELs that find exceedances show that there is only a probability of impact. Further studies would be necessary to understand the exact site-specific nature of the predicted threshold effects. This is the typical approach in an ecological risk assessment. Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> See response to Comment 9.49.

<u>The Pebble Limited Partnership (Doc. #5752)</u>

9.52 The unknowns and uncertainties underlying the Assessment are so extensive that they produce a document that is more guesswork than science. As peer reviewer Charles Slaughter pointed out:

> The probability approach outlined for potential TSF dam failure is unpersuasive. It is difficult to relate to a number like “0.00050 failures per dam year,” or to the implication on p. 4-47 that one can expect a tailings dam failure only once in 10,000 to one million “dam years.” This could suggest to the casual reader that failure of the hypothesized TSF1 dam (for which one “dam year” is one year) should not be anticipated in either the time of human occupation of North America, or the span of human evolution. *Id*. at 62.

EPA Response: **We agree with Dr. Slaughter that probabilities and frequencies can be difficult to understand. We added Box 9-2 to the final assessment, which explains how the failure frequencies and probabilities are derived and how they can be interpreted. We also added a condensed version of this material to the Executive Summary.**

North Coast Rivers Alliance (Doc. #5061)

9.53 Where the Assessment does discuss certain types of failures, it does not discuss worst-case scenarios. For example, the Assessment models the effects of tailings dam failures, but only offers a "conservative estimate" of the quantity of tailings that would be released.

EPA Response: **The comment is correct in that the loss of 20% of tailings is not a worst case estimate. However, even that conservative case is estimated to have very severe effects and is beyond the capability of the available models and data to estimate the tailings surge.**

The Wildlife Society (Doc. #5272)

9.54 There are real risks associated with contamination of aquatic habitats from routine mine operations. The assessment accurately characterizes the potential for large-scale impacts resulting from failure(s) of tailings storage facilities. The assessment also appropriately considers the cumulative risks that result from associated infrastructure, such as pipelines and a transportation corridor on landscape ecological processes and wildlife populations.

EPA Response: **Comment noted; no change required.**

G.Y. Parker (Doc. #5615)

9.55 Issues related to tailings dam failure. It is likely that, across the watersheds, multiple tailings dams must retain their integrity as engineered structures in perpetuity in the face of changing climate as well as repeated events of unusual, if infrequent, weather and earthquakes. The likelihood of a failure during operation is low due to the relatively short time frame and availability of maintenance and monitoring. In the long term, the several dams that will likely be in place will accumulate damage over the centuries that they will be in place. Logically, the likelihood of failure will increase, with catastrophic consequences.

Recommended Restriction for a § 404(c) Determination: Prohibit the storage of tailings in impoundments. No reactive material stored long term.

EPA Response: **Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.**

Northern Dynasty Minerals Ltd. (Doc. #3650)

9.56 The most widely quoted reference in the 2013 Assessment in relation to the historical record of tailings dam failures is the 2001 ICOLD report which documents accidents and failures at 220 tailings dams reported between 1917 and 2000. After removing accidents that did not result in a failure with tailings release, the BBWA reports that 135 TSF failures from the ICOLD database remained. In reviewing these cases, the BBWA correctly interprets the data as indicating that the stability of tailings dams may increase with time. However, in the 2013 Assessment, this assertion is caveated with the following new discussion:

> "However, failures do occur after operation. In December 2012, the tailings dam at the closed Gullbridge Mine, Newfoundland, failed leaving a gap 50 m wide and the height of the dam (Fitzpatrick 2012). The mine opened in 1967, rehabilitation of the site occurred in 1999, and an inspection in 2010 found that the dam was deteriorating (Stantec Consulting 2011)." (Pg. 9-4)

The new case history provided is one that can be readily mitigated with appropriate design, construction, operations and management. The Gullbridge Mine was operational between 1967 and 1971. An October 2012 Stantec report, prior to the failure, indicates that the 10 m high tailings dam was in poor condition. There was evidence of past failures and past repairs. Stantec's stability assessment indicated a static factor of safety (FS) of 1.0, indicating very high potential for a slope failure.

The TSFs at Pebble will not be designed or constructed at an FS of 1.0 after closure. As such, the inclusion of this case history clearly demonstrates the bias of the BBWA. Consistent with the intent of the ICOLD report, the best use of failure case histories is "to learn from them, not to condemn."

<u>EPA Response:</u> The assessment makes statements of fact concerning failures. We agree that this information may be useful for learning about designing, constructing, operating, and maintaining tailings dams.

9.57 *2012 Geosyntec Comment*: Example case histories of TSF failures are either not relevant to Pebble, or their failure modes can be readily mitigated through proper design, construction, operations and management.

How 2013 Assessment Responds to Comment: A preamble has been added to the presentation of examples of TSF failures (Box 9-1), which states: 9-3 "The tailings dam failures below illustrate the characteristics and potential consequences of a tailings dam failure. The details of the design, construction, or operation of any tailings dams constructed for mines in the Bristol Bay watershed would not be the same as these mine tailings dams, but these examples demonstrate that tailings dam failures can occur, and illustrate how these failures may affect downstream areas. In addition, the dams in these failure examples were significantly smaller than the dams in our mine scenarios."

Discussion on Adequacy of 2013 Response: While the response recognizes that "details" of design, construction and operation at Pebble will be different than those in the TSFs that failed, the original 2012 comment remains true. The four failure examples stem from poor construction, poor operations, and/or poor design. Therefore, they are not relevant to a TSF of the caliber that will be proposed at Pebble. If these case histories are to remain in the report, they should be presented as lessons from the past. The lessons learned from those failures and how the failure modes can be prevented should be included in the report. Much of that discussion is included in Geosyntec's 2012 report.

<u>EPA Response:</u> As the comment acknowledges, the preamble to the examples of tailings dam failures indicates that design, construction and operation methods have changed. The lessons learned are reflected in the very low probabilities of tailings dam failure

estimated for the mine scenarios. However, we would be remiss if we published a risk assessment that did not acknowledge that tailings dams have failed and did not describe the consequences.

9.58 *2012 Geosyntec Comment:* Perhaps the most widely quoted reference in relation to the historical record of tailings dam failures is the 2001 ICOLD report which documents accidents and failures at 220 tailings dams reported between 1917 and 2000. In the 2012 Assessment, after removing accidents that did not result in a failure with tailings release, 135 TSF failures from the ICOLD database remain. No significant attempt is made to interpret the implications of these failure case histories on the hypothetical mine scenario. Only the total number of failures is used when evaluating probabilities of failure. … It is our opinion that all of these failure mechanisms can be mitigated with proper investigation, design, construction, operations and maintenance, and oversight. Consistent with the intent of the ICOLD report, we consider that it is more appropriate to use these case histories "to learn from them, not to condemn." (p. 13)

How 2013 Assessment Responds to Comment: The use of the ICOLD data, now summarized in Table 9-1, remains unchanged in the 2013 Assessment. The interpretation in the 2012 Assessment that the ICOLD data indicate that the stability of tailings dams may increase with time is now caveated with the following new discussion: 9-4

> "However, failures do occur after operation. In December 2012, the tailings dam at the closed Gullbridge Mine, Newfoundland, failed leaving a gap 50 m wide and the height of the dam (Fitzpatrick 2012). The mine opened in 1967, rehabilitation of the site occurred in 1999, and an inspection in 2010 found that the dam was deteriorating (Stantec Consulting 2011)." (p. 13)

Discussion on Adequacy of 2013 Response: The ICOLD data continues to be presented without recognition that these historical failures are not directly applicable to a modern mine. Consistent with the intent of the ICOLD report, we continue to consider that it is more appropriate to use these case histories "to learn from them, not to condemn." Additionally, we note that the new case history provided is one that can be readily mitigated with appropriate design, construction, operations and management. The Gullbridge Mine was operational between 1967 and 1971. An October 2012 Stantec report, prior to the failure, indicates that the 10 m high tailings dam was in poor condition. There was evidence of past failures and past repairs. Stantec's stability assessment indicated a static factor of safety (FS) of 1.0, indicating very high potential for a slope failure. The Pebble TSFs would not be designed or constructed to sit at an FS of 1.0 after closure. As such, what is the purpose of including this case history without focusing on the lessons to be learned?

<u>EPA Response:</u> We would be negligent if the risk assessment did not cite the historical record. We have revised the text to clarify that the use of the historic tailings dam failure data was to set a reasonable upper bound of the dam failure probability. The assessment addresses the use of modern dam engineering and construction methods throughout, and acknowledges that improved design, construction, and monitoring practices may reduce failure rates by an order of magnitude or more. However, the Gullbridge tailings dam failed despite lessons learned from prior tailings dam failures. Future tailings dam failures will also occur despite lessons learned.

9.59 *2012 Geosyntec Comment:* Performing a review of tailings dams that are successful is challenging, as the literature focuses more on problems than success stories. However, the literature does provide documentation related to several recent earthquakes that have subjected modern tailings dams to significant stresses. The following four case histories of large active tailings dams, while certainly not an exhaustive review, do indicate that analogies to seismic risks at the Pebble site exist showing that applying modern design, construction, and operations and management practices can result in successful performance under significant stress with no, or minimal, damage reported.

How 2013 Assessment Responds to Comment: The only indication within the 2013 Assessment that tailings dams can perform adequately was also in the 2012 Assessment: 9-7 "Very few existing rockfill dams approach the size of the structures in our mine scenarios, and none of these large dams have failed."

Discussion on Adequacy of 2013 Response: No new discussion in the 2013 Assessment addresses the comment made by Geosyntec.

<u>EPA Response:</u> The comment does not indicate how the new discussions in the revised assessment fail to address the Geosyntec comment.

9.60 2012 Geosyntec Comment: N/A

How 2013 Assessment Responds to Comment: The 2013 Assessment expands on the discussion of probability of TSF failure by performing a statistical evaluation assuming that the TSFs at Pebble will be constructed as Class II (standard engineering practice) or Class I (state-of-the-practice engineering) facilities. Starting from base rates of 1 in 10,000 (Class II) and 1 in 1,000,000 (Class I) dam year probabilities of slope failure, the 2013 Assessment multiplies these values by four to account for other modes of failure, by eight to account for eight total dams at Pebble 6.5 buildout, and follows an exponential distribution to predict failure rates at 1,000 years of 96% (Class II) and 3% (Class I).

Discussion on Adequacy of 2013 Response: This statistical analysis oversimplifies a very complex process. At each step of the way, the assumptions can introduce significant error and bias. Had the authors of the reference document (Silva et al., 2008) which was used to obtain the starting failure probabilities (e.g., 1 in 10,000 for a Class II dam) been asked whether they considered their method suitable for predicting a 96% failure rate for a TSF constructed with standard engineering practices, they would most likely disagree. We also note that, as described in our 2012 report, the Pebble TSFs will almost certainly be designed and constructed to Class I standards, consistent with a State of Alaska "High Hazard" classification, and hence the 96% failure rate is not only an unreliable statistic, it is not relevant.

<u>EPA Response:</u> The comment is based on speculation concerning a hypothetical reaction of the authors of Silva et al. (2008). The comment does not indicate what the errors and biases might be or how the calculations should have been performed.

9.61 *2012 Geosyntec Comment*: The Wardrop (2011) report indicates that the TSF design will be based on the Maximum Credible Earthquake (MCE). The MCE, as defined by ADNR (2005) as "the greatest earthquake that reasonably could be generated by a specific seismic source, based on seismological and geologic evidence and interpretations." As such, every potential fault that could impact a project has its own MCE, and the design must consider the most critical fault(s) for the project. The seismic analysis provided in the 2012 Assessment does not acknowledge that seismic risks will be evaluated thoroughly during the permitting process.

How 2013 Assessment Responds to Comment: Box 4-6 of the 2012 Assessment has become Box 9-2, with the language largely unchanged. We note the addition of the following statement: "Although the design specifications proposed in Ghaffari et al. (2011) exceed the minimum requirements for dams in Alaska, the deterministic dataset used is small and contains considerable uncertainties, which could lead to an underestimate of the potential seismic risk."

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. The seismic analysis provided in the 2012 Assessment does not acknowledge that seismic risks will be evaluated thoroughly during the permitting process.

<u>EPA Response:</u> The assessment accurately describes the state of knowledge and the uncertainties concerning the locations of faults. Issues associated with permitting are outside the scope of the assessment.

9.62 *2012 Geosyntec Comment:* The analysis in the 2012 Assessment relies on a very coarse 30 meter digital elevation model (DEM) to develop channel bathymetry (pg. 4-53). The coarse nature of the 30 meter DEMs does not account for channel complexity in the floodplain where side channels or wider braided channels are only activated during floods and are available for sediment deposition. Off channel wetlands and watercourses are also missed. The lack of channel complexity and channel morphology oversimplifies the channel roughness and leads to river channels characterized as too "clean" and "smooth." As a result the coarse model very likely over predicts flows, velocities and sediment transport relative to what would be expected in reality (Crosby, 2006).

How 2013 Assessment Responds to Comment: There is no significant change from 2012. The 2013 Assessment continues to rely on the coarse 30 meter DEM.

Discussion on Adequacy of 2013 Response: The 2013 Assessment does not address Geosyntec's 2012 comment. The analysis continues to be based on the use of a coarse 30 meter DEM (Box 9-4, pg. 9-15). In addition, we note the use of this coarse DEM has now expanded. On Page 3-20 of the 2013 Assessment, the authors discuss conducting a flow analysis using the DEM data to establish the gradient of streams and the channel morphology. The report (pg. 3-20) also uses the DEM data to evaluate the valley gradient for the stream network. This would result in grossly misrepresenting stream gradients as:

- The 30 meter DEM grid resolution is too coarse, and
- In reality, high gradient streams are a step and pool system and NOT a straight shot down the valley floor. One must look at the hydraulically effective slope which is much lower.

Note that this calculated stream gradient was also used to evaluate slopes along the transportation corridor at stream crossings (pg. 10-15).

<u>EPA Response:</u> We agree that coarse terrain data makes hydraulic modeling more difficult. Given the available data (30-m DEM), the hydraulic model presented initial

instabilities. This was addressed through application of necessary baseflow to eliminate numerical instabilities. However, the introduction of baseflow was inconsequential when compared to the modeled floodwave. This is typical and acceptable practice, especially when using a model to understand large flow events. The model is not intended to review both low flow and flood flow results, as the available 30-m DEM is not appropriate for low flow calculations.

9.63 In order to model the catastrophic effects of a tailings storage facility (TSF) embankment failure, EPA assumes that a probable maximum precipitation (or storm) event would overtop the embankment and cause a breach. EPA selects this failure mode despite acknowledging that overtopping due to flood is a relatively easy risk to manage through proper engineering design and prudent operations. This is another instance where EPA has responded to Peer Reviewers' criticisms of the 2012 draft BBWA by preparing an appendix on the subject in the 2013 report (in this case, modern TSF engineering) and then failing to apply what it describes in the appendix to its hypothetical mine.

<u>EPA Response:</u> In the final assessment, flooding to generate overtopping is no longer simulated.

9.64 By way of example, the maximum storm event at Pebble would deposit 0.36 m (or 14 inches) of rain over 24 hours and have the effect of raising the water level in Pebble's TSF by an estimated 2-5 feet. This maximum storm event would be easily contained within a TSF that is designed and managed according to standard industry practice.

<u>EPA Response:</u> See response to Comment 9.63.

9.65 Under normal operating conditions, TSFs at Pebble are expected to maintain an average of more than 25 feet of freeboard (the vertical distance from the top of the embankment to the surface of the tailings pond) at all times so as to manage flood and overtopping risk. The decant water pond in the Pebble TSF would also be set back horizontally from the embankment by 1,000 feet or more, further minimizing such risks.

<u>EPA Response:</u> See response to Comment 9.63.

9.66 Overall, EPA acknowledges that TSF failures around the world have diminished significantly in the last 20 years, particularly in North America. EPA cites the current failure rates for modern state-of-the-art designed embankments at about 1 failure per 250,000 years, and acknowledges that no structures of the size and design anticipated at Pebble have ever failed.

<u>EPA Response:</u> Comment noted; no change required.

9.67 While the report does not explicitly state what freeboard height was included in their scenario, it does explicitly state that the storm loads can be mitigated easily with freeboard: "If sufficient freeboard were maintained, it would be possible to capture and retain the expected volume of the PMF in the TSF." Box 9-4 (Pg 9-15).

The 2013 Assessment is therefore basing their dam failure analysis on an extremely improbable event, once again demonstrating the bias in the report. In fact, the report gives clear indication of this bias: "Although a tailings dam failure is a low-probability event, the probability is not zero." (Pg. 9-13).

The probability of overtopping may not be zero, but it is extremely small for a modern TSF of this size and importance. Such a small probability of failure does not warrant the alarmist dam breach analysis included in the BBWA.

<u>EPA Response:</u> See response to Comment 9.63.

9.68 In fact, the maximum flow depths in the failure scenario have increased dramatically relative to the 2012 Assessment. This appears to be a result of a significant change in the peak discharge rate from the dam breach analysis. For the 2013 Assessment's "Pebble 2.0" dam breach scenario, which assumes breach of a 209 m high tailings dam and release of 20% of the stored tailings, the maximum discharge rate is now 149,300 m^3/s (Table 9-4), greater than 12 times the 2012 maximum discharge of 11,915 m^3/s (Table 4-11) for what is presumably the same failure scenario. The analysis modeled a dam breach over a 30 km path from the TSF to the confluence of the North Fork Koktuli and South Fork Koktuli Rivers. A comparison of several stations near the end of the analysis show:

- Station 10: maximum flow depth has increased from 8.8 m to 35 m;
- Station 5: maximum flow depth has increased from 8.1 m to 53 m; and
- Station 1: maximum flow depth has increased from 14 m depth to 44 m.

One set of assumptions was made in 2012. A very different set of assumptions was made in 2013, with very different results. Given the limitations of the HEC-RAS model, the coarse nature of the inputs to the model, and the sensitivity of the model to changes in parameters, it is clear that neither result is a reasonable representation of what would actually happen in the very unlikely event of a dam breach. Either full details of the model should be provided in an appendix for review, or the model results should be removed from the report completely.

<u>EPA Response:</u> The final assessment explicitly acknowledges sensitivity of the HEC-RAS approach to initial conditions and assumptions, and includes additional descriptions of the approaches used to derive these estimates. The final assessment uses HEC-RAS inputs that have been revised in response to multiple comments from reviewers, and thus reflect revisions that incorporate our best understanding of TSF failure outcomes. Assumptions of the modeling approach are provided in the assessment, and we believe them to be within reasonable bounds.

9.69 The 2013 Assessment continues to assume that deposition occurs at high velocities, extending out across the width of the inundated area at the peak of the flood wave. Box 9-3 of the 2013 Assessment states: "It was also predicted that deposition could occur in the channel and the floodplain of each section following the maximum predicted flow depth during the peak of the flood wave as the flood and debris flow receded."

However, for the most part the revised evaluation disconnects sediment depth from the dam breach analysis. Box 9-3 also states: "We assumed that sediment deposition would be greatest near the dam, forming a "wedge" from the lowest elevation of the breach and extending downstream. The calculated sediment depths ranged from 45 to 10 m and extended 1.3 and 3.3 km for the 90-m (Pebble 0.25) and 209-m (Pebble 2.0) dam failures, respectively. … Using this maximum width of inundation, a 0.3-m depth of sediment was deposited on the floodplain and channel."

Sediment thicknesses are now almost entirely controlled by assumptions:

- Sediment “wedge” up to 45 m thick near the dam, extending at a slope of 15:1 (H:V) (pg. 9-19); and
- Sediment thickness at a constant 0.3 m thick beyond the toe of the “wedge.”

If deposition of the sediments from the dam failure is no longer the outcome of the dam breach analysis, its continued inclusion in the BBWA further demonstrates the bias of the document.

EPA Response: The comment is correct that sediment deposition depths are controlled by assumptions, as explained in Box 9-4. We describe the sediment deposition as a significant source of uncertainty. Valley topography, rate of the dam failure, and ultimate make-up of the flood wave sediment concentration and viscosity can affect outcomes and complicate predictive efforts. Despite the uncertainty associated with the complexities of hydraulic forces that would act on this sediment, we present reasonable post-failure sediment deposition outcomes in the two dam failure scenarios. Other outcomes are possible, but all share the common reality that massive quantities (i.e., millions of cubic meters) of tailings fines would be deposited in downstream floodplains and channels.

9.70 *2012 Geosyntec Comment:* The lateral extent of the cross-sections in the HEC-RAS model in the 2012 Assessment were likely insufficient, resulting in increased flow depth and higher velocities (Table 4-13, pg. 4-59).

How 2013 Assessment Responds to Comment: The 2013 Assessment does not address this comment and no longer includes the cited table from the 2012 Assessment.

We note that the maximum flow depths have increased dramatically relative to the 2012 Assessment. This appears to be a result of a significant change in the peak discharge rate from the dam breach analysis. For the 2013 Pebble 2.0 scenario, the maximum discharge rate is now 149,300 m^3/s (Table 9-4), greater than 12 times the 2012 maximum discharge of 11,915 m^3/s (Table 4-11) for what is presumably the same failure scenario.

At station 10 (formerly station 9.4) maximum flow depth has increased from 8.8 m to 35 m. For station 5 (formerly 5.4) maximum flow depth has increased from 8.1 m to 53 m. For station 1 (formerly 0.6) maximum flow depth has increased from 14 m depth to 44 m.

Discussion on Adequacy of 2013 Response: The 2013 Assessment does not address Geosyntec’s 2012 comment. More importantly, the extraordinary change between the 2012 and 2013 analysis is evidence that the dam breach analysis should not be relied upon.

One set of assumptions was made in 2012. A very different set of assumptions was made in 2013, with very different results. Given the limitations of the HEC-RAS model, the coarse nature of the inputs to the model, and the sensitivity of the model to changes in parameters, it is clear that neither result is a reasonable representation of what would actually happen in the very unlikely event of a dam breach. Either full details of the model should be provided in an appendix for review, or the model results should be removed from the report completely.

<u>EPA Response:</u> We disagree with this comment. Although a 30-m DEM was used, the geometries of the sections were measured valley wall to valley wall. The TSF failure would generate a large floodwave peak, and the flood depths and velocities reported are possible.

9.71 *2012 Geosyntec Comment:* The Manning's friction coefficient was increased to "better reflect the influence of sediment-rich water during tailings dam failure" (pg 4-53). However the 2012 Assessment does not supply the reader with information as to how they evaluated the appropriate Manning's coefficient, nor do they state the value used. The implications of changes in model parameters would likely be significant given the scale and likely sensitivity of the analysis.

How 2013 Assessment Responds to Comment: The 2013 Assessment now states: 9-21 "When applied to tailings dam failure events, it is appropriate to increase channel roughness coefficients to better emulate flow characteristics of concentrated sediment flows. Manning's n = 0.2 for the channel and 0.6 for the floodplain were selected."

Discussion on Adequacy of 2013 Response: The 2013 Assessment does now state what Manning's n was used. However the report does not provide any analysis or justification for these numbers. In addition the report does not indicate if multiple model runs were run to evaluate sensitivity of model results to Manning's n, as recommended in the original comments.

<u>EPA Response:</u> Manning's n-value of 0.2 was used for the main channel and 0.6 was used for the floodplain. These coefficients represent sediment-rich flows and are appropriate for review of the potential dam failure flows. We recognize that these high n-values are not typically applied to clear water modeling simulations.

9.72 *2012 Geosyntec Comment:* The mine tailings dam breach run-out scenarios in the 2012 Assessment are modeled to a distance of only 30 km and the analysis then utilizes a tailings run-out regression equation to calculate total mine tailings travel distances beyond the last segment of the model (pg. 4-57). Switching from a simplistic sediment transport approach to an even more simplistic regression equation once the mine tailings reach the confluence of the North Fork Koktuli and South Fork Koktuli Rivers only adds to the uncertainty in the estimates of the distance of sediment transport.

How 2013 Assessment Responds to Comment: The 2013 Assessment did not address this comment as the HEC-RAS model continues to end at a distance of 30 km (Box 9-5, pg 9-21), followed by use of the tailings run-out regression equation (pg 9-20).

Discussion on Adequacy of 2013 Response: The 2013 Assessment does not address Geosyntec's 2012 comment.

<u>EPA Response:</u> The final assessment explicitly recognizes that these analyses are simplistic and uncertain. However, they are reasonable approximations of potential outcomes that are within the range of feasible outcomes.

9.73 *2012 Geosyntec Comment:* Sedimentation of the dam break flood wave in the 2012 Assessment was calculated when the flood wave was at its maximum predicted depth (pg. 4-57). When river flows are at their maximum flood stage, river velocities are often at their highest, which is not conducive to sediment deposition. The majority of sediment deposition occurs on the receding limb of the flood curve, when river velocities are starting to decrease.

How 2013 Assessment Responds to Comment: As described in Box 9-5, the 2013 Assessment provides a very different evaluation of sediment deposition. "We assumed that sediment deposition would be greatest near the dam, forming a "wedge" from the lowest elevation of the breach and extending downstream. The calculated sediment depths ranged from 45 to 10 m and extended 1.3 and 3.3 km for the 90-m (Pebble 0.25) and 209-m (Pebble 2.0) dam failures, respectively. It was also predicted that deposition could occur in the channel and the floodplain of each section following the maximum predicted flow depth during the peak of the flood wave as the flood and debris flow receded. Using this maximum width of inundation, a 0.3-m depth of sediment was deposited on the floodplain and channel."

Discussion on Adequacy of 2013 Response: The 2013 Assessment continues to assume that deposition occurs at high velocities, extending out across the width of the inundation wave at the peak of the flood wave. However, for the most part the revised evaluation disconnects sediment depth from the dam breach analysis. Sediment thicknesses are now almost entirely controlled by assumptions:

- sediment "wedge" up to 45 m thick near the dam, extending at a slope of 15:1 (H:V) (pg. 9-19); and
- sediment thickness at a constant 0.3 m thick beyond the toe of the "wedge."

This revised approach raises the following question: What is the purpose of the dam breach analysis?

<u>EPA Response:</u> See response to Comment 9.69.

9.74 *2012 Geosyntec Comment*: The Hjulstrom curve was used in the 2012 Assessment to evaluate sediment transport velocity (pg. 4-57). While the Hjulstrom curve is a widely used reference to evaluate sediment transport in streams, it is not well-equipped to be used to evaluate sediment settling in a dense, mostly solid flow such as the scenarios set forth in the report.

How 2013 Assessment Responds to Comment: The 2013 Assessment did not address this comment as the reference to Hjulstrom remains in the text of Box 9-5 (pg. 9-21).

Discussion on Adequacy of 2013 Response: While the 2013 Assessment does not address the comment, the revised approach to sediment deposition, which is based on assumption and not on analysis, makes our 2012 comment, and the continued use of the Hjulstrom curve in Box 9-5 of the 2013 Assessment, irrelevant.

<u>EPA Response:</u> The Hjulstrom curve presents the relationship between grain size and velocity and supports statements regarding expected deposition as floodwaves recede. It is provided to inform readers that may not have the expertise to draw upon references to understand this relationship. However, there is not a specific application of the curve in the assumptions related to deposition that may occur following a dam failure.

9.75 a) Chambers and Higman, 2011 – "Long Term Risks of Tailings Dam Failure"

<u>Summary</u>

- Some statistical interpretation is misleading
- Cases affect the statistics and do not allow modern design practices and operations in well-regulated environments to be fully appreciated
- Report has not fully understood most recent data from ICOLD 2001 (International Commission on Large Dams)
- Disregards effective modern mitigation methods

EPA Response: Chambers and Higman (2011) is one of several papers that reviewed the historical record of tailings dam failures and that reached similar conclusions. Section 9.1.1 of the final assessment discusses some of the limitations of the available data. Chambers and Higman (2011) acknowledge improvements in tailings dam safety, but caution that recent engineering failures should remind us that we may not fully understand "… some of the critical issues we should be addressing."

American Fisheries Society (Doc. #3105)

9.76 Nonetheless, the 2013 draft is overly conservative in estimating likely impacts. For example: (…) It assumes that slope failures (which can be reduced by engineering safety factors) would be the major cause of failures at TSF, but unusual weather events (which are amplified in frequency and magnitude by climate change) have been the major cause of TSF failures in the past 10 years (see Azam and Li. 2010. Tailings dam failures: a review of the last one hundred years. Geotechnical News. December: 50-53).

EPA Response: The assessment acknowledges that climate change may affect the probability of tailings dam failures.

9.77 Nonetheless, the 2013 draft is overly conservative in estimating likely impacts. For example: (…) It assumes that historical rates of system failures from other regions of the world offer appropriate rates in the much harsher and more variable Alaskan environment.

EPA Response: We agree that the conditions in Alaska may influence the probability of failure. However, there is too little experience with tailings dams in Alaska to estimate Alaska-specific rates.

9.78 Nonetheless, the 2013 draft is overly conservative in estimating likely impacts. For example: (…) It assumes that failure of tailings storage facilities (TSF) will release only 20% of the tailings, whereas Dalpatram (see Dalpatram, A. 2011. Estimation of tailings dam break discharges. USSD Workshop on Dam Break Analysis Applied to Tailings Dams. 24-26 August) estimated up to 40% release.

EPA Response: The 20% value was retained as a reasonable scenario.

9.79 Nonetheless, the 2013 draft is overly conservative in estimating likely impacts. For example: (…) It limits the fate of spilled tailings to 30 km because that is the limit of the models used; however, some amount of toxic contaminants and fine sediments will flow to the sea, thereby greatly extending the impact zone.

EPA Response: Although the modeled runout distance is limited, the long-range downstream movement of tailings is discussed in multiple sections of Chapter 9.

Ground Truth Trekking (Doc. #3928)

9.80 Cumulative dam length is also likely a factor in dam security (and may, in fact, explain why "a bigger number of dams means more dam failures" – because cumulative length is greater). Some of Pebbles projected individual dams would be very long, many kilometers in length, which will impact the probability of failure.

EPA Response: Comment noted. However, we have no means to use dam length in the calculation of failure probabilities.

Earthworks (Doc. #5556)

9.81 Furthermore, it's inappropriate to assert that modern operations/regulations can/will prevent the failures modes identified in the watershed assessment. For example, data does not exist to demonstrate that new technology will prevent, or even reduce the rate, of tailings impoundment failures. Tailings dams simply haven't been around long enough to determine whether newer construction methods will withstand the test of time required for mine waste storage in perpetuity. As stated in (Chambers and Higman, "Long Term Risks of Tailings Dam Failure," October 2011), it has been 15 years since the International Commission on Large Dams (ICOLD 2001) initiated a major effort to investigate tailings dams and change construction and operational practices, and the rate of tailings dam failures has remained relatively constant - at roughly one failure every two years (Davis and Martin 2000). These dam failures are not limited to old technology or to countries with scant regulation. Previous research pointed out that most tailings dam failures occur at operating mines, and that 39% of the tailings dam failures worldwide occur in the United States, significantly more than in any other country (Rico, et. al., 2008a, p. 848).

EPA Response: Comment noted; no change required.

Center for Science in Public Participation (Doc. #5657 and #5540)

9.82 "Because 90% of tailings dam failures have occurred in active dams (Table 9-1), the probability of a tailings dam failure after TSF closure would be expected to be lower than the historical average for all tailings dams." (p. 9-10)

It might be noted that many, if not most engineered tailings dams are probably 75 years old or less. Since these dams must function in perpetuity, and we do not have data even closely representative of that length of time, the assumption that the probability of tailings dam failure after closure "would be expected to be lower" might be premature.

EPA Response: Comment noted; no change required.

9.83 Box 9-4. Modeling Hydrologic Characteristics of Tailings Dam Failures: "If sufficient freeboard were maintained, it would be possible to capture and retain the expected volume of the PMF in the TSF. However, to examine potential downstream effects in the event of a tailings dam failure, we assume that sufficient freeboard would not exist and overtopping would occur. This may be less likely when the TSF would be actively monitored and maintained, but barring human error in the near term, may be more representative of post-closure conditions in the future." (p. 9-15)

Most tailings ponds have spillways post-closure, and the Pebble Limited Partnership has hinted this may be a feature of some or all of tailings dams at Pebble. As a result, overtopping of a tailings dam due to a lack of "sufficient freeboard" would not be a possibility.

It is also likely possible to maintain a small lake on top of the closed tailings facility while still having a spillway to deal with a probable maximum flood event. That said, the observation that "Tailings dam failure via overtopping is expected to have similar effects as failures resulting from other causes (e.g., slope failure, earthquakes)" is a legitimate concern because, for example, a post-closure breach of the tailings dam due to a seismic-related failure would release a significant amount of saturated tailings.

EPA Response: As the assessment describes, there has been at least one case of overtopping of a tailings dam with a spillway.

9.84 The BBWA conservatively assumes a TSF failure of 20% tailings volume and out flow up to 30 km but reported range of tailings spills are 1% to 100%. Rico et al. 200818 found a high correlation (r^2= 0.86) between volume of tailings at time of failure and outflow volume, and that volume was correlated to a lesser extent with run-out distance (r^2=0.57).

Recommendation: Consider impacts from a larger tailings release scenario. Consider that tailings will continue to wash down river with storms.

EPA Response: The 20% value was retained as a reasonable scenario. The downstream movement of tailings is discussed in multiple sections of Chapter 9.

9.85 "This assessment recognizes that a variety of scenarios could occur that would influence tailings and debris transport potential. Included here is only one hydrology failure scenario where impoundment capacity is exceeded, due to either lack of freeboard or bypass infrastructure failure. It should be noted that a scenario involving failure during fair weather could also occur and cause similar down-valley flows." (p. 9-16)

Recommendation: It might be more appropriate to say "… a failure involving a non-hydrologic event …" rather than "… a failure during a fair weather …".

EPA Response: Language has been modified to recognize other sources of failure initiation.

9.86 Box 9-6. Background on Relevant Analogous Tailings Spill Sites "Soda Butte Creek, Montana and Wyoming. The headwaters of Soda Butte Creek drain the New World mining district in Montana before entering Yellowstone National Park. From 1870 to 1953, porphyry deposits were mined for gold and copper with some arsenic, lead, silver, and zinc." (p. 9-35 emphasis added)

I am aware of gold mining (not porphyry), lead-zinc mining (not porphyry), and copper mining (not porphyry) in the New World mining district, but no porphyry deposits. There is some speculation that a porphyry copper deposit may exist at depth in this area, but I am not aware of any reports or data that strongly suggest this.

Recommendation: It might be just as relevant to say "deposits" as opposed to "porphyry deposits".

<u>EPA Response:</u> The statement is based on the cited reference (Marcus et al. 2011).

9.87 Attachment C: Notes on Northern Dynasty Minerals 2nd Watershed Assessment Comments

Northern Dynasty (NDM): EPA has continued to ignore modern mine engineering practices and regulatory requirements; including,

> b. “Tailings Storage Facility Designed to Fail”
>
> In the Watershed Assessment EPA has been conservative in its assumptions and analysis of potential tailings dam failures. Mine supporters would like the EPA to assume that the failure of the tailings dam at Pebble could not happen. Making such an assumption for a risk assessment would be both naïve and irresponsible, yet this is indeed what EPA’s critics are proposing. Mine proponents always assume that failures are due to “old” technologies or to imprudent practices by less responsible developers, but that these mistakes could never occur on their projects.

EPA has also noted:

> “Based on a review of historical and currently operating mines, some failure of water collection and treatment systems would be likely during operation or post-closure periods. A variety of water collection and treatment failures are possible, ranging from operational failures resulting in short-term releases of untreated or partially treated leachates to long-term failures to operate water collection and treatment systems in perpetuity. A reasonable upper bound failure scenario would involve a complete loss of water treatment and release of untreated wastewater.” (Second External Review Draft, p. ES-15)

It would be negligent for EPA not to assess the potential impacts from a water treatment plant failure as a part of a risk assessment. It is not appropriate to claim that EPA designed the water treatment plant to fail. EPA merely looked at a range of potential water treatment plant failures – an appropriate and necessary set of assumptions for a risk assessment.

<u>EPA Response:</u> Comment noted; no change required.

9.88 Attachment A: EPA Watershed Assessment Second Draft Responses to Selected Peer Review Panel Questions and Critiques

PEER REVIEW COMMENT (Dirk van Zyl): A significant improvement in tailings management is the implementation of an Independent Tailings Dam Review Board (ITRB) for large mining projects (Morgenstern, 2010)… I expect that a tailings review board will also be used for the Pebble Mine and the behavior of a tailings management facility designed and operated under these conditions will be more representative of the potential failure likelihoods expected for such a facility.

EPA Response: The State of Alaska regulates its dams, including tailings dams, under Alaska Administrative Code (AAC) Title 11, Chapter 93, Article 3, Dam Safety (11 AAC 93). Each dam is assigned to a class based on the potential hazards of a tailings dam failure (Table 9-2).

Chambers Comment: Unfortunately there is no requirement Alaska Administrative Code (AAC) Title 11, Chapter 93, Article 3, Dam Safety (11 AAC 93) to convene an independent tailings review board, hence no guarantee, that an independent review board will be utilized at Pebble. Alaska has not utilized an Independent Tailings Dam Review Board for a mine in the past.

Alaska code specifies that a qualified engineer is required to assure that a dam is designed, built, and operated with appropriate concerns for safety. A "qualified engineer" is defined in the Alaska dam safety regulations under Title 11, Chapter 92, Section 193 of the Alaska Administrative Code (11 AAC 93.193). To meet the criteria for a qualified engineer, an individual must be a civil engineer currently licensed to practice in Alaska under the State Board of Registration for Architects, Engineers, and Land Surveyors. The regulations also state that the qualified engineer must have at least five years of experience as a licensed or registered professional civil engineer.

Regardless, Pebble is not the only mine that is likely for the Bristol Bay region if the Pebble Mine is constructed and the transportation infrastructure that would facilitate further development is put into place. It is likely these secondary mines would not face the same level of scrutiny that a large mine like Pebble would.

In addition, there are many examples of the dam construction-type changing in later stages of a mining project. This is perfectly illustrated by the Fort Knox Mine in Alaska where all but the final stage of tailings dam construction was downstream, but the final dam lift is upstream – the type of construction most susceptible to seismic instability.

EPA Response: Comment noted; no change required.

Kachemak Bay Conservation Society (Doc. #1118 and #4284)

9.89 Engineered waste storage systems of mines have been in existence for only about 50 years and their long-term behavior is not known. More information is needed.

EPA Response: Comment noted; no change required.

9.90 Finally, as if any of the above issues were not enough justification to halt the Pebble project, Alaska's active geology should! And it just might if the project is undertaken. The potential for catastrophic failure of all or some of the engineered safeguards due to seismic or volcanic events seems likely, considering the lengthy timeframe stored toxic wastes will pose a threat to the region. Geologic fault lines and active volcanoes in the area should not be minimized, as information from the Pebble Partnership has done, but should seriously be considered as real threats, not just during the active mining phase, but looking forward to some end-date, when the resulting project contaminants can no longer poison the wetlands, rivers, and life of the Bristol Bay watershed. Mine failures are common and to be expected. The historical record is clear. Consider the example of the landslide within Rio Tinto's Bingham Canyon mine near Salt Lake City Utah on 4/11/13. Also, the much worse bauxite tailings storage dam failure in Kolontar Hungary in 2010, which killed ten residents, wounded 120 and devastated the town of Kolontar and several other downstream communities. Even greater environmental damage was done by a huge spill of cyanide-containing wastewater from a gold processing plant in Baia Mare, Romania in 2000. That environmental disaster left 2.5 million people temporarily without safe drinking water. The toxic waste – with cyanide levels 400 times the maximum normal amount – poured into local rivers, ultimately inflicting serious damage on more than 1,000 kilometers of waterway in the Danube ecosystem in four countries. It killed millions of fish and, by some accounts, "wiped out" all life adjacent to Hungary's Tisza River, from fish-eating birds to foxes to hares. These are only three of the escalating number of mine failures from around the globe and none of them was precipitated by a seismic event. To allow the world's largest open-pit mine development, with all of its inherent risk, to move forward in Alaska's unpredictable seismic reality would be folly, of the worst kind. Likely, future generations would deem that choice, "insane".

EPA Response: Comment noted; no change required.

Moore Geosciences, LLC (Doc. #2911)

9.91 The authors of the revised report have expanded their assessment of probability of failure and added substantial material that strengthens their estimates of probabilities and estimates of uncertainty. This is especially true for seismic risk.

EPA Response: Comment noted; no change required.

9.92 The revised assessment now presents an even more conservative estimate of the amount of tailings released during failure. The estimates for the two scenarios have reduced total storage volumes while continuing to use a maximum of 20% of total volume of tailings removed during failure, resulting in maximum values lower than the previous assessment. The continued use of "30+ km" is a very substantial under-estimate of the potential extent of damage from tailings deposition. Based on the empirical relationship between the total amount of tailings stored in an impoundment and the amount released developed by Rico et al. (2008, Eq. 7), I would expect on the order of 35% of the total tailings to be released. The continued use of the 20% value is not supported by the literature on tailings impoundment failures (Azam and Li 2010):

> "Based on historical tailings dam failure data, it is reasonable to assume that all construction material from the dam breach and from 30 to 66% of the impoundment tailings material could contribute to debris flow following a tailings dam failure (Browne 2011)."

The authors' use of a lower set of values (5-20%) is thus a very conservative estimate; it severely under-estimates the potential release of tailings and therefore the distance of transport downstream and resulting damage from a tailings impoundment breach. The literature of tailings impoundment failure suggests much longer run-out distances than the assessment estimates. The Los Frailes mine failure released only about 4.6 million m3 of tailings and acidic water (Rico et al. 2008), but the resulting tailings run out distance was about 41 km in the Rio Guadiamar. The Bafokeng mine tailings impoundment breach released even less tailings, about 3 million m^3 of tailings, but still resulted in a run out distance of 45 km. In some cases, tailings impoundments failures can severely affect river systems for much farther distances. The tailings dam failures in Romania (reported in the cited document by ICOLD 2001) resulted in damaging effects over 1400 km downstream from the source. In all the historical data presented in Rico et al (2008), the volume of tailings released are substantially smaller than the potential volumes released from those examined in the Bristol Bay assessment ($\leq$4.6 million m^3); nevertheless, the run-out distances reached up to 120 km. These volumes are only about 1/5 of the lowest volume release scenario used in the Bristol Bay assessment. Therefore, it is reasonable to expect that any failure in the Bristol Bay system would result in tailings being transported substantially farther downstream than those reported in Rico et al. (2008). Using Rico et al.'s (2008) approach, I would expect run-out distances well over 150-300 km in the Bristol Bay watershed. As I pointed out in my previous comments, the run out distance for the amount of tailings modeled for the larger Pebble scenarios are likely better captured by the OK Tedi mine in Papua New Guinea. Tailings from the OK Tedi mine "dominates river sediments, floodplain and lake bottoms for 610 km downstream from the mine" (Luoma and Rainbow 2008). Such a complete transformation is a likely picture of how a large tailings failure would affect the rivers downstream from the Pebble mine.

<u>EPA Response:</u> The modeled runout distance of a spill was limited by the available data and models. The experience with prior mines is marginally relevant because of the importance of site characteristics. For example, the OK Tedi spill was in very steep topography, unlike the topography in the Nushagak and Kvichak River watersheds.

9.93 The revised assessment expands and clarifies the physical and geochemical effects on the landscapes and ecosystems below the potential mining areas. This is an excellent assessment of the types of damage and their duration. Potential spills would likely bury many thousands of hectares of riparian and floodplain environments. Once the floodplain was filled with tailings, excess tailings would be directly transported downstream. The large amount and thickness of tailings on the floodplain would act as a long-term source for contaminants to all water bodies downstream. This source would last decades to centuries as is seen in historically mining-contaminated floodplains throughout the world (Moore and Luoma 1990; Macklin 2006; Moore and Langner 2012). The revised assessment has also done a thorough job of presenting the potential pathways and effects of contaminants on the ecosystem and the potentially huge magnitude of these processes. Metals dissolved in the water column are highly and immediately available to biota, while metal-rich sediment can cause wide-ranging damage to aquatic ecosystem health, extirpating vulnerable species and simplifying food webs (Luoma and Rainbow, 2008). Metal mobilization immediately after a tailings spill can be quite large and have enduring effects on ecosystems for decades or centuries. Simulated weathering experiments and geochemical modeling by Koseff et al. (2012) showed that 50-95% of metal content could be mobilized within 20 years after deposition. This shows the "serious short- to long-term effects that accompany tailings dam spills onto floodplain environments…" (Koseff et al. 2012). Work in the Clark Fork River in Montana has shown that tailings effects can last much longer. In that river system, even after a century of natural attenuation of tailings contamination, metals concentrations in the river sediment will likely remain above effects thresholds for decades to come (Moore and Langner 2012). Any of the tailings release scenarios presented in the Bristol Bay assessment would result in distributed, long-term metal sources over large areas that would be physically and economically impractical to remove. This then would likely result in toxic effects for hundreds of years (Luoma et al. 2008; Luoma and Rainbow 2008).

<u>EPA Response:</u> Comment noted; no change required.

Center for Biological Diversity (Doc. #2922)

9.94 A tailings dam failure would result in billions of tons of mining waste, including potentially toxic materials, washing downstream. Water quality would be destroyed and fish populations in the Kvichak and Nushagak Rivers would suffer massive casualties, resulting in tainting of all or much of Bristol Bay salmon production (Hauser 2007). This would have major impacts on Iliamna Lake seals, resulting in high levels of direct mortality through toxic effects, decreased reproductive success, and suppression of the immune system resulting in increased disease risk. Tainted salmon would also suffer high mortality rates, which would influence the amount of prey available to Iliamna Lake seals.

EPA Response: Comment noted; no change required.

S. L. O'Neal (Doc. #5528)

9.95 P. 9-28: PLP's Environmental Baseline Document is cites as a source of aquatic insect information. The report contains erroneous information, and its use should be eliminated and/or qualified.

EPA Response: We cite the EBD as a source of macroinvertebrate community information. The characterized communities were broadly similar to those observed by Bogan et al. (2012). The assessment did not make further use of specific taxonomic information from the EBD.

9.96 [I]n addition to passage being a potential issue for resident fish and invertebrate recolonization after a tailings dam failure, the lack of marine derived nutrients delivered by salmon would inhibit recolonization.

EPA Response: We agree. The importance of marine derived nutrients in freshwater foodwebs is recognized multiple times in the final assessment, and is specifically incorporated as a negative feedback loop with reductions in salmon productivity and abundance in the conceptual diagrams.

K. Zamzow, Ph.D. (Doc. #5054)

9.97 Tailings Migration. Kinetic testing of numerous representative ore body samples should be required throughout the life of the mine, based on standard test procedures; testing methods and data need to be available to regulators.

- A pyrite concentrate should be produced.
- If dry stack tailings are produced, pyrite should be removed to the extent that is technically feasible, and liners should be placed under the stacks.
- If tailings are stored in an impoundment, require the impoundment to be lined.

EPA Response: Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.

B. Killer (Doc. #9642)

9.98 To assume there will be no breaching or leaking of the dam reeks of the same hubris exhibited by the nuclear industry 60 yrs ago, leaving us, esp. here in Washington, with a legacy of catastrophic, interminable pollution of our land, air and water. Because of the acid-generating nature of the Pebble ore body, the waste would need environmental treatment in perpetuity. Any release of mine waste into the surface or groundwater has the potential to harm Bristol Bay's salmon runs, along with the waters used by every other species in or traveling through the vicinity.

EPA Response: Comment noted; no response required.

Chapter 10: Transportation Corridor

Iliamna Village Council (Doc. #5784)

10.1 Because the Bristol Bay watershed is located in one of the last remaining virtually roadless areas in the United States, development of any mine in the Bristol Bay watershed would require substantial expansion and improvement of the region's transportation infrastructure. There are few existing roadways, no improved federal or state highways, and no railroads, pipelines, or other major industrial transportation infrastructure. The mine scenarios evaluated in the USEPA assessment include a 138-km gravel surface, all-weather permanent access road connecting the mine site to a new deep-water port on Cook Inlet. This length does not include road sections within the mine site itself. Approximately 113 km of this corridor would fall within the Kvichak River watershed. The discussion below will not consider damages to salmon habitat during the actual construction of the corridor. Such damages should be considered as temporary, whereas those discussed below are ongoing.

EPA Response: Doc. #5837 rescinded this comment; no change required.

10.2 The transportation corridor area comprises 27 sub-watersheds draining to Iliamna Lake. These sub-watersheds encompass approximately 690 square miles and contain nearly 900 miles of stream channels. The corridor would include 18 bridges (11 over known anadromous (fish returning from the sea to spawn) streams and 7 other streams likely to support salmonids). All other stream crossings would be culverted. Thus, given that the transportation corridor would cross a total of 53 streams and rivers known or likely to support migrating or resident salmonids, culverts would be constructed on 35 presumed salmonid streams. Not infrequently, culverts fail. Culverts are deemed to have failed if fish passage is blocked (e.g., by debris, ice, or beaver activity) or if stream flow exceeds culvert capacity, resulting in overtopping and road washout. Literature reports suggest an average culvert failure rate of 47% (i.e., culvert surveys indicate that, on average, 47% of culverts block or inhibit fish passage at any given time).

EPA Response: Doc. #5837 rescinded this comment; no change required.

10.3 When culverts are plugged by debris or overtopped by high flows, road damage, channel realignment, and severe sedimentation often result. Changes in sediment load due to culvert failures can change habitat value in the stream. It is diminished as the channel becomes wider and shallower and silt is deposited in the streambed. Stream crossing failures that divert stream flow outside of stream channels are particularly damaging.

During operation of the mine, frequent inspections of the road, bridges and culverts will make this damage less severe, but there is no doubt that culvert blockage and other changes caused by the road itself will seriously impact salmon spawning and survival.

EPA Response: Doc. #5837 rescinded this comment; no change required.

10.4 There are other problems associated with the transportation corridor, such as noise, dust, vibrations, and truck accidents, all of which could add to the diminishment of salmon reproduction and survival. Trucks will carry chemicals and supplies from the port to the mine, including some of the flotation chemicals that are quite toxic to fish. Spillage of these chemicals due to a truck accident would cause considerable but non-quantifiable damage to a fish and spawning habitat. Trucks also carry molybdenum concentrate to the port, and a substantial spill of this concentrate could also cause considerable damage to fish recourses.

EPA Response: Doc. #5837 rescinded this comment; no change required.

Alaska Miners Association (Doc. #2910)

10.5 Error #12: status unclear. Assumption of a Road (2012 TR, page 16). A road may be required to develop the Pebble Mine. However, it is quite possible that other mines within the watershed would not be developed using a road, would use a shorter road, or would use a road in a less (or more) sensitive area. Thus the road impacts may not be representative of non-Pebble mines in Bristol Bay. As we cannot determine whether the Assessment is focused on Pebble or on any mine in Bristol Bay, we cannot determine the potential significance of this error. However, we do note that EPA ignored the critique in their 2013 draft.

EPA Response: The assessment evaluates potential risks of mine development at the Pebble deposit. Mining at similar deposits in the region likely would pose similar types of risks, as is discussed in Chapter 13 of the revised assessment.

10.6 Error #13: not addressed. Omission of Prevention and Mitigation Strategies – design changes for the road (2012 TR, pages 16-17). As AMA's 2012 review pointed out, EPA proposes a specific road alignment and by implication road construction techniques and then disparages them because of the environmental impacts they will cause. The obvious solution is to provide a higher level of design/construction standards and a robust monitoring program to catch problems before they cause these problems.

EPA Response: The assessment's road alignment matches the alignment proposed by Northern Dynasty Minerals in Ghaffari et al. (2011). We note in the assessment that environmental risks would not be expected to change substantially with minor shifts in road alignment. These risks take into account the use of best management practices and mitigation measures, which are discussed in text boxes throughout Chapter 10. Nonetheless, environmental characteristics along the transportation corridor would likely render the effectiveness of standard or even "state-of-the-art" mitigation measures highly uncertain (see Box 10-5 of the final assessment). Although culverts and other infrastructure components can be designed to higher than usual standards, they

are not always installed correctly or may not stand up to the rigors of a harsh environment.

10.7 Error #14: not addressed. A check on conclusions: EOA came to different conclusions for other mine roads (2012 TR, pages 17-18). AMA's 2012 review pointed out that EPA came to different conclusions in this watershed assessment than it did for similar mine roads in Environmental Impact Statements in which it was the lead agency. EPA's 2013 draft failed to respond to this critique.

<u>EPA Response:</u> The assessment stands on its own.

10.8 Post-Closure Road and Culvert Failure. While AMA did not provide specific errors concerning EPA's post-closure analysis of potential road and culvert failures, it did provide some comments. See 2012 TR, analysis on page 27, especially footnote 35.

<u>EPA Response:</u> As stated in the assessment, we expect that the road would remain in place after mining has ended. Thus, inhibition of fish passage and reductions could still occur after mining. The assessment does not address who would adopt the road after mine operations end. Also note that the assessment is an ecological risk assessment, not a regulatory document.

<u>Center for Biological Diversity (Doc. #2922)</u>

10.9 If the proposed Pebble Project goes forward, construction and operations of the mine site and transportation infrastructure for the mine would have major and population-level impacts on Illiamna Lake seal.

There are no reports that Pebble Partnership aerial surveys for Illiamna Lake seals disturbed the animals, but stress behaviors would be difficult to observe in the absence of behavioral or physiological studies. Surveys are also greatly limited by occurring at a height from which behavioral observations are difficult, if not impossible. Aerial surveys conducted by ABR for Pebble Partnership were flown at 245 to 305 m (weather permitting), and circled back to recount or photograph the seals, increasing the disturbance pressure on the animals. While PLP baseline studies report the flight path as being high enough not to disturb seals (Pebble Project, Northern Dynasty Mines 2007) significant impacts are still possible. Aircraft flying at less than 1,000 have the potential to disturb hauled-out seals, with even more impacts expected if aircraft fly at less than 500 m (Tyack 2008). Aircraft disturbance is especially stressful during the molt or pupping season, which is when the majority of ABR surveys for the Pebble Project baseline studies were conducted. As noted by the Marine Mammal Commission (MMC) in 2009 comments on a research permit, the number of overflights for such research could lead to "excessive disturbance" (Adams 2009). Of course, any disturbance to the seals from the research would be dwarfed by that accompanying development of the Pebble Project itself.

<u>EPA Response:</u> See response to Comment 5.27.

10.10 If the Pebble Project moves forward and an improved access road is constructed, the road would greatly increase land-based disturbances for hauled-out seals. It is likely that the use of the haul road would also greatly increase if dredging or other improvements are made to the port on the Cook Inlet side. Impacts include anthropogenic noise disturbance of traffic and construction, especially from the large haul vehicles that would regularly travel the access road. There would also be increases in direct disturbance from humans accessing the lakeshore, increased boating activity by industrial and recreation users, increased air traffic into the village of Illiamna, and higher levels of light disturbance especially during the normally dark winters. The improved access road may also result in increased residential human population in the area. This may lead to increased hunting or poaching of seals, and to increased competition for seals with human fishermen for salmon. Additionally, off-road and all terrain vehicle use in the area near the road would expand. ATVs and other loud motor vehicles travelling at fast rates of speed may be especially disturbing to seals.

EPA Response: See response to Comment 5.27.

10.11 Barge traffic associated with mine development and operation could affect seals hauled out on Illiamna Lake. During the pupping season, and where there are small pups in the lake, local residents have historically avoided areas where seals are feeding, such as the mouth of the Illiamna and Newhalen River (Fall et al. 2006). This is because residents believe that barge or boat traffic near hauled out seals affects the pupping success through disturbing the seals and decreasing survival of the young (Fall et al. 2006). Any increase in boat traffic near sites used by seals could adversely affect the Illiamna Lake seals, especially during salmon runs and the pupping season.

EPA Response: See response to Comment 5.27.

10.12 Illiamna Lake seals might respond with flight and/or alert behaviors to aircraft flying at or below approximately 1,000 m altitude, especially helicopters. In studies, aircraft appear to disturb seals more by the sound they produce than by the visual (Pitcher and Calkins 1976, Osinga et al. 2012). Born et al. (1999) found that fixed-wing aircraft are less disturbing to hauled out ringed seals than helicopters, and that disturbance could be reduced if helicopters approached no closer than 1,500 m and small fixed wing planes no closer than 500 m (Born et al. 1999). Illiamna Lake seals at foraging sites near the village of Iliamna where helicopters take off and land may be especially impacted (Northern Dynasty Minerals Ltd 2011). Helicopters likely pass directly over or very close to important foraging sites en route to the Pebble Project area. Frost et al. (1993) found that spotted seals responded to an approaching aircraft at a distance of over 1 km, even when the plane's flying altitude was 760 m (Frost et al. 1993). Thus, increased air traffic of any kind, especially larger jets used for transporting personnel associated with Pebble Project to and from the proposed larger airstrip that would be constructed near the village of Iliamna would likely significantly disturb the seals.

EPA Response: See response to Comment 5.27.

Natural Resources Defense Council (Doc. #5378 and #5436)

10.13 Where impacts from a dredge and fill project are unavoidable, such as the habitat and flow losses resulting directly from the mine footprint and transportation corridor described in the Assessment, the Clean Water Act requires compensatory mitigation to replace the loss of wetland and aquatic resource functions in the watershed.

EPA Response: Comment noted; no change required.

10.14 With respect to the area proposed for a road and pipeline corridor, “special circumstances” (EPA Assessment, at app. G) render “highly uncertain” the effectiveness of even “state of the art” best-practice mitigation measures. Environmental mitigation methods identified in the Wardrop Report suffer from being “mutually exclusive or offsetting,” “potentially superseded or limited by engineering, operational, maintenance, or fiscal concerns,” or “likely to be ineffective” given the hydrogeomorphology, subarctic climate and hydrogeologic conditions, seismicity, and pristine condition and inherent sensitivity of the environment in Bristol Bay watershed.

For instance, limiting the area disturbed by the transportation corridor creates risk from “stacking” the road and pipelines closely together. When minimizing stream crossings, the two most potentially effective mitigation measures “stand in opposition to each other,” because the “tortuous” nature of a route with the fewest stream crossings would undermine the intent of minimizing area of disturbance. And burial or boring of pipelines underground can disrupt subsurface hydrology. As these examples reveal, “there is no ‘free lunch’ when it comes to mitigating the environmental impacts of a new road in a previously roadless landscape.”

<u>EPA Response:</u> Comment noted; no change required.

10.15 EPA explicitly recognizes, as requested by the peer review panel, “that the transportation corridor and all associated ancillary development, including future resource developments made possible by the initial mining project, will necessarily and inevitably have impacts.” (Peer Review, *supra* note 44, at 8.) Potential risks to fish habitat and populations resulting from construction and operation of the transportation corridor – including filling and alteration of wetlands, stream crossings fine sediments, dust deposition, runoff contaminants, and invasive species – are unacceptable by 404(c) standards. “Only rarely has it been possible to build roads that have no negative effects on streams” (EPA Assessment, 10-14). In Bristol Bay, risks to fish from construction and operation of the transportation corridor are particularly significant because of the hydrological complexity of the region. The construction and operation of the transportation corridor could “fundamentally alter” this balance, causing unacceptable adverse effects.

Specifically, the transportation corridor would cross 53 streams “known or likely to support” salmonids. Culverts, which can cause severe interference with fish movement, would be constructed on 35 presumed salmonid streams. Culvert failures would be common, particularly post-closure, and would block fish passage and degrade downstream habitat. Approximately 11% of the transportation corridor would also intersect mapped wetlands: an additional 24% would be located within 100 m of wetlands, and another 16% would be located within 100 to 200 m of wetlands. Wetlands provide important salmonid resting, spawning, and rearing habitat, and support food abundance and diversity. Product concentrate and diesel pipeline failures near streams would also be expected to occur during the life of a mine: “Both would cause acute lethal effects on invertebrates and fish, and the concentrate could create highly toxic sediment” (EPA Assessment 14-17.)

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Conservation Foundation (Doc. #6803)</u>

10.16 Beyond water treatment, the assessment conservatively details potential impacts from possible failures – pipeline, road, culvert, and even tailings dams.

<u>EPA Response:</u> Comment noted; no change required.

<u>Kachemak Bay Conservation Society (Doc. #4284)</u>

10.17 KBCS believes that this assessment needs to consider all impacts associated with future large-scale mining in and outside of the Bristol Bay watershed, including: 1) The development of a new deep-water port on Cook Inlet. The new port is necessary for shipping out the mined ore and importation of fuels, equipment and manifold other services necessary for operations. The associated storage facilities and the handling of ore, fuels, chemicals etc. pose an undefined but potential catastrophic risk to Cook Inlet. KBCS wishes to understand these potential risks, both to the Cook Inlet ecosystem, subsistence, commercial and sports fisheries and the social impacts on the many communities so dependent on Alaska's most economically important waterway.

<u>EPA Response:</u> As described in Chapter 2, potential effects of a port on Cook Inlet are outside the scope of this assessment.

<u>American Fisheries Society (Doc. #3105)</u>

10.18 [The 2013 draft] assumes that mining and road systems will work as planned in a very harsh and unstable Alaskan environment where roads are uncommon for very good reasons (see Appendix G for reasons why this is unlikely to occur).

<u>EPA Response:</u> This characterization of the assessment is incorrect. We assume that mitigation measures would be used but also note that these measures do not always work as planned.

10.19 The salmon surveys likely underestimate the stream length with salmon because they were not conducted through use of a probability design, all stream length was not censused, and all stream lengths were not censused or surveyed for multiple years and multiple seasons to evaluate temporal variability (see Hughes et al. 2000. EMAP-Surface Waters; a national, multiassemblage, probability survey of ecological integrity. Hydrobiologia 422/423: 429-443).

<u>EPA Response:</u> We agree that the characterization of stream length with salmon is likely a conservative estimate (e.g., see Box 7-1 and Box 10-1).

<u>K. Denton (Doc. #0227)</u>

10.20 For example, just the road system required to get the ore out of the region will have to cross 20 salmon bearing streams and run basically through the small native community of Pedro Bay on the Northeast shore of Lake Illiamna. The thought of dozens of enormous trucks a day rumbling through this tranquil subsistence village, forever changing the daily way of life for the inhabitants, while the very cause of the trucks presence slowly (and perhaps catastrophically) depletes the salmon runs they have come to rely on for millennium is simply unconscionable.

<u>EPA Response:</u> Comment noted; no change required.

<u>K. Zamzow, Ph.D. (Doc. #5054)</u>

10.21 "Another post-closure issue of concern is road maintenance, which will be needed to maintain the water treatment plant in perpetuity. The access road will need to continue to keep stream crossings open for juvenile and adult fish and minimize runoff into streams" (Chapter 10).

There will be an incentive to maintain the road if additional mines or induced development occurs, but little incentive if there is no further economic development beyond a single Pebble deposit sized mine.

<u>EPA Response:</u> Comment noted; no change required.

10.22 Leachate collection needs to be in place wherever waste rock, including NAG, is used in construction of mine facilities.

Bridges or embedded culverts should be used, and road crossings should follow current and evolving best practices over the life of the main to maintain migratory corridors for juvenile and adult fish and prevent hydraulic changes. Road maintenance needs to use the best technical practices, without regard to economics, to keep sediment, salts, hydrocarbons, antifreeze, and other transportation-related material out of streams, and bonding needs to be sufficient for good road inspection and maintenance in perpetuity.

Consider testing concentrations of calcium on relevant species and life stages per the potential toxicity of road salt runoff.

<u>EPA Response:</u> Comment noted; no change required.

10.23 The assessment for truck-related spills was conducted by extrapolating from truck trips at the Pogo gold mine (Section 10.3.3.1). Would it have been more appropriate to base the assessment on a copper porphyry mine?

<u>EPA Response:</u> For the assessment spill scenario, we extrapolated from truck trips at the Pogo gold mine because we had relevant data on number of trucks required to transport reagents, as well as annual ore production.

<u>G. Y. Parker (Doc. #5615)</u>

10.24 The Watershed Assessment calculates the rate of failures of culverts to allow fish passage post-operation of Pebble mine at 11 to 21 salmonid streams suffering from impeded fish passage.

<u>EPA Response:</u> Comment noted; no change required.

10.25 Similarly, the Assessment calculates the rate of accidents of trucks carrying chemicals used in mineral processing and the rate of near-stream spills at two per 78 years.

EPA Response: **Comment noted; no change required.**

10.26 *Recommended Mitigation:* Effects of roads can be partially mitigated by ensuring that roads are not subject to fluvial and hydrologic processes at road crossings including flood plan processes.

Recommended Restrictions for a 404(c) Determination:

Crossing of Anadromous Streams:

(a) No fill material may be placed in the flood plain of rivers and streams designated by the State of Alaska as important for the spawning, rearing, or migration of anadromous fishes. Absent empirically defined flood plains the flood plain is defined as the area below the elevation of the plane across the stream valley at twice the thalweg depth.

(b) Bridge superstructures must be used to support the bridge in place of piers where practicable.

(c) Where superstructures have been demonstrated to be impracticable, bridges may be placed on piers. Multiple bridge piers may be placed in waters, but the minimum practicable number of piers must be used and each pier must occupy the minimum foot print necessary to, combined with all the piers on the same bridge, safely support the bridge structure.

Crossing of non-anadromous streams:

(a) Crossing of streams that do not provide spawning, rearing or migration habitat for anadromous fishes must be constructed according to methods described in the most recent version of the United States Department of Agriculture-Forest Service Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings.

Wetland crossings:

(a) Roads crossing wetlands (as defined by the United States Army Corps of Engineers Wetland Delineation Manual and applicable supplements) must be constructed with porous road beds so that there is no ponding or visible impedance or diversion of flow of water due to the presence of the road fill prism.

Roadside ditches:

(a) Roadside ditches may not discharge to waters of the United States.

(b) Roadside ditches must have cross drainage such that water is not diverted along the axis of the road for more than 50 feet.

EPA Response: **Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.**

Northern Dynasty Minerals Ltd. (Doc. #3650)

10.27 *2012 Geosyntec Comment:* Statistical methods used in the assessment of piping failure rates are of questionable validity. Use of the exponential distribution to model pipeline failures, and assumptions of constant failure rate along the length of a pipe, are inappropriate. The failure rate this derived (98% change of line failure over 25 years) are misleading at best.

How 2013 Assessment Responds to Comment: With the exception of an adjustment for length of the transportation corridor, the 2012 statistical analyses and associated inaccuracies appear to be unchanged.

Discussion on Adequacy of 2013 Response: No adequate response appears to have been provided, and failure rates continue to be misleading.

<u>EPA Response:</u> The reported aggregate pipeline statistics include pipelines of various ages and include both corrosion and mechanical failures. Although the cited sentence from the draft assessment was included to give the reader some additional perspective on failure rates, the rates for both failure modes are similar and the aggregate statistics were used to develop the presented estimates of failure probability.

The failure rate is constant with time because no data or models were available to increase the rate over time as the pipelines age. The same rate was assumed for all four pipelines because oil and gas pipeline failure rates are similar and there are no data from the mining industry concerning failure rates for concentrate or return water pipelines. The failure rate used is an average across all types of pipeline segments, so it can be applied to the rate for each pipeline as a whole (including stream crossings, valves, etc.).

Based on the trends in the failure rates, one could hypothesize that over the life of a pipeline, the initial failure rate might be lower than the overall average and the later failure rate would be higher than the average as corrosion failures increase. However, the low expected frequency of failures for pipelines of the length in the assessed scenarios would not be expected to provide enough data to confirm such a hypothesis. It should be noted that of the four pipelines in the mine scenarios, one would carry diesel fuel and one would transport natural gas, so the use of statistics from the oil and gas industry is justified for these pipelines. The revised assessment does assess the environmental impacts of a spill from the diesel fuel pipeline (Chapter 11).

10.28 While it is difficult to understand how culverts designed and built to modern engineering standards will replicate the performance of outdated and unregulated culverts under any post-mining maintenance scenario, there are clearly management controls available to ensure this does not occur. Permitting agencies could impose reclamation and post-closure management conditions on Pebble to ensure that installed road culverts continue to operate effectively. It is also likely that Pebble will continue to maintain the road and culverts for many decades after mining ceases in order to meet its reclamation, closure and long-term monitoring obligations.

<u>EPA Response:</u> Fish passage impacts described in the revised assessment assume modern design guidelines for culverts. These specifications are described in Box 10-2, which references the memorandum of agreement between the Alaska Department of Fish and Game and the Alaska Department of Transportation and Public Facilities. Best management practices or mitigation measures would be used to minimize potential impacts to salmon ecosystems from construction and operation of the proposed

transportation corridor. Nevertheless, inhibition of fish passage and reductions in habitat still could occur (Box 10-5), even under post-closure management conditions. Even though a mining company may intend to manage the road for many decades after mining ceases, they may not be able to.

10.29 *2012 Geosyntec Comment*: Road culvert failure modes do not consider existing state of the practice guidance. he 2012 Assessment states: "Road crossings often fail because of outfall barriers, excessive water velocity, insufficient water depth in culverts, disorienting turbulent flow patterns, lack of resting pools below culverts, or a combination of these conditions (Furniss et al. 1991)." The culvert failure modes presented in the report are comprehensive and relevant. Guidance exists for fish friendly designs that mitigate each of these failure modes, such as the Memorandum of Agreement between Alaska Department of Fish and Game and Alaska Department of Transportation and Public Facilities for the Design, Permitting, and Construction of Culverts for Fish Passage (ADFG and ADOT&PF, 2001). Each of these modes of failure cited can be addressed using modern fish passage and channel stability design principles.

How 2013 Assessment Responds to Comment: The 2013 Assessment includes a new Box 10-2, Culvert Mitigation. This box describes "guidance to protect designers and permitting staff to ensure that culverts are designed and installed to provide efficient fish passage and to ensure statewide consistency in title 16 permitting of culvert related work."

Discussion on Adequacy of 2013 Response: Unfortunately, while Box 10-2 describes some of the relevant guidance, but that is the extent of the 2013 Assessment's acknowledgement of modern fish passage and channel stability design principles. As in the 2012 Assessment, the 2013 report falls back on the following statement to justify the use of inapplicable failure statistics:

10-27 "After mine operations end, traffic would be reduced to that which is necessary to maintain any residual operations on the site, and inspections and maintenance would likely decrease. If the road was adopted by the state or local government entity, the frequency of inspections and quality of maintenance would likely decline to those provided for other roads. Either of these possibilities could result in a proportion of failed culverts similar to those described in the literature."

Under this scenario, it would appear that any road under government supervision is likely to have a 30% to 60% failure rate.

<u>EPA Response:</u> See response to Comment 10.28.

10.30 *2012 Geosyntec Comment:* The 2012 Assessment discounts the effectiveness of established sediment and erosion control practices for road construction and operation (Appendix G).

How 2013 Assessment Responds to Comment: The 2013 Assessment includes Box 10-3, Stormwater Runoff and Sediment Mitigation. No significant modifications appear to have been made to Appendix G to address this comment.

Discussion on Adequacy of 2013 Response: The discussion of erosion and sediment control measures in Box 10-3 (p. 10-33 and 10-34) partially addresses Geosyntec's 2012 comment.

However, there is no discussion on how these control practices can impact the exposure and risk characterization for road construction and operation.

EPA Response: Potential mitigation measures or best management practices for the transportation corridor are described in Chapter 10 of the revised assessment. Erosion and sediment control measures are included in Box 10-3. We did not feel it was necessary to duplicate this information in Appendix G. Chapter 10 notes that BMPs would be used along the transportation corridor to minimize potential risks to salmonids and the ecosystems that supports them.

10.31 *2012 Geosyntec Comment:* The 2012 Assessment has not considered mitigation strategies for addressing concerns over road salts for dust & ice control (pg 5-62).

How 2013 Assessment Responds to Comment: Revised sections of the 2013 Assessment, including Stormwater Runoff (p. 10-29) and Dust (pg 10-35), provide some expanded discussion on this topic. Discussion of mitigation strategies is limited to Box 10-3 (p. 10-33 and 10-34).

Discussion on Adequacy of 2013 Response: The discussion of erosion and sediment control measures in Box 10-3 (p. 10-33 and 10-34) partially addresses Geosyntec's 2012 comment. However, there is no discussion on how these control practices can impact the exposure and risk characterization for road construction and operation.

EPA Response: See response to Comment 10.30.

10.32 EPA now acknowledges that culverts designed and maintained to modern standards as required by regulation in Alaska have a "low" probability of failure. However, study authors continue to assert that following mine operations, these modern culverts will exhibit failure rates commensurate with outdated, unregulated and un-permittable culverts employed 40 years ago in other jurisdictions. Comments submitted in response to the 2012 BBWA pointed out that the references used to support the culvert failure rates generally attribute failure (defined as blockage of fish passage) to non-compliance with permit requirements, poor design and improper construction.

EPA Response: See response to Comment 10.28.

10.33 In commenting on the 2012 draft BBWA, Peer Reviewers were highly critical of EPA's use of outdated and unregulated culvert design and maintenance practices to predict performance at Pebble. Although study authors inserted some new information about modern culvert design criteria into the 2013 draft BBWA, and acknowledge that proper maintenance of road culverts would likely lead to greater than forecast environmental performance during mine operations, EPA continues to insist that long-term performance of culverts will revert to the failure projections in the 2012 BBWA. EPA provides no justification for this assumption.

EPA Response: See response to Comment 10.28.

10.34 *2012 Geosyntec Comment:* Probability of failure estimates for culverts during mine operation and after closure are inaccurate and not applicable to the Pebble Project. Table 8-1 of the 2012 Assessment shows a low probability of failure for culverts during the operation of the mine and cites frequent inspections and regular maintenance as the reasons. Post-operation failure probability is indicated as 0.3 to 0.6, which has already been shown to not be applicable. The failure probability does not account for the use of bridges, box culverts and fish friendly culverts in place of typical culvert designs. The surveys of road culverts used as justification for the high failure rates were rarely designed for fish passage. Additionally, the report does not account for the possibility of decommissioning (removal) of some or all of the culverts post-operation.

How 2013 Assessment Responds to Comment: Probability of failure estimates for culverts during and after mine operation and after closure remains unchanged in the report. However, as the 2013 Assessment reports that 35 salmonid streams would have culverts as opposed to 14 salmonid streams in the 2012 Assessment, the number of blocked culverts has increased significantly.

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. The failure probabilities do not account for the use of bridges, box culverts and fish friendly culverts in place of typical culvert designs. The survey of road culverts used as justification for the high failure rates were rarely designed for fish passage. Additionally, the report does not account for the possibility of decommissioning (removal) of some or all of the culverts post-operation.

<u>EPA Response:</u> Culvert failure frequencies cited in the assessment are based on culverts designed for fish passage and take into account the use of best management practices or mitigation measures that are discussed in text boxes throughout Chapter 10. A number of culvert types may be used along the transportation corridor, and it is not in EPA's purview to suggest which ones should be used. However, culvert design approaches specified in the memorandum of agreement between the ADF&G and the ADOT are described in Box 10-2 of the assessment. Although culverts are designed to certain specifications, they are not always installed correctly or do not stand up to the rigors of a harsh environment.

The comment states that the probability of failure estimates for culverts during and after mine operation and after closure remains unchanged in the assessment. Reference to Flanders et al. (2000) was deleted in the revised assessment, causing a slight reduction in culvert failure frequency. The estimated number of streams likely to support salmon increased but the number of those bridged decreased by two. Thus, the number of salmon-supporting streams with culverts, and the number of streams blocked at any one time, increased in the revised assessment.

We expect that the road would remain in place after mining has ended. Hence, decommissioning (removal) of culverts post-operation, as mentioned in the comment, is not a viable option.

<u>The Pebble Limited Partnership (Doc. #5752)</u>

10.35 EPA admits that it cannot estimate changes in fish productivity, abundance, and diversity from potential impacts associated with the construction and operation of the road transportation corridor. *Id.* at 10-40. Nonetheless, EPA claims that there will be adverse impacts to salmonid species from the transportation corridor. These claims are not supported by the scientific literature.

EPA speculates that after active mining operations cease, approximately 47% of all streams along the transportation corridor will become blocked at any given time, stopping the upstream migration of spawning salmonids. *Id.* at 10-28. This assumption is based on what the EPA characterizes as "typical maintenance practices" following mine closure. *Id.* But to support this assumption, EPA relies on studies that are inapplicable to modern road construction and maintenance requirements in Alaska. *See* Geosyntec Comments, Tbl. 1 at 11. In fact, those studies acknowledge that with proper design, construction and maintenance practices, many of the identified modes of failure could be prevented. *Id.* The engineers and scientists at Geosyntec specifically evaluated the list of potential culvert failures that EPA identified in the Assessment and concluded that "[e]ach of the modes of failure cited can be addressed using modern fish passage and channel stability design principles." *Id.* at 12.

EPA is also assuming that culverts could become blocked during the operational life of the mine despite daily inspections of the road and culvert system. EPA is presuming that culverts will be installed incorrectly, not built to specifications, or otherwise will fail in a "harsh environment." Assessment at 10-27 to 10-28. EPA offers no support for these assumptions.

EPA's discussion related to wetland impacts within the transportation corridor is also speculative. EPA claims that the "[r]isks to salmonids from filling of wetlands" and other "hydrologic modifications… are likely to diminish the production of anadromous and resident salmonids in many of the 53 streams known or likely to support salmonids that would be crossed by the transportation corridor." *Id.* at 10-40. This stark assessment is not supported by EPA's own analysis. Although EPA attempted to quantify risk to salmonid habitat due to alteration or filling of wetlands along the transportation corridor, the Agency acknowledged that the "distribution of salmonids in wetlands along the transportation corridor is not known" (*id.* at 10-19) and that the "[e]ffects on fish production" from wetland impacts within the transportation corridor "cannot be estimated given available data…" *Id.* at 10-20. In light of these unknowns, it is unclear how EPA can conclude that wetland impacts within the transportation corridor "are likely to diminish" salmonid production. There is no science underlying EPA's assessment.

Finally, EPA's estimate of truck-generated dust volume in the transportation corridor is based on a single study from 1973 conducted on rural roads in Iowa. EPA acknowledges that its road dust generation estimate may be reduced up to 50-75% due to the application of dust control techniques, but that such a reduction would have a "negligible effect on risks to fish…" *Id.* at 10-41. This conclusion is inconsistent with EPA's methodology for assessing potential risks to fish from road dust generation, and highlights EPA's pervasive effort to downplay effective mitigation techniques while exaggerating risk. EPA's risk assessment for road dust focuses on assessing the quantity of dust generated and the subsequent localized fate and transport of that dust. *Id.* at 10-35 to 10-37. A reduction in generated dust would necessarily reduce potential risk.

<u>EPA Response:</u> See responses to Comments 10.28 and 10.34. The revised assessment states that "the exact magnitudes of changes in fish productivity, abundance, and diversity cannot be estimated at this time," but summarizes the species, abundances, and distributions that would potentially be affected. Also, the assessment concludes that, assuming typical maintenance practices after mine operations, approximately 15 of 32 culverted streams with restricted upstream habitat would be entirely or in part

blocked at any time. "As a result, salmonid passage—and ultimately production—would be reduced in these streams, and they would likely not be able to support long-term populations of resident species such as rainbow trout or Dolly Varden." References to support these statements are found throughout Chapter 10.

Statements in the assessment regarding risks to salmonids associated with the transportation corridor are supported by references found throughout Chapter 10. The distribution of salmonids in wetlands, ponds, and small lakes along the transportation corridor is not known. However, these aquatic habitat losses can result in the loss of resting habitat for adult salmonids and of spawning and rearing habitat in ponds and riparian side channels. These habitats can also provide enhanced foraging opportunities. Additional discussion and references are found in Section 10.3.1.2. In sum, filling wetlands would eliminate habitat for salmonids and would indirectly alter wetlands in ways that could reduce the quality, quantity, and accessibility of habitat for fish.

With respect to the estimation of dust production from the transportation corridor, the statement cited in the comment actually reads, "Overall, these uncertainties likely have a negligible effect on risks to fish, but a moderate effect on our dust production calculations." The revised assessment acknowledges that the estimated value for dust generation (6,700 metric tons annually for the length of road within the Kvichak River watershed) may be an underestimate or an overestimate, but regardless "it indicates that dust production along the transportation corridor could be substantial."

<u>The Pebble Limited Partnership (Doc. #5535)</u>

10.36 The assumed standards for the installation culverts for the road crossing of streams are speculative and outdated. The conclusions of substantial damage to streams and blockage of fish passage are predicated on the assumption of undersized and improperly installed culverts. The USFWS's Fish Passage Program has shown that with appropriate modern designs, the probability of culvert failure can be dramatically reduced.

<u>EPA Response:</u> See response to Comment 10.28.

10.37 As stated in earlier PLP review comments, the Alaska Dept. of Transportation &PF Alaska Dept. of Fish & Game Memorandum of Agreement represents the minimum design generally required by permitting agencies. However, the Assessment continues to neglect modern designs for stream crossings and fish passage. Further it contradicts itself in the evaluation. The report states that 'standards for culvert installation in fish-bearing streams in Alaska consider road safety and fish passage, but not the physical structure of the stream or habitat quality' (page 10-28, paragraph 1). However, in Table 10-2 the Tier 1 design method description states that 'The Tier 1 approach most clearly replicates natural stream conditions…" (page 10-29). A Tier 1 design, by definition, considers the physical structure and habitat of the stream. The text is contradicted by the information presented later in the box.

<u>EPA Response:</u> See responses to Comments 10.28 and 10.34.

10.38 The Assessment has used estimates of culvert failure rates that do not apply to the design standards that will be used for culverts. The risks should be reevaluated using more appropriate data sets that better represent potential failure rates of culverts built to the relevant design standards in order to give decision makers a better understanding of the actual risks in relation to the significance to salmon and other fish in these waterbodies.

EPA Response: See responses to Comments 10.28 and 10.34.

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10.39 *Section:* Section 5.4.1, Page 5-59, Paragraph 1, First Sentence: "Culverts are the most common migration barriers associated with road networks."

Original Response/Comment: Culverts designed using modern design guidelines developed by ADOT&PF, CDFG, NMFS, USDA, FHWA, Washington Department of Fish and Wildlife (WDFW), and others have been constructed that allow aquatic and terrestrial organisms unhindered movement up and down aquatic corridors such as streams and rivers. Examples of such installations have been constructed within the Municipality of Anchorage, Mantanuska-Susitna Borough, and Kenal Peninsula Borough, and are supported with funds from the U.S. Fish and Wildlife Service and are permitted by the various research agencies.

Comments Regarding Adequacy of Response in Second Draft: Modern standards are discounted in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document). Due to the assumption that modern standards will not be implemented correctly, the document overstates likely impacts.

EPA Response: See responses to Comments 10.28 and 10.34.

10.40 *Section:* Report Section Identification: Box 5.1

Original Response/Comment: NWI wetland mapping is based on aerial photo interpretation that is large scale and is not accurate at the scale being used here, particularly for road impacts. Also, NWI data is often 20 to 30 years old. Therefore, while it is appropriate for a large scale screening, it is not acceptable for predicting site-specific impacts without a large potential for error. It is a bit confusing, but it seems 100 meters along rivers and 200 meters along NWI wetlands were set aside as buffers. If the roadway in the mine site passed within these buffers, a hydrological impact was tallied. In addition the road impacts were based on a 200 ft wide road corridor, while 'direct fill' was based on a 9.1 m wide roadway. These buffers are quite large and likely overestimate the hydrological impact. This overestimation offsets at least a portion of the purported 'conservative' estimate resulting from inaccurate stream and fish presence maps.

Recommended Change: Most regulatory wetland and river buffers are equal to or less than 150 feet. Reducing the buffer to this more accurate area of 'impact' would produce a more accurate estimate of impacts to wetlands and rivers along the road corridor.

Comments on Adequacy of Response in Second Draft: There was additional description of how the buffers were derived, but they were not changed in the analysis. For example, the 200-m road buffer was derived from Forman 2000 (page 10-14). There was no change in the use of NWI data to calculate affected area for wetlands. Therefore, the analysis likely continues to overestimate impacts.

<u>EPA Response:</u> For potential impacts from the transportation corridor, we provided estimates of the length of roadway within either 100 m or 200 m of both streams and wetlands, as well as estimates of the acreage of wetlands within either 100 m or 200 m of the road (explained in Box 10-1). In this context, "buffer" is not a regulatory determination, but is used as a mapping term that applies to the technique used to determine the lengths and acreage within those distances. We then described impacts that have been documented within similar proximities. The 200-m road buffer was derived from an estimate of the road-effect zone for secondary roads (Forman 2000). This effect zone was not changed in the revised assessment because it is appropriate. In fact, as noted in Box 10-1, our characterization of both stream length and wetland, pond, and small lake area affected is likely a conservative estimate.

10.41 *Section:* Report Section Identification: 5.4.6.3

Original Response/Comment: Says 'Additionally, 19.4 km of roadway would intersect wetlands within and beyond those mapped by the National Wetlands Inventory (NWI). Runoff from these segments of roadway could have a significant impact on these wetlands.

Recommended Change: Are there any examples or studies that can back up this statement?

Comments Regarding Adequacy of Response in Second Draft: The statement remains in the revised version, although instead of 19.4 km they provide a figure of 12 km of roadway that would intersect wetlands. No reference to how this figure was derived was provided. On page 10-19 the document states that 'The area of wetlands filled by the roadbed would be 0.11 km^2 (i.e., approximately 12 km of road, assuming a road width of 9 m)," although it is not clear if this is the calculation to which the statement refers.

<u>EPA Response:</u> The statement, "Runoff from these segments of roadway could have a significant impact on these wetlands," was changed to the following in the revised assessment: "Runoff from these road segments could have significant effects on fish and the invertebrates that they consume, particularly if sensitive life stages are present." This statement refers to road segments intersecting streams (noted earlier in the paragraph) as well as those intersecting wetlands. References for the toxicity of de-icing salts and dust suppressants are provided in Section 10.3.3.2 in the revised assessment.

The "12 km of roadway" that would intersect wetlands refers back to the statement in Section 10.3.1.1, and was derived from Table 10-4.

10.42 *Section*: 4.3.9.1

Original Response/Comment: The fact that culverts washed out may not be pertinent to the assessment. Were the culverts that washed out constructed in accordance with today's standards and BMPs? If not, this sentence should be deleted.

Comments Regarding Adequacy of Response in Second Draft: This issue has not been addressed. The unstated assumption remains that culverts have a high potential to washout despite advances in technology or implementation of mitigation measures.

<u>EPA Response:</u> The Williamsport-Pile Bay Road was a State of Alaska road, so we assume it was constructed and maintained to state standards. We feel that this is a reasonable assumption.

10.43 Section: 5.4

Original Response/Comment: Suggest replacing "often propagate" to "historically propagated"

Comments on Adequacy of Response in Second Draft: The statement remains unchanged.

<u>EPA Response:</u> The statement that the comment refers to is a general statement that is of current relevance; no change required.

10.44 *Section:* Report Section Identification: 5.4 Roads and Stream Crossings

Response/Comment: The opening section has several general and broad sweeping statements regarding roads impacts on stream and river conditions. In particular, the statements are phrased such that it implies roadway impacts are broad and can propagate significant distances upstream and downstream. The following statement needs some sideboards "The physical effects of roads on streams and rivers often propagate long distances from the site of a direct road incursion, as a result of the energy associated with moving water (Richardson et al. 1975)." For instance, a culvert located on a steep stream (say greater than 6% slope) will not likely have extensive (several kilometer) upstream and downstream effects on the stream and floodplain due primarily to the steep valley slope and road crossings on flat, alluvial channels and floodplains could potentially affect and impact streams for significant distances upstream and downstream.

Recommended Change: Rephrase sentence to emphasize that improperly designed road crossings.

Comments Regarding Adequacy of Response in Second Draft: Section 10.3.2. The sentence remains essentially unchanged but for a clarification of 'actual stream crossing'. The physical effects of roads on streams and rivers often propagate long distances from actual stream crossings, because of the energy associated with moving water (Richardson et al. 1975). There is no further discussion of the improper versus properly designed culverts, so the comment has not been addressed.

<u>EPA Response:</u> The statement that the comment refers to is a general statement that does not require further detail. As noted later in the revised assessment, culverts would be designed to certain specifications (Box 10-2) but are not always installed correctly or may not stand up to the rigors of a harsh environment. No change required.

10.45 *Section:* Report Section Identification: 5

Original Response/Comment: The pages state that the transportation corridor crosses 34 streams and rivers. As stated in the Executive Summary "The most likely serious failure associated with the transportation corridor would be blockage or failure of culverts". This is readily avoided through either small bridges or very large culverts or a series of culverts designed to handle extremely large events. Given the sensitivity of the rivers and streams to the fisheries, the company should be required to build long lasting crossings that would not plug up. It will cost additional money to build these crossings but they would avoid the type of plugging impacts discussed on these pages.

Recommended Change: Add language that these impacts would most likely be avoided in the permit process by requiring significant long lasting crossing designs.

Comments Regarding Adequacy of Response in Second Draft: The analysis still assumes that culverts will be primarily used, and the information on blockages and failures remains largely unchanged in the document.

<u>EPA Response:</u> See responses to Comments 10.28 and 10.34.

With respect to the use of bridges, they would generally have less impact to salmon than culverts, but can result in the loss of long riparian side channels if they do not span the entire floodplain. The actual decision as to what type of structure (bridge versus culvert) would be constructed at each crossing would be made by industry engineers in consultation with Alaska permitting staff.

10.46 *Section*: Section 5.4.1, Page 5-60, Paragraph 1, Last Sentence: 'Although the well-planned installation of culverts allows natural flow upstream and downstream of crossings, failure rates are generally high (Sections 4.4, 3.3 and 6.4)."

Original Response/Comment: Modern culvert design standards foster designs that are self-sustaining, durable, and provide continuity of geomorphic processes such as the movement of debris and sediment (CDFG 2009). NMFS design criteria require that all fish passage facilities be designed for the 100-year flood event (2001) and that any potential damage to the crossing be addressed as part of the design process. These design criteria significantly reduce the potential of culvert failure, both blockage of fish passage and road washout, and promote habitat and fluvial process continuity.

Comments Regarding Adequacy of Response in Second Draft: Modern standards are discounted in the statement, 'Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

<u>EPA Response:</u> Modern standards are not discounted in the assessment. As noted in Chapter 6, we assume state-of-the-art practices for design, construction, and operation of the road infrastructure, including design of bridges and culverts for fish passage. Modern design guidelines for culverts are described in Box 10-2, which also summarizes three design approaches for culverts, including the Stream Simulation Design developed by USDA.

10.47 *Section:* 5.4.4.2

Original Response/Comment: As described in detail in several sources (WDFW 2011, CDFG 2009, USDA 2008, ADOT&PF 2001) modern approaches to culvert design incorporate a continuous streambed that mimics the slope, structure and dimensions of the natural streambed. Water depths and velocities are as diverse as those in the natural channel, providing passageways for all aquatic organisms (USDA 2008) and maintaining sediment and debris continuity. Water depth through culverts is maintained during low flow through incorporation of a constructed channel to concentrate flow and maintain stream thalweg continuity. Design criteria require evaluation of velocities during flows that occur during key migration periods (e.g., low flows) so as not to impede fish passage. Failure in such properly formulated stream crossings is limited and the long term biological benefits of such stream systems can be maintained over time.

Comments Regarding Adequacy of Response in Second Draft: Modern standards are discounted in the statement, 'Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in section 10.3.2.1.' (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

<u>EPA Response:</u> See response to Comment 10.46.

10.48 *Section:* 5.4.4.2

Excerpt: Section 5.4.4.2, Page 5-61, Paragraph 2, Sentence 2: "Culverts can reduce flow to these habitats by directing flow from the entire floodplain through the culvert into the main channel. High water velocities in a stream channel may result from storm flows being forced to pass through a culvert rather than spread across the floodplain. Higher velocities cause scour and downcutting of the channel downstream of the culvert, hydrologically isolating the floodplain from the channel and consequently blocking fish access to floodplain habitat."

Original Response/Comment: While old and inadequate culvert installations do occur in sensitive habitats across the United States, modern industry design approaches reduce the physical and biological impact to streams and rivers. Chapter 6.5.1.1 of USDA, 2008 describes a number of stream simulation type culvert design strategies which can be used in wide, active floodplain scenarios. These design techniques can be used to protect and/or restore floodplain processes and habitats (USDA, 2008).

Comments Regarding Adequacy of Response in Second Draft: Modern standards are discounted in the statement, 'Although culverts are would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

<u>EPA Response:</u> See response to Comment 10.46.

10.49 *Section:* Report Section Identification: 5.4.6.3

Original Response/Comment: EPA references the Memorandum of Understanding (MOU) between ADF&G and ADOT&PF as a statewide standard for culvert installation on fish-bearing streams. This MOU is not a statewide standard for all entities; rather, it simply serves as an agreement between the two agencies that establishes a tiered approach to culvert installation and some minimum design requirements.

Recommended Change: The watershed assessment should make it clear that statewide standards for culvert design and installation currently do not exist. ADF&G evaluates each proposed culvert installation on a case by case basis.

Comments Regarding Adequacy of Response in Second Draft: Pg 10-28 second paragraph, reference to Standards for culvert installation on fish-bearing streams in Alaska remains, and Box 10-2, which discusses the MDA, does nothing to emphasize the project-by-project nature of culvert evaluation as mentioned by the commentator. The comment has therefore not been addressed.

<u>EPA Response:</u> The assessment does not reference the MOA between ADF&G and ADOT&PF as a state standard, but rather as containing standards for culverts on fish-bearing streams. The procedures, criteria and guidelines described in the MOA are used by ADF&G for permitting culvert related work in fish-bearing waters, and represent the state-of-the-art methodologies for Alaska. The culvert-design approaches are summarized in Box 10-2 of the assessment.

Text has been added to Section 10.3.2.3 of the final assessment to note the project-specific nature of culvert evaluation.

10.50 *Section:* 5.4.4.3

Excerpt: Section 5.4.4.3, Page 5-62, Paragraph 1, Sentence 3: “The behavioral responses to culverts of the up-migrating and down-migrating life stages of the salmonid species that use the potentially crossed streams are uncertain.”

Original Response/Comment: The behavioral responses to culverts of upstream and downstream-migrating salmonid species of all life stages are well understood. Modern Stream simulation type design techniques evolved from decades of field studies related to culvert passage evaluation. One such example is the document titled Improving Stream Crossings for Fish Passage prepared by the Humboldt State University Foundation for NMFS in 2004. This document emphasizes watershed hydrology, fisheries biology, and culvert hydraulics. The document conclusions are based upon years of monitoring juvenile and adult salmonid passage. Other examples are readily available in the literature.

Comments Regarding Adequacy of Response in Second Draft: Pg 10-28 second paragraph, the referenced sentence has been modified: Culverts are not always built to specifications and the behavioral responses of migrating salmonid life stages to culvert-induced changes in flow are not always anticipated correctly. The wording appears to sidestep the commentator’s point about the availability of information on culverts and fish. Furthermore, the suggested reference has not been incorporated. The comment has not been substantially addressed.

<u>EPA Response:</u> The revised assessment notes that culverts are not always built to specifications and the behavioral responses of migrating salmonid life stages to culvert-induced changes in flow are not always anticipated correctly. We do not deny that important research has been conducted related to culvert fish passage. Nevertheless,

uncertainty of behavioral responses to culvert-induced changes in flow is supported by text in the memorandum of agreement between the Alaska Department of Fish and Game and the Alaska Department of Transportation and Public Facilities (ADF&G and ADOT 2001), which alludes to the need for comparative field data (i.e., data from different species).

10.51 *Section:* Report Section Identification: 5.4.10

Original Response/Comment: Because a stream by stream assessment has not been done and actual stream crossings have not been designed or located, it is impossible to determine the actual impacts. The purported "likely" diminished production on 510 km of 30 streams is likely a significant overestimate of potential impacts.

Recommended Change: Examine width of stream versus width of flood plain and determine whether culverts would be adequate to maintain stream function and fish passage and where bridges are required to do the same. Given use of appropriate culverts, bridges, and road construction practices, estimate damages downstream, within the most likely length of impact, (200 meters?).

Comments Regarding Adequacy of Response in Second Draft: Ch 10- The stream width vs. width of floodplain was not used to determine culvert effectiveness. Blockages were assumed to occur, unless regular maintenance was performed.

<u>EPA Response:</u> The revised assessment assumes that crossings over streams with mean annual streamflows greater than 0.15 m^3/s would be bridged. However, the actual decision as to what type of structure (bridge versus culvert) would be constructed at each crossing would be made by industry engineers in consultation with Alaska permitting staff.

The basis for culvert failure frequencies is referenced in both the draft and revised assessments. The transportation corridor scenario assumes regular inspection and maintenance during mining operations.

10.52 *Section:* Report Section Identification: 6.4

Original Response/Comment: Simply using bridges over smaller streams would essentially eliminate the potential for culvert failures. Proper culvert design and conservative over-sizing, would significantly reduce potential for culvert failure.

Recommended Change: Provide more detailed analysis on culvert failure rates for well designed or oversized culverts for the size of streams most likely to be culverted along the corridor.

Comments Regarding Adequacy of Response in Second Draft: Culverts were assumed to fall unless regularly maintained. No consideration of bridges over small streams was provided in the analysis.

<u>EPA Response:</u> Bridges would generally have less impact on salmon than culverts, but can result in the loss of long riparian side channels if they do not span the entire floodplain. The revised assessment assumes that crossings over streams with mean annual streamflows greater than 0.15 m^3/s would be bridged. However, the actual

decision as to what type of structure (bridge versus culvert) would be constructed at each crossing would be made by industry engineers in consultation with Alaska permitting staff.

The basis for culvert failure frequencies is referenced in both the draft and revised assessments, and assumes modern culvert design guidelines. The transportation corridor scenario assumes regular inspection and maintenance during mining operations. Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or may not stand up to the rigors of a harsh environment.

10.53 *Section*: 6.4.3

Excerpt: Section 6.4.3, Page 6-43, Last Paragraph, Two Sentences: 'Thus, two of the remaining 16 streams with less than 5.5 km of upstream habitat might be bridged, leaving 14 salmonid streams with culverts. Assuming typical maintenance practices after mine operations, roughly 50% of these streams, or 7 streams, would be entirely or in part blocked. As a result, salmon spawning would fail or be reduced in the upper reaches of the streams and the streams would likely not be able to support long-term populations of resident species such as rainbow trout or Dolly Varden.

Original Response/Comments: This conclusion is based on the assumption that all culverts are designed similar to those case studies implemented in the past three decades, which do not adequately account for the natural geomorphic and biological processes of sensitive stream habitats. Culverts designed using modern design guidelines developed by ADOT&PF, CDFG, NMFS, USDA, FHWA, WDFW, and others can be implemented to reduce potential impact to the physical and biological resources of streams and rivers.

Comments Regarding Adequacy of Response in Second Draft: Modern standards are discounted in the statement, 'Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in section 10.3.2.1." (pages 10-27 to 10-28). Box 10-2 provides information on culvert mitigation provided in the MOA between ADOT and ADF&G (a 2001 document).

<u>EPA Response:</u> See response to Comment 10.46. The culvert failure frequencies cited in the assessment are from modern roads and represent the most relevant data available.

10.54 *Section*: 6.4.3

Excerpt: Thus, two of the remaining 16 streams with less than 5.5 km of upstream habitat might be bridged, leave 14 salmonid streams without culverts. Assuming typical maintenance practices after mine operations, roughly 50% of these streams, or 7 streams, would be entirely or partly blocked.

Original Response/Comment: We could address this comment about typical maintenance practices once we know more about how the road is being designed and the validity of the 50% assumption.

Comments Regarding Adequacy of Response in Second Draft: No more information was provided to account for the maintenance assumption and culvert failure, although the estimate was revised from 50% to 47% in the revised edition.

<u>EPA Response:</u> Typical maintenance practices after mine operation would be similar to those provided for other roads, and the proportion of failed culverts would be similar to those described in the literature (see Section 10.3.2.1 of the revised assessment). The estimate of culvert failure frequency was revised from 50% to 47% in the revised assessment due to the deletion of the Flanders et al. (2000) reference.

10.55 This section presents an assessment of potential impacts to fish populations related to transportation corridor river and creek crossing structures. It sets out a method to quantify the risk, likelihood, and consequence of impacts posed by crossing salmonid-bearing streams along a hypothetical transportation corridor. The chapter does not cover impacts from stream crossings on non-salomnid-bearing streams.

In the introductory paragraphs of Section 10.3.2, potential impacts by culverts and bridges are not differentiated. The text states that "the transportation corridor could affect 290 stream km between its road crossings and Illiamna Lake… fish may also be affected in the approximately 830 km of stream upstream of the transportation corridor…" (page 10-20, paragraph 2). These values are based on 53 assumed stream crossings from data in Tables 10-6, 10-7, and 10-8. The BBA's presented values for potential impacted stream lengths are not related to the type of stream crossing, culvert, or bridge, or a specific impact, but only to the existence of a crossing.

However, in Section 10.3.2.1 the discussion centers primarily on culverts. In the first paragraph of this section, the BBA states the working assumption that 35 streams would be crossed with culverts and the remaining river crossings are assumed to have bridges. The rest of the chapter discusses culverts only; bridges are not mentioned, though the analysis should include them to be complete.

While not specifically stated, the BBA appears to define the risk to the resource – here, salmonids – as the consequence of an impact at the transportation corridor crossing combined with the likelihood of the impact crossing. Section 10.3.2 presents discussions on and references for the potential impacts of stream crossings, the consequences of these impacts, and the likelihood of them occurring. The following reviews the presented potential impacts, consequences, and likelihoods.

<u>Potential Impacts:</u> The discussion of potential impacts of stream crossings starts with describing general impacts on the creek downstream of the road corridor from all crossing types. This is followed by discussions restricted to impacts related to culvert crossings. Information about how bridge type crossings interact with streams is lacking. Because of this, the discussion of the interaction between streams and the transportation corridor is incomplete.

Potential culvert impacts (often referred to as failures in the BBA) include perching, debris blockage, wash out, aufeis, sedimentation, excessive velocities, and others. While each impact has a range of effects, the BBA tends to present and discuss only the most severe impacts and primarily considers total restriction of fish migration as the culvert. To be complete the BBA should include a discussion of how structure selection, design, construction, and maintenance can mitigate potential stream crossing impacts.

Consequences: The BBA generally presents only the most severe consequences related to a specific impact. Impacts to culvert performance are varied and can occur at any time, with some affecting fish and some not. Therefore, defining the consequence to fish of an impact to a culvert is important. For example, a culvert can be blocked by ice (impact) with no effect to fish (consequence) if the blockage occurs when fish are not present, or sediment deposition (impact) could affect several meters of stream downstream of a culvert but leave the remaining kilometers of stream unaffected (consequence). To be complete, the BBA should present the entire range of consequences associated with an impact and that consequences can be mitigated through planning, design, and maintenance.

For example, the final two paragraphs of section 10.3.2.3 end with "…These potential reductions in downstream habitat quality and inhibited fish passage could occur in any of the 35 culverted streams that support salmonids…" and that "…As a result, these streams would likely not be able to support long-term populations…" The magnitude and severity of the consequences have a broad range from very minor to severe and fleeting to persistent. This range of impacts is not articulated to readers in the BBA. Also, the BBA does not state that the selected design criteria and construction methods used for the crossings can address potential consequences.

EPA Response: Chapter 10 considers risks to fish habitats and populations associated with the transportation corridor. The introductory paragraphs of Section 10.3.2 discuss stream crossings in general. In the final assessment we note that bridges would generally have fewer impacts on salmon than culverts, but could result in the loss of long riparian side channels if they did not span the entire floodplain. Values for potential impacted stream lengths are not related to the type of crossing, but potential risks from stream crossing failures concentrate on culverts because, as noted above, bridges would generally have fewer impacts on salmon than culverts.

Contrary to what is suggested in the comment, the assessment does assume that appropriate design and mitigation would be used and presents routine as well as severe impacts associated with culverts.

10.56 *Excerpt:* Second paragraph.

Technical Comment: While the discussion in this paragraph is technically correct, the situation described is very uncommon along the transportation corridor.

Comment Category: One-dimensional analysis.

EPA Response: We do not believe the situation described in this paragraph is uncommon.

10.57 *Excerpt:* Third paragraph, failure rates cited.

Technical Comment: Three references were cited to develop a statistic for culvert performance. Reviewing two of the references suggest they may not be appropriate for the proposed designs. The 47% average failure rate appears to be based on the simple average of the 3 failure rates cites. Furthermore, these references have a range of 30 to 58%, Section 14.1.2.3 states a failure rate of 30 to 60%.

Comment Category: Inconsistent use of reference data.

EPA Response: Data in the three references noted in the comment are appropriate for estimating culvert failure frequencies for the transportation corridor. The estimated culvert failure frequency in the assessment is the average of the failure frequencies found in the three references, as noted in the assessment.

10.58 *Excerpt:* Fourth paragraph, aufeis discussion.

Technical Comment: This paragraph discusses the impacts of culverts filling with ice and relates two consequences: Road overtopping during break up flows and blocking fish passage. The reference cited is 1985 which reviewed culverts installed before then. Current design often installs flood relief culverts above or outside areas where ice accumulates to mitigate for the potential that a road is overtopped by spring melt due to an ice-filled culvert. Also, rainbow trout spring spawning migration should be checked against when ice in culverts could occur. The fish movement may be late enough to avoid this potential.

Comment Category: One-dimensional analysis.

EPA Response: Discussion in the paragraph cited in the comment is accurate, and the 1982 (not 1985) reference is relevant. Additional information on ice formation, including an additional reference (Slaughter 1990), is provided in Section 7.3.2.4 of the revised assessment. Rainbow trout spawning migration is relatively early, so they could be affected by ice accumulation.

10.59 *Excerpt:* First paragraph.

Technical Comment: The paragraph discusses blockages and inspections. The inspection timing and responses are not based on a mine plan. Therefore the conclusion may not represent the proposed conditions along the transportation corridor.

Comment Category: Unsupported conclusion.

EPA Response: Inspection timing and responses in the assessment are not based on a mine plan because none is presently available; instead, they are based on the most relevant, currently available data.

10.60 *Excerpt:* Last paragraph of section.

Technical Comment: This paragraph presents a scenario of culvert maintenance after the mine is closed. It makes three assumptions, the road is given over to government maintenance, maintenance frequency will decrease, and maintenance quality will diminish. None of these are supported by references or citations.

Comment Category: Unsupported conclusion.

EPA Response: We assume that if the road is turned over to a government entity, it will receive the level and quality of maintenance that governments routinely apply to rural

roads. That maintenance is reflected in the reported culvert failure frequencies, which are documented in the references cited.

10.61 *Excerpt:* "They are not always installed correctly or do they stand up to the rigors of a harsh environment, as indicated by the failure rate cited in Section 10.3.2.1"

Technical Comment: Three references were cited to develop a statistic for culvert performance. Reviewing the two references suggest they may not be appropriate for the proposed designs. The 47% average failure rate appears to be based on the simple average of the 3 failure rates cited. This paragraph appears to be discussing both drainage and fish passage culverts, but it is not clear. This should be clarified as the references cited only evaluated fish passage culverts and not drainage culverts.

Comment Category: Invalid assumptions.

EPA Response: See response to Comment 10.57. Cited culvert failure frequencies are based on culverts designed for fish passage and take into account the use of best management practices or mitigation measures that are discussed in text boxes throughout Chapter 10. Although culverts are designed to certain specifications (Box 10-2), they are not always installed correctly or may not stand up to the rigors of a harsh environment.

10.62 *Excerpt:* First paragraphs "Culverts are not always built to specifications…"

Technical comment: This implies that whatever is constructed will not be constructed to the design criteria. A citation should be added to justify the assertion.

Comment Category: Unsupported conclusion.

EPA Response: The revised assessment notes that, although culverts would be designed to certain specifications, they are not always installed correctly (i.e., according to design criteria) or may not stand up to the rigors of a harsh environment. This is indicated by culvert failure frequencies in the references provided in Section 10.3.2.1. The failure frequencies cited are from modern roads and represent the most relevant data available.

10.63 *Section:* Report Section Identification: 6

Original Response/Comment: These pages address the potential effects of a concentrate spill in the transportation corridor, with its many stream crossings. Page 6-30 states that a concentrate spill would be limited to 475 cubic meters due to automatic shutoff, and it states that all or part of this mass could enter the stream. If the concentrate slurry volume is 475 cubic meters, the concentrate itself is probably around 50% of that amount. It is stated that a concentrate spill into a stream or wetland would result in acute exposure of fish and invertebrates to toxic water. This is very doubtful for a few reasons: 1) the slurry concentrate consists of approximately 50% water (at a pH of likely greater than 7.0), and sulfides of copper as chalcopyrite, some pyrite and bornite. These minerals take a significant time, probably years, to fully oxidize and produce acid. The assessment does not consider that there will be time to clean up the concentrate spill before any major oxidation would take place. There may still be some stream damage or wetland damage but it is not likely that toxic water would be present, 2) There is also no mention that the vast majority of the length of the pipelines is on land and may never reach a stream and 3) the concentrate is very valuable and the Company will have a major economic incentive (as well as permits and requirements) to clean up any spills to the best extent possible.

Recommended Change: Present a more unbiased view of the likelihood of a concentrate spill entering a stream and discuss that the oxidation of the sulfides occurs at a potentially very slow rate, thus lessening the impacts to water quality over time. Also, these impacts could be mitigated by requiring a detailed Spill Mitigation Plan in the permit process.

Comments on Adequacy of Response in Second Draft: This comment is not reflected in the current review draft. The comment stands. The impacts of a concentrate spill do not accurately reflect actual expected impacts.

<u>EPA Response:</u> Spill mitigation would not mitigate the acute effects of the spill due to the aqueous phase of the slurry. The concerns about dissolution kinetics are addressed by using an analysis of actual product concentrate slurry from an operating mine similar to the proposed Pebble mine and USGS analyses of leachate from product concentrate from the Atik mine. Those materials had leached rapidly, not over years. The comment does not suggest an alternative analysis. Finally, the collection of spilled concentrate would cause physical damage to receiving streams and Iliamna Lake deltas and require remediation, as well as mitigation.

10.64 *Section:* Report Section Identification: Main Report, Section 5.4, Roads and Stream Crossings

Original Response/Comment: The assumptions regarding the number of culverts and bridges may be inaccurate. On numerous occasions, ADF&G has communicated to the Pebble Limited Partnership the desire for bridges at all stream crossing locations. Bridge designs, not culverts, will be the starting point for each considered road crossing.

Recommended Change: The watershed assessment should reflect ADF&G's preference for bridges instead of culverts and the roadway risks/impacts discussion should focus on possible effects of bridges on stream habitat and fish resources.

Comments on Adequacy of Response in Second Draft: It was assumed that crossings over streams with mean annual flows greater than 0.15 m^3/s would be bridged and the remaining culverted. There was no indication in the document that ADF&G prefers that all stream crossing locations be bridged. The risk characterization still focuses on culvert crossings.

<u>EPA Response:</u> The assumption in the draft assessment regarding number of bridges came from Ghaffari et al. (2011). In the revised assessment, crossings that would be bridged are based on mean annual streamflows, as explained in the text. The risk characterization focused on culvert crossings because bridges would generally have fewer impacts on salmon than culverts. Nonetheless, they could result in the loss of long riparian side channels if they did not span the entire floodplain. It is probably not realistic that a majority of the crossings would be bridges. The actual decision as to what type of structure (bridge versus culvert) would be constructed at each crossing would be made by industry engineers in consultation with Alaska permitting staff.

10.65 *Section:* Report Section Identification: 5.4 Road and Culvert Failures, Stormwater Runoff

Original Response/Comment: The narrative implies that only roads can have negative effects on stream passage. Flood events can have substantive changes in the natural stream environment in regards to 'modification of drainage networks, acceleration of erosion processes, which, in turn, can lead to changes in streamflow regimes, sediment transport and storage, channel bank and bed configurations, substrate composition, and the stability of slopes adjacent to streams.' The assumption that roadway salts would be used for general winter maintenance is a considerable jump. BMPS for roadway maintenance in winter climates depend largely on the temperatures, existing road surface, type and rate of vehicle travel, and other considerations. In colder climatic conditions, salts are not utilized for winter maintenance. If salts/brines are used for winter maintenance they are typically used on paved roadways. Given the heavy vehicle traffic this road would carry, this writer assumes a non-paved surface for the major roadways.

Comments Regarding Adequacy of Response in Second Draft: A discussion of floods is only addressed in relation to release of tailings slurry, culvert failure, or climate change. There is no discussion of natural sedimentation and transport processes in the watersheds, other than increased streamflow will induce higher rates of sediment transport. The assumption that salt would be used for winter maintenance remains in the document. Pg 10-30 The assumption that road salts are an issue is implied by the statement …chemicals released during spills along the corridor, and salts or other materials used for winter road treatment. The term 'paved' is not even used in Chapter 10. The comment has therefore not been addressed.

<u>EPA Response:</u> It was not our intent to imply that only roads can have negative effects on stream passage, but Chapter 10 addresses risks associated with the transportation corridor. The revised assessment states that roads would be treated with salts (e.g., calcium chloride) and other materials to reduce dust and improve winter traction. The term "paved" is not used in Chapter 10, as the road is described as a gravel-surfaced permanent access road in Ghaffari et al. (2011).

10.66 *Excerpt:* A risk assessment by Environment Australia estimated that a spill of as little as 10% of a 25-metric-ton-capacity truck of sodium ethyl xanthate into a stream would require a "650000:1 dilution before the potential hazard is considered acceptable" and that the spill could not be mitigated (NICNAS 2000).

Technical Comment: The scenario assumes that the entire capacity is in one container and therefore all could spill. In practice, reagents such as sodium ethyl xanthate are transported in smaller containers that frequently have additional lining/protection in each container. In addition, it is common practice in sensitive areas to transport reagents inside sealed shipping containers to further reduce the risk of damage to individual reagent containers. So the likelihood of 10% of the entire volume being released is very small.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> The risk assessment by Environment Australia was presented in the assessment to highlight the high toxicity of sodium ethyl xanthate. We acknowledge in the assessment that the risk of spills could be reduced by the use of spill-resistant containers.

10.67 *Excerpt:* Page 10-35: The amount of dust derived from a road surface is a function of many variables, including composition and moisture state of the surface, amount and type of vehicle traffic, and speed. An Iowa Highway Research Board Project (Hoover et al. 1973) that quantified dust sources and emissions created by traffic on unpaved roads found that one vehicle, traveling 1 mile of unpaved road once a day every day for 1 year, would result in the deposition of 1 ton of dust within a 1,000-foot corridor centered on the road (i.e., traffic would annually deposit 1 ton of dust per mile per vehicle).

Page 10-36: Based on the estimate from Hoover et al. (1973), the average amount of dust (in tons) generated per mile of road per year along the transportation corridor within the Kvichak River watershed would be equivalent to the daily average number of vehicles passing along the corridor (one vehicle making a round-trip constituting two passings). Using this method, the mine scenarios would generate approximately 6,700 metric tons annually for the entire length of road within the Kvichak River watershed. This value may be underestimated because smaller vehicles use typical rural roads in Iowa, or overestimated if roads in Iowa are dryer or if dust suppression is effective, but it indicates that dust production along the transportation corridor could be substantial.

Technical Comment: The exposure characterization does not account for the lower driving speed for large trucks anticipated in the Alaska rural road context compared to smaller vehicles in the Iowa rural road context of Hoover et al. 1973. As such, the value may be an overestimate because driving speed along rural roads in Iowa is likely higher than for large trucks along rural roads in Alaska. In addition, the assessment assumes that dust suppression is not effective which is an inaccurate assumption given that dust suppression is a critical industry best practice and permit condition of any mine. Furthermore, operation of the transportation corridor would need to meet air quality standards, including for dust. Overall, the assessment does not account for or adjust for baseline sources of fugitive dust emissions (pre-mine context) in the area. According to an ADEC Rural Dust Survey (2010) of rural Alaskan communities, including Kokhanok, Nondalton, and Pedro Bay, there are existing problems with road dust, in particular from speeding ATV traffic on gravel or dirt roads.

Citations: Alaska Department of Environmental Conservation (ADEC), Air Quality Division. ADEC Rural Dust Survey Preliminary 2010 Results.

Comment Category: Comments are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> The revised assessment notes the amount of dust derived from a road depends on many factors. Our dust production estimate is based on a study that quantified dust sources and emissions created by traffic on unpaved roads, and we acknowledge that extrapolation of this study to the assessment's transportation corridor does not take several variables (e.g., moisture of the road surface, number and width of tires, use of dust control agents) into account. These uncertainties likely have a negligible effect on risks to fish, but a moderate effect on our dust generation estimates. The assessment does not account for baseline sources of fugitive dust emissions, because the assessment areas is largely roadless.

10.68 Culvert failure rates still reference old data sets. Comments submitted on the first external draft pointed out that using this old data and data from dissimilar climate areas or ecosystems is inappropriate.

<u>EPA Response:</u> The culvert failure frequencies cited in the assessment are from modern roads and represent the most relevant data available.

10.69 *Section:* Report Section Identification: 5.4.1 through 5.4.6

Original Response/Comment: These subsections are not risk assessment. There are no set conditions defined that, if met, would constitute risk or no risk. There is no comparison of likely conditions to acceptable conditions. Thus, there is no assessment of risks. Rather, there is just a litany of potential effects listed. Essentially, the risk characterization for these subsections reiterates that any and all of the bad things related to roads "could" happen. It does not provide that any specific risks would, or are likely to, occur. Without this, the section is just saying, "there is a risk of these things happening", without any likelihood estimation. Without some form of likelihood or some thresholds, any decision making or conclusions become based on individual interpretation and not a shared basis of understanding.

Recommended Change: Conditions or design thresholds, or a range of such, must be described that, if not met, could/would result in ecologically unacceptable conditions.

Comments on Adequacy of Response in Second Draft: The risk characterization portion of the road construction does not address specific risks. The comment stands. The assessment needs to incorporate mitigation and design features that would offset impacts. The assessment also needs to be revised to truly assess the risk of events. This analysis does not meet EPA's standards for risk assessment.

<u>EPA Response:</u> We do not agree that impacts could most likely be avoided in the permit process by requiring long-lasting crossing designs. Best management practices (BMPs) or mitigation measures would be used to minimize potential impacts to salmon ecosystems from construction and operation of the proposed transportation corridor. However, even with the use of BMPs, inhibition of fish passage and reductions in habitat still could occur.

10.70 Section: 5.4.1

Original Response/Comment: The cited sources do not adequately evaluate the failure rates of culverts installed to modern standards.

Comments on Adequacy of Response in Second Draft: The information used to report on culvert failure was unchanged. The only indication provided in the document of modern standards is in the statement, "Although culverts would be designed to certain specifications (Box 10-2), they are not always installed correctly or do not stand up to the rigors of a harsh environment, as indicated by the failure frequencies cited in Section 10.3.2.1." (pages 10-27 to 10-28). The analysis continues to overestimate the likely impacts of culverts by assuming they will not be correctly constructed.

<u>EPA Response:</u> See responses to Comments 10.34 and 10.68.

10.71 *Section:* 5.4.4.2

Original Response/Comment: The impacts described in this section can easily be mitigated through culvert sizing and design and can, therefore, be avoided.

Comments on Adequacy of Response in Second Draft: The final conclusions indicate that, "Salmonid spawning migrations and other movements may be impeded by culverts in 35 streams, 32 of which contain restricted (less than 5.5 km) upstream habitat. Assuming typical maintenance practices after mine operations, approximately 15 of these 35 streams would be entirely or partially blocked at any time." (page 10-40). The analysis continues to assume that road crossings will not be properly designed or installed. The assumed rate of failure is the rate that occurred under standard practices of the mid to early 20th century and are not the same as standards used today. Therefore, the analysis continues to overstate the likely impacts of culverts on fish populations.

EPA Response: See responses to Comments 10.34 and 10.68.

10.72 *Section:* Report Section Identification: 5.4.8.2

Original Response/Comment: Similar to section 5.4.8.1, total potential worst-case impact is implied and assumed. The assumption that significant impacts occur on every crossed stream both upstream to non-fish bearing conditions, and downstream to an outlet, grossly overstates and misrepresents likely impacts. It is not clearly stated how upstream portions of stream will be impacted. In earlier portions of the Bristol Bay Assessment it is stated impacts MAY extend to 200 meters away from the road. However, later in the assessment, it implies the impact can be measured miles downstream and upstream. The mileage represented in Tables must be qualified such that it does not imply impacts to the entire mileages listed.

Recommended Change: Provide discussion about the level of impacts close to the road and account for the distance downstream where impacts are ameliorated, particularly for those streams that are crossed only once and/or do not have any fish in them near the road crossing.

Comments Regarding Adequacy of Response in Second Draft: There is no indication of the level of impact associated with the transportation corridor, only distances are provided. There is no clear indication how the upstream portions will be impacted, aside from restricted access through culvert blockages. The same buffer distances were used to estimate distance of impact in this analysis (Box 10-1).

EPA Response: The assessment does not assume that significant impacts occur on every crossed stream along its entire length, downstream to an outlet or upstream to non fish-bearing conditions. The revised assessment states that the transportation corridor could affect 290 stream km between its road crossings and Iliamna Lake, and that fish may also be affected in the approximately 830 km of streams upstream of the transportation corridor that are likely to support salmonids (based on surveys and stream gradients less than 12%, Table 10-8). Upstream portions of streams would be impacted through potential blockage of fish passage (e.g., culverts plugged by debris, or stream flow exceeds culvert capacity resulting in overtopping and road washout).

In this assessment we delineated the proximity of the transportation corridor to National Hydrology Dataset streams and National Wetlands Inventory wetlands. The 200-m road buffer for effects outward from the road was derived from an estimate of the road-effect zone for secondary roads (Forman 2000), as noted in the revised assessment. Impacts from the road over water (i.e., at stream crossings) would be expected over much longer distances. As noted in the revised assessment, the physical

effects of roads on streams and rivers often propagate long distances from actual stream crossings due to the energy associated with moving water. Alteration of hydrology and sediment deposition by road crossings can change channels or shorelines many kilometers away. Tables in the assessment document upstream lengths of streams likely to support salmonids and downstream lengths to Iliamna Lake. We do not feel it is necessary to qualify these distances.

With respect to the recommended changes, discussion about the level of impacts is contained in the risk characterization section of specific potential impacts. We do not have enough information to postulate about the downstream distance from crossings where impacts may be ameliorated.

The 200-m road buffer noted above was not changed in the revised assessment because it is appropriate. In fact, as noted in Box 10-1, our characterization of both stream length and wetland, pond, and small lake area affected is likely a conservative estimate.

10.73 Likelihood: The BBA uses culvert failure rates that are not representative for use in assessment of transportation projects in Alaska. The sources used by the BBA were reviewed and found to not represent the state of Alaska's industry. The BBA needs to collect data representative of stream crossing designs used in Alaska and reevaluate the conclusions of the Assessment.

The BBA does not clearly document how culvert failure rates used in the Assessment were derived. The BBA authors appear to have used culvert failure frequencies from three references to derive a frequency for the likelihood that culverts would fail and impact fish populations. While this frequency is not specifically stated in the BBA, it appears to be the average of the individual failure rates found in the three references. Two references used by the BBA were reviewed for applicability to the assessment and modern culvert design requirements and techniques used in Alaska.

EPA Response: The culvert frequencies cited in the assessment are from modern roads. Because the Bristol Bay watershed is an undeveloped area, much of the literature is necessarily from areas outside of Bristol Bay. However, to the extent possible we used examples from representative environments, and applied the results to the proposed mine. The comment is correct in that the estimated culvert failure frequency in the assessment is the average of the failure frequencies found in the three references, as noted in the assessment.

Two references reviewed were by Price et al., who evaluated culvert performance in Washington State and Langill and Zamora, who evaluated culverts in Nova Scotia. These are readily available through the Internet; these were reviewed to determine whether the failure rates in them are applicable.

… Because Price et al. specifically excluded culvert designed by stream simulation methods, the failure rates in the study would not apply to culvert installations that would be permitted in Alaska where stream simulation methods are generally required.

EPA Response: Although Price et al. attempted to exclude stream simulation culverts from their study, they note that four were included that were fish passable structures. Culverts in Alaska are designed and permitted using a number of design approaches;

the stream simulation approach is not applicable in all conditions (e.g., where stream gradients are 6% or greater).

Barnard, in a draft paper cited in Price et al., reports a very low potential for stream simulation designed culverts to be fish passage barriers. Barnard (Draft, 2003; referenced in the Price et al. article) states in the abstract that “Results show that when designed and constructed according to [Washington] stream simulation design criteria (Culvert bed width = 1.2(Channel width) +2 feet, and slope of culvert < 1.25 (Channel slope)), stream simulation culverts are reliable and create similar passage conditions compared to the adjoining channel.” The author notes that the study did not evaluate fish passage in this study per se. The study evaluated only whether channel morphology similar to the stream near the culvert developed within the culvert, inferring that if the fish could travel in the stream, they could travel through the culvert.

The Price et al. study did include two culverts that were designed using stream simulation method. Price et al. report barrier rates of zero for the two stream simulation design culverts. Later, Price et al. (page 1121) state “All 24 bottomless structures assessed in this study were passable. Although we attempted to exclude stream simulation culverts from this study, the four that were inadvertently included were fish passable structures.” It does not appear that the BBA included this finding in their Assessment.

<u>EPA Response:</u> The assessment uses recent literature to estimate potential culvert failure frequencies but does not provide detailed information from those cited references. The Price et al. study did include a number of stream simulation culverts that were fish passable structures. Though the stream simulation design approach most clearly replicates natural stream conditions (as noted in Box 10-2 of the assessment), it is not applicable in all stream conditions.

The Langill and Zamora (2002) study evaluated culverts installed in Nova Scotia. The culverts were on first and second order small streams. For these culverts, design methods are prescriptive and set out by a general permit. The design standards required only 3 inches of embedment for an 18-inch-diameter culvert to 6 inches of embedment for a 48-inch-diameter culvert. The maximum slope for fish-bearing streams is 0.5 percent. The Nova Scotia design criteria for these culverts are less stringent than stream simulation methods required by the ADOT&PF ADF&G MOA.

A culvert failure criterion in this study was related to culvert slope. Langill and Zamora report that (page 8) “A culvert slope of 0.5% was used as the limit for determining effective fish passage. It is generally accepted in the [Canadian] Maritime region [which includes Nova Scotia] that fish passage is impaired with a culvert slope greater than 0.5% (Conrad & Jansen, 1994)” and that (page 14) “Fragmentation of fish habitat occurred when the culvert slope exceeded 0.5%.” The failure rate reported in this article is not applicable for use in the BBA because it is specific for eastern Canada. Also, there are many examples of fully functional fish passage culvert installations with slopes greater than 0.5% on Alaskan salmonid streams.

<u>EPA Response:</u> It is not the purpose of the assessment to address the adequacy of culvert design types. The fact is that many culverts on fish-bearing streams in the Langill and Zamore study failed to meet the accepted slope criterion for fish passage in

the study area. Further, many culverts were classified as non-fish passage due to perched outfall.

10.74 The BBA states that "standard for culvert installation in fish-bearing streams in Alaska consider road safety and fish passage, but not the physical structure of the stream or habitat quality" (page 10-28, paragraph 1). However, in Table 10-2 the Tier 1 design method description states that "The Tier 1 approach most clearly replicates natural stream conditions…" (page 10-29). A Tier 1 design, by definition, considers the physical structure and habitat of the stream. The text does not match the information presented later in the box. Furthermore, as stated in earlier PLP review comments, the ADOT&PF ADF&G MOA represents the minimum generally required by permitting agencies. Recent designs and installed culverts have required more evaluation and documentation that culvert installations present the minimum potential habitat and fish passage impacts.

EPA Response: **Text in the assessment has been revised in the final assessment to read: "Standards for culvert installation on fish-bearing streams in Alaska mainly consider fish passage (ADF&G and ADOT 2001). Additional factors unrelated to fish passage, such as the physical structure of the stream or habitat quality, are addressed on a project-specific basis during preparation of the Alaska Department of Transportation and Public Facilities environmental document."**

10.75 In conclusion, the BBA overstates the potential short- and long-term risks to salmonids from creek and river crossing structures along the transportation corridor. The overstated risks come about because the BBA used estimates of culvert failure rates that do not apply to the design standards that will likely be used for culverts in Alaska. The risks should be reevaluated using more appropriate data sets that better represent potential failure rates of assumed design standards in order to give decision makers a clear understanding of the likelihood and consequences of impacts in the watershed from these structures.

EPA Response: **The assessment does not overstate the risks to salmonids from crossing structures along the transportation corridor. As noted in Chapter 6, we assume state-of-the-art practices for design, construction, and operation of the road infrastructure, including design of bridges and culverts for fish passage. Modern design guidelines for culverts are described in Box 10-2. The culvert frequencies cited in the assessment are from modern roads. Because the Bristol Bay watershed is an undeveloped area, much of the literature is necessarily from areas outside of Bristol Bay. However, to the extent possible we used examples from representative environments, and applied the results to the proposed mine.**

10.76 *Excerpt:* Estimation of dust production from the transportation corridor. Our dust production estimate is based on a study that quantified dust sources and emissions created by traffic on unpaved roads. Extrapolating that study to the transportation corridor does not take into account variables such as composition and moisture of the road surface, number of tires and their widths, and speed. In addition, road dust generation may be reduced by 50 to 70% by the application of dust control agents such as calcium chloride. Overall, these uncertainties likely have a negligible effect on risks to fish, but a moderate effect on our dust production calculations.

Technical Comment: The exposure characterization does not account for the lower driving speed for large trucks anticipated in the Alaska rural road context compared to smaller vehicles in the Iowa rural road context of Hoover et al. 1973. As such, the value may be an overestimate because driving speed along rural roads in Iowa is likely higher than for large trucks along rural roads in Alaska. In addition, the assessment assumes that dust suppression is not effective which is an inaccurate assumption given that dust suppression is a critical industry best practice and permit condition of any mine. Furthermore, operation of the transportation corridor would need to meet air quality standards, including for dust. Overall, the assessment does not account for or adjust for baseline sources of fugitive dust emissions (pre-mine context) in the area. According to an ADEC Rural Dust Survey (2010) of rural Alaskan communities, including Kokhanok, Mondalton, and Pedro Bay, there are existing problems with road dust, in particular from speeding ATV traffic on gravel and dirt roads.

Citations: Alaska Department of Environmental Conservation (ADEC), Air Quality Division. ADEC Rural Dust Survey Preliminary 2010 Results.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: See response to Comment 10.67.

Center for Science in Public Participation (Doc. #5657 and #5540)

10.77 Northern Dynasty (NDM): 2. EPA has continued to ignore modern mine engineering practices and regulatory requirements; including (…)

c. “Road Culverts Designed to Fail” (NDM 2013a)

EPA addressed culvert failures in the Second External Review Draft thusly:

> “Extended blockage of fish passage at road crossings is unlikely during operation in our scenarios, which specify daily inspection and maintenance. However, after mine operations cease, the road may be maintained less carefully by the operator or may be transferred to a government entity that likely would not be able to support daily inspection and maintenance. In either case, the proportion of culverts that are impassible would be expected to revert to levels found in published surveys of public roads (range of 30 to 58%, mean of 47%). Of the approximately 46 culverts that would be required, 35 would be on streams that are believed to support salmonids. Hence, over the long term, 10 to 20 streams would be expected to lose passage of salmon, rainbow trout, or Dolly Varden for an indefinite period of time, and some proportion of those streams would have degraded downstream habitat resulting from sedimentation from washout of the road.” (Second External Review Draft, p. ES 16-17)

EPA did not take a catastrophic approach toward risk analysis in the Second External Review Draft. As can be seen from the quote above EPA attempted to outline a reasonable long term risk scenario. Unlike the permit-related EIS process, where all of the risks are assumed to be mitigated, in the risk assessment EPA looks at what is likely to happen in the long term based on the actual performance of these facilities.

EPA Response: Comment noted; no change required.

10.78 The assumption that culverts will be checked daily and immediately fixed if fish passage is impaired during mine operation is not realistic. Surveys of permanent Alaskan roads indicate the majority of surveyed culverts impair or block fish passage including on the: Tongass where 66% of 273 culverts were inadequate for salmon passage (Flanders and Cariello, 2000); the Mat-Su Borough where 89% of 518 culverts were unlikely to pass juvenile salmon (MBSHP, 2011); and the Kenai Peninsula where 82% of 270 surveyed culverts provided inadequate salmon passage (kenaiwatershed.org). In Washington state 30% of recently installed culverts were barriers to fish passage (Price et al. 2010). Many more miles of road than estimated in the BBWA would have to be built to support mining, not just the mine to port road.

Recommendation: Increase likely estimates of road lineage. Make culvert impact estimates more realistic based on published Alaskan road impacts.

<u>EPA Response:</u> We assume that the transportation corridor would receive daily inspection and maintenance during operation of the mine. Though temporary repairs to the road would be made in response to a noticeable failure (and take longer in the case of multiple failures), these fixes may not fully address fish passage, which may be reduced or blocked for longer periods. We also note that some failures that would reduce or block fish passage might not be noticed by a driving inspection. As noted in the final assessment, the frequency of culvert failure detection depends on the level of surveillance along the corridor.

With respect to the recommendation to increase likely estimates of road lineage, the revised assessment notes that the mine site could contain more than 19 km of main roads, as well as numerous pit and access roads. Potential risks associated with these roads would be similar in type to those described in Chapter 10. With respect to culvert impact estimates, we are aware of references on roads in Alaska that report a higher frequency of culvert failures than reported in the assessment. However, we chose to use references reporting culvert failure data only from modern roads.

10.79 "…The number of spills over the roughly 25-year life Pebble 2.0 scenario would be 3.9—that is, 4 spills from truck accidents would be expected during mine operations. Over the roughly 78-year life of the Pebble 6.5 scenario, 12 spills would be expected." (p. 10-30)

It might be mentioned that there has already been a mine-related truck accident that resulted in a fuel spill (Pile Bay Road Spill of 6Jun09), and fuel reached surface waters.

There are also some statistics available from the Red Dog mine where there is truck travel along a haul road that is roughly half the length (52 miles) to that of the road proposed for Pebble.

"Based on the average daily trips in 17 years more than 200,000 concentrate and 10,000 fuel truck trips have occurred. In that 34 documented spills have resulted in over 1,000 tons of concentrate being spilled. From 2000 through 2007 one fuel truck spill of 7,000 gallons occurred." (Red Dog Mine Extension Aqqualuk Project, Final Supplemental Environmental Impact Statement, Volume 1, Tetra Tech, October 2009, p. 3-159)

The documented spill rate at Red Dog is approximately 2/yr. This rate would yield 156 spills over a 78-year mine life at Pebble (in addition the road at Pebble would be twice as long as the road at Red Dog).

EPA Response: **We are familiar with the Red Dog Mine, but based the estimate of the number of trucks on Pogo Mine because it is a gold mine and because we had relevant data on annual production and the number of trucks needed for reagent transport.**

Anonymous (Doc. #5862)

10.80 I found the example that the culverts would be monitored daily to be unrealistic and hilarious. Yes, someone will be paid to drive the road every day, but we all know that human nature being what it is, they will not get out of the truck and inspect each culvert on both sides of the road. Why would they? It is proven that the Alaskan state govt doesn't have the money it would take to have adequate oversight.

EPA Response: **We believe the assumption of daily inspection and maintenance during operation is realistic, although the final assessment notes that the frequency of culvert failure detection depends on the level of surveillance and that some failures might not be noticed by a driving inspection. The final assessment also notes that inspection and maintenance would decrease after mine operations stop.**

10.81 How much dust from the tailings will be deposited over water and land? I did not read the entire report, just the summary, but no mention of this is made. From 27 summers in Bristol Bay I can honestly say that it BLOWS out there. The wind will pick up sand, much less dust. Add that up over a couple hundred years. Thus the risks of mining are actually higher than the Assessment states.

EPA Response: **For reasons described in Section 6.4.2.5, we do not consider dust from tailings beaches in the assessment.**

Alaska Chapter of the Wildlife Society (Doc. #7415)

10.82 The Assessment appropriately considers the cumulative risks that result from associated infrastructure, such as pipelines and a transportation corridor. The Assessment also appropriately recognizes that development of smaller mines becomes more likely as infrastructure to support the Pebble project is established.

EPA Response: **Comment noted; no change required.**

Chapter 11: Pipeline Failures

G. Y. Parker (Doc. #5615)

11.1 With regards to pipelines, Mr. Parker believes that the "recommended mitigation and restriction in a§ 404(c) determination should be highest engineering and operations standards.

EPA Response: **Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.**

11.2 2. With respect to failure of pipelines carrying ore concentrate, the Assessment estimates one to two stream-contaminating spills in 78 years and two wetland-contaminating spills in 78 years.

<u>EPA Response:</u> Comment noted; no change required.

11.3 4. With respect to failure of pipelines carrying process water, the Assessment makes the same estimate of one to two stream-contaminating spills in 78 years and two wetland contaminating spills in 78 years.

<u>EPA Response:</u> Comment noted; no change required.

11.4 3. With respect to failure of pipelines carrying diesel fuel, the Assessment makes the same estimate of one to two stream-contaminating spills in 78 years and two wetland contaminating spills in 78 years.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Miners Association (Doc. #2910)</u>

11.5 Error #22: status unclear Assumption of a Product Pipeline (2012 TR, page 26). A product pipeline may be required to develop the Pebble Mine. However, no other mine in Alaska uses such a pipeline. In fact, very few gold mines have a need for a pipeline because the gold is so much more compact than copper concentrate. Thus, it is statistically likely that other mines within the watershed would not use a pipeline. The predicted pipeline impacts are unlikely to be representative of non-Pebble mines in Bristol Bay. As we cannot tell what EPA's hypothetical mine is supposed to represent (Pebble, copper porphyry mines, all mines?), we cannot determine the significance of this error. We do note that AMA pointed out this error in their 2012 comments, and the 2013 made no changes with respect to this issue.

<u>EPA Response:</u> The assessed scenario includes a concentrate pipeline because Northern Dynasty Minerals specified such a pipeline in its preliminary plan (Ghaffari et al. 2011). The use of such pipelines at other Alaskan gold mines is not relevant. No change required.

11.6 Error #23: not addressed. Omission of Pipeline-related Prevention and Mitigation Strategies (2012 TR, page 26-27). EPA calculates that the probability of a spill occurring and entering a stream is such that one would expect stream-contaminating spills over the duration of the project. This frequency is obviously unacceptable (as EPA points out). It is unclear why EPA believes it would be allowed. In fact, the government would obviously require prevention and mitigation strategies to lower the risk before allowing such a pipeline to be operated. Thus, the risks are obviously overestimated. See AMA 2012 comments, pages 26 – 27.

<u>EPA Response:</u> The risks are estimated on the only basis available, historic practice. Failure rates in practice might be lower due to improved design or higher due to the abrasive properties of the concentrate.

11.7 Error #24: not addressed. A check on conclusions: EPA came to a different conclusion for a potential mine pipeline at the Red Dog Mine (2012 TR, page 27). AMA's 2012 review pointed out that EPA came to different conclusions about pipeline failure in its 2009 Red Dog EIS than it did in the watershed assessment. In the 2013 draft, EPA failed to explain why one conclusion was inappropriate for a pipeline at Red Dog, but another conclusion on the exact same issue was appropriate for a pipeline in Bristol Bay.

EPA Response: This assessment stands on its own. There has been no environmental impact statement for a mine at the Pebble deposit.

The Pebble Limited Partnership (Doc. #5535)

11.8 The Assessment evaluates a release from a full-bore rupture (worst case scenario) but lumps all data from all types of spills and pipeline failures together to assess this one type of rupture. This is a flawed approach. Further, the report does not provide key parameters to technically evaluate the accuracy of the mass estimate and the reasonableness of the consequence evaluation. Showing these parameters is standard practice in any scientific analysis and would allow a critical assessment of the release scenarios and assumed impacts. Without this information, there is nothing to substantiate these conclusions.

EPA Response: Many of the pipeline parameters were included in the revised assessment, and additional parameters have been included in Chapter 11 in the final assessment. The frequency of releases does include all releases and the scenario represents one potential release, both of which are stated in the assessment.

The Pebble Limited Partnership (Doc. #5536)

11.9 Overstatement of Spill Probability

The pipeline spill probability assessment inaccurately correlates Pipeline and Hazardous Materials Safety Administration (USA) and Energy and Utilities Board (Canada) pipeline incident data to a full-bore rupture release of a 20 centimeter, double-walled pipeline. Both datasets document all reported incidents from leaks to ruptures for all causes (e.g., corrosion, third–party damage). Therefore, a frequency value derived using all incidents will be biased toward the incidents that populate the database the most. In both databases, small volume releases from leaks represent nearly 80% of the reported incidents. Full-bore ruptures represent a much lower population in the databases. An appropriate frequency value for the pipeline scenarios should be based upon the frequency of full bore ruptures so that a representative comparison can be made to the presented scenario. If done, it is likely that the frequency of occurrence will be lower than established in the Assessment. Similarly, the causes of release are qualitatively used in the evaluation. Release frequency based on cause can be established, which would then assist in identifying the applicable threats of a release. Finally, EPA's scenario assumes that a double-walled pipeline will be used (Section 6.1.3.2) for above ground pipe. Modification factors for this mitigation measure would further reduce the release frequency for the evaluation. So, because a generic frequency value has been used and not adjusted for release type, cause(s), and mitigation measures, the frequency used in the report overestimates the likelihood of a full-bore release from the pipeline. In addition, the report does not state whether the pipeline is operated 24/7 or at specific times or intervals.

EPA Response: See response to Comment 11.8. We found no compilation of data on full bore ruptures and the comment provides none. A frequency of failures based on cause is irrelevant to the receiving environment.

11.10 Lack of Key Parameters for Release Scenario

The report analysis assesses a release from a full-bore rupture. It describes in general terms that a release volume is affected by the shutdown time of remote valves and the draindown of the pipeline. These parameters are the basis of the volume of slurry released from the pipeline, the related mass of concentrate transported to the downstream water bodies, and the resulting effect on salmonids. The report does not provide key parameters to technically evaluate the accuracy of the mass estimate and the reasonableness of the consequence evaluation. Parameters that could not be readily discernible in the report are pump flow rate, length of pipeline under draindown, and the time of draindown. Showing these parameters would allow a critical assessment of the volume released under pumping conditions before remote valve isolation, the volume drained under gravity, the length of pipeline under draindown, and the time for the pipeline to drain under gravity.

<u>EPA Response:</u> See response to Comment 11.8.

11.11 *Page*: 11-5 and 11-6

Section: 11.1

Excerpt: Although the range of published annual failure rates for oil and gas pipelines spans more than 1 order of magnitude (0.000046 to 0.0011 per km) (URS 2000), the range for pipelines most similar to the assessment pipelines along the transportation corridor is much narrower. For example, the failure rate is 0.0010 failure/km-yr for pipelines less than 20 cm in diameter (OGP 2010), 0.0015 failure/km-yr for pipelines in a climate similar to Alaska (Alberta, Canada) (ERCB 2013), and 0.00062 failure/km-yr for pipelines run by small operators (those operating total pipeline lengths less than 670 km) (URS 2000). The geometric mean of these three values yields a probability of failure of 0.0010 failure/km-yr.

Contributor: ERM.

Technical Comment: The frequency data used in the cited references were developed using PHMSA's and EUB pipeline incident dataset. An entire dataset includes releases from discrete and mainline elements, both of which have different release frequencies. The applicability of using a release frequency based upon an entire dataset rather than a scenario-specific frequency should be discussed.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> We do not agree that those subsets of data are particularly representative of a product concentrate pipeline operated by PLP.

11.12 *Page*: 11-5 and 11-6

Section: 11.1

Excerpt: Complete break or equivalent failure of the product concentrate pipeline. Complete break or equivalent failure of the return water pipeline. Complete break or equivalent failure of the diesel pipeline.

Contributor: ERM.

Technical Comment: The frequency data used in the cited references were developed using PHMSA's and EUB pipeline incident dataset. The entire dataset includes releases from all reported spill volumes ranging from leaks to ruptures. Use of frequency data for all incidences rather than for a full bore rupture as described in the scenario overestimates the likelihood of a spill related to a full bore rupture.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> See response to Comment 11.9.

11.13 *Page*: 11-6

Section: 11.1

Excerpt: It may be argued that engineering can reduce pipeline failure rates below historical levels, but improved engineering has little effect on the rate of human errors.

Contributor: ERM.

Technical Comment: The Assessment includes a cursory discussion of the causes for a pipeline release but should identify the applicable causes for the scenario pipelines. The release frequencies of these causes should then be used in developing the applicable scenario release frequency. The Assessment states that improved engineering has little effect on the rate of human error release frequency but this has not been demonstrated. The text should establish what the release frequency is for human error and its materiality on the frequency rates used.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> We found no compilation of data on ruptures due to human error and the comment provides none.

11.14 *Page*: 11-7

Section: 11.2

Excerpt: Total travel times to Iliamna Lake are estimated to be 240 minutes and 24 minutes to Chinkelyes and a Knutson Creek spill, respectively.

Contributor: ERM.

Technical Comment: The estimated transport time represents the time the slurry is predicted to first arrive at the water body and not the time for the entire slurry to empty into the water body. The report should address the total time for the mass to reach the receptor and the rate of introduction.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

EPA Response: See response to Comment 11.8.

11.15 *Page*: 11-7

Section: 11.2

Excerpt: Total travel times to Iliamna Lake are estimated to be 240 minutes and 24 minutes to Chinkelyes and a Knutson Creek spill, respectively.

Contributor: ERM.

Technical Comment: The evaluation is a very simplistic approach to assessing the fate and transport of a release from a pipeline. The estimated transport time represents the estimated time for the slurry to first arrive at the water body and not the time for the entire slurry mass to empty into the water body. The time to drain down the pipeline is not addressed and because it is absent the reader assumes that all the mass is released at once rather than over time. The report should address the total time for the mass to reach the receptor and the rate of introduction.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

EPA Response: See response to Comment 11.8.

11.16 *Page*: 11-8

Section: 11.2

Excerpt: Flows were calculated from precipitation models used to determine mean annual runoff for the assessment’s stream culvert analysis.

Contributor: ERM.

Technical Comment: The evaluation is not sufficiently transparent to assess if the slurry characteristic and channel surface roughness are taken into account to calculate the flow rates and transit time to the defined receptors. Because the information is not readily discernable from the text and tables, it is unclear if appropriate hydrologic flow conditions are used in the precipitation model and the accuracy cannot be reasonably and critically reviewed. The precipitation model should be identified and the condition for overland and channel flow should be defined.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Information is presented out of context or in a misleading way.

EPA Response: The slurry is characterized as consisting of a liquid phase, which would have the same dynamics as the water in the receiving stream, and the product particles, which would be transported based on the Hjulström diagram at an undefined rate.

11.17 *Page*: 11-8

Section: 11.3.1

Excerpt: During the entire spill, gravity drainage governs the flow rate based on calculations for free-flowing pipes.

Contributor: ERM.

Technical Comment: The evaluation is not sufficiently transparent to assess the length of the pipeline subject to draindown, the slope of the pipeline, the effect of slurry characteristics on flow through a hole, and how draindown time and volume were estimated. Without this information, the analysis would be incomplete. The approach and assumptions used in this evaluation result in a slurry release rate and volume to the environment. Therefore, if the approach and assumptions are inaccurate, the release rate and volume are inaccurate, and as a result, the conclusion regarding the mass reaching a receptor and the total time for the entire release volume to reach the receptor are inaccurate.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Information is presented out of context or in a misleading way.

EPA Response: The length of draindown was supplied for both scenarios. Other parameters have been added in Chapter 11 of the final assessment.

11.18 *Page*: 11-8

Section: 11.3.1

Excerpt: The assumed total slurry volume draining to the stream would equal the pumped flow rate times 5 minutes, plus the volume between the break and local high point in the pipeline.

Contributor: ERM.

Technical Comment: The evaluation is not sufficiently transparent to assess what pumped flow rate was used for the scenario pipelines, what pipeline draindown lengths, rate, and time were used, and whether the flow rates are based on the physical characteristics of water or the slurry mix. Because the information is not readily discernable in the text and tables, the accuracy of the mass release estimates and the eventual effect cannot be reasonably and critically reviewed.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Information is presented out of context or in a misleading way.

EPA Response: **These parameters were added to the final assessment.**

11.19 *Original Draft Location*: Page 6.34, Report Section Identification: 6.2.1.3

Original Comment: Contributor – State of Alaska, Response/Comment – Comment: Why are Liters used in this section? 366,000 Liters sounds like a very large amount number, but is about 100,000 gallons or 366 cubic meters which is a relatively small volume. Also it is unclear whether this is liters of water entrained in the slurry or total volume of slurry, in which case, the water volume would be significantly less. The statement that "None of the river or streams …could provide enough dilution to avoid the acute criterion" is misleading. Acute criteria are generally based on 48 hour or 96 hr LC50 or similar endpoints. As soon as the two-minute spill ended, the water within the slurry would begin to be diluted by clean stream water. Similarly, but more slowly, the pore water within the slurry would be infiltrated and diluted by clean stream water. Over some relatively short period of time the water concentrations outside of the slurry would likely rapidly decrease below acute criteria. This could be minutes to hours. Thus, it is unlikely flowing water would have metals concentrations raised up to the criteria for more than a few minutes or hours. It is also likely that within days, the pore water within the spilled slurry would be notably diluted. Longer term high concentrations could be possible in a small pond or wetland where there is no significant flow. A very small 5-liter per second stream provides 18,000 L per hour and 432,000 L per day. So in one day 5 L/s stream could provide clean water volume of 100% of the total spill volume.

Recommended Change: Provide a more accurate description/understanding of the dynamics of slurry spill entering moving water.

Comments Regarding Adequacy of Response in Second Draft: Not addressed. Comments – The current slurry spill scenarios for Chinkelyes and Knutson Creeks does not address the time of exposure, and uses the single point estimate of concentration in comparison with the AWQC. No discussion of the exposure durations are considered in this evaluation.

EPA Response: **Liters are standard international units for liquids. The spill event is not 2 minutes in duration and the time to response is not the same as the duration of a test. Even after the transport solution is washed out, sediment pore waters are not clean. The contaminants leach from the particles and recontaminate the pore water as described in the assessment.**

11.20 Calculation of Impacts Related to Release Scenarios

The report identifies that 67 tons of concentrate will travel down Chinkelyes Creek and 24 tons of concentrate will travel down Knutson Creek and that the travel time will be 240 minutes and 24 minutes, respectively, until it reaches Iliamna Lake. The hydrology assessment using a precipitation model and culvert analysis is a very simplistic approach to estimating sediment transport in stream channel conditions, and could easily be predicting a travel time that would be much quicker than actual for the mass reaching the water bodies. Since all the mass is not released as a single slug, the duration of the release also should be incorporated in the fate and transport evaluation so that the hydrology of the spill volume can be critically evaluated. In addition, the travel time appears to represent the time for water to travel from the release point to the receptor. The report qualitatively acknowledges that the density of the slurry plays a role in how it is transported, but this was not taken into account when calculating the arrival time, and the rate at which the mass would be introduced to the water body. Finally, the total time for slurry mass to enter the water body would allow for a refined assessment of the consequence of the release. Providing the arrival time of the aqueous phase of the release loses the benefit of fully understanding the dynamics of the release into the receiving water body. The flow model should address slurry characteristics, surface roughness, duration of the spill volume and channel geometry as a more appropriate screening approach that is consistent with the scenarios.

<u>EPA Response:</u> The travel times are for the aqueous phase, not the solids.

11.21 *Page*: 11-9

Section: 11.3.2

Excerpt: Under these concentrate pipeline failure scenarios, 67 metric tons of product concentrate would be released into Chinkelyes Creek or 24 metric tons into Knutson Creek.

Contributor: ERM.

Technical Comment: The evaluation is not sufficiently transparent to assess what pumped flow rate was used for the scenario pipelines, what pipeline draindown lengths, rate, and time were used, and whether the flow rates are based on the physical characteristics of water or the slurry mix. Because the information is not readily discernable in the text and tables, the accuracy of the mass release estimates and the eventual effect cannot be reasonably and critically reviewed.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> Additional parameters are provided in Chapter 11 of the final assessment.

11.22 *Page*: 11-10

Section: 11.3.2

Excerpt: In other words, we expect 1 to maybe 2 such spills in the Pebble 6.5 scenario. Similarly, a spill would have a 35% probability of entering a wetland, resulting in an estimate of 0.038 wetland-contaminating spills per year or 2 wetland-contaminating spills in the Pebble 6.5 scenario.

Contributor: ERM.

Technical Comment: The frequency data used in the cited references were developed using PHMSA's and EUB pipeline incident dataset. An entire dataset includes releases from discrete and mainline elements, both of which have different release frequencies. The applicability of using a release frequency based upon an entire dataset rather than a scenario-specific frequency should be discussed. Because of the inclusion of leaks with rupture frequencies in the evaluation, the conclusion that a spill would enter a wetland is an over-estimation of the probability of occurrence.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

<u>EPA Response:</u> There has never been a pipeline like the scenario pipeline, so scenario-specific failure rates are not available.

11.23 *Original Draft Location*: Page 6.33, Report Section Identification: 6.2.1.1

Original Comment: Contributor – State of Alaska, Response/Comment – Comment: The last paragraph of the section, just below Table 6-8 is likely incorrect. Not all invertebrates will die at the probable effect concentration (PEC), and only predicted concentrations of copper notably exceed PECs. Invertebrates would colonize the fine grained sediment resulting from a pipeline spill, just not those sensitive to the metals contained in the pipeline slurry.

Recommended Change: More accurately represent what is likely to occur.

Comments Regarding Adequacy of Response in Second Draft: Not addressed. Comments – Pg 11-16 while the original statement has been removed, the following is an example of the analysis that remains: A concentrate spill into a stream is likely to kill invertebrates and early life stages of fish immediately. If it is not remediated (and remediation of streams may not be possible), it would certainly cause long term local loss of fish and invertebrates. It appears that the comment has not been addressed.

<u>EPA Response:</u> The comment does not explain how a copper concentrate would constitute a suitable substrate for any aquatic invertebrates. The evidence presented in the assessment indicates that it would be highly toxic.

11.24 *Page*: 11-10

Section: 11.3.5

Excerpt: For example, TransCanada's risk assessment for the Keystone XL pipeline assumed that the time to detection would range from 90 days for a small leak (1.5% of pumping volume) to 9 minutes for a large leak (50% of pumping volume) and that an additional 2.5 minutes would be required for the shutdown sequence (DNV Consulting 2006, O'Brien's Response Management 2009). Therefore, a large spill like the one assessed here would leak for 11.5 minutes based on a state-of-practice design from an experienced company. This is more than twice our assumed duration.

Contributor: ERM.

Technical Comment: The flow dynamics of shutting down a 36 inch diameter line transporting between 700,000 and 800,000 barrels of crude oil per day (Keystone XL) are not the same as shutting down a 20 cm diameter line. Shutdown of large diameter and high flow pipelines must be done in a way as to not cause a breach in the pipeline elsewhere. The example used is a not relevant comparison for shutdown time and the assumed 5 minute shutdown time should be supported by pipeline systems of similar construction and flow.

Citations: N/A.

General Subject Area: Environmental consequences of pipeline failure.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

EPA Response: We found no data on shutdown of product concentrate pipelines. The Keystone XL pipeline is an imperfect analogy, which is why the quoted times to shutdown were not used in the scenario. However, it does indicate that detection and shutdown times for modern pipelines are not negligible.

The Pebble Limited Partnership (Doc. #5752)

11.25 6. The Assessment exaggerates the risk from pipeline failures. EPA's assessment of risk from potential pipeline failures is rife with speculation and unsupported assumptions. As a threshold matter, the failure rates in the Assessment appear to be derived from pipelines that are not constructed to the standards applicable to pipelines for the Pebble project. Indeed, the numeric risks appear to be derived from pipelines that were built many decades ago. See Assessment at 11-5. Pipeline technology has changed significantly since the time that many of these pipelines were constructed and the authors should not attempt to judge a modern pipeline based upon ones that are decades-old.

Much as the Assessment did not account for other types of mitigation, EPA has not accounted for potentially protective measures that could prevent pipeline spills or minimize their consequences. Essentially, EPA has not considered modern pipeline design and containment measures, appropriate use of remote sensing equipment and automatic shut-off values, and modern maintenance measures. Indeed, EPA provides a back-handed acknowledgement of these measures, noting that "[i]t may be argued that engineering can reduce pipeline failure[] rates below historical levels …" Assessment at 11-6.[7] Absent consideration of these protective measures, the pipeline risk assessment is virtually meaningless.

[7] EPA's apparent explanation for ignoring modern technological safeguards is to cite "human error." EPA apparently believes that because technology cannot prevent human error, its risk assessment is valid. Id. at 11-6. Yet, EPA provides no quantification of the risk from "human error." Unless EPA separates the "human error" component of its risk from that which would not occur but for outdated technology, the anecdotes included in the Assessment recounting human error are uninformative about risks from operations that use modern technology. Moreover, EPA's implicit suggestion that consequences from human error cannot be prevented by engineering measures is simply unfounded. In fact, many modern preventive measures would counteract human error.

<u>EPA Response:</u> Failure rates are inevitably based on the history of operation. The assessment acknowledges the potential for lower rates, but has no basis for estimating them, and the comment provides none.

11.26 In reality, modern technology can mitigate the effect of most spills. For example, placement of isolation valves would limit the volume of slurry that could be spilled. Along with automatic leak detection, isolation valves limit the volume of spilled material. EPA's hypothetical spill, see id. at 11-8, assumes a scenario that exaggerates the potential volume of spillage from a well-designed pipeline. In fact, the location described in this hypothetical would likely trigger additional engineering requirements to prevent the scenario described in this text. See, e.g., Geosyntec Comments at 9-10.

<u>EPA Response:</u> The configuration of isolation valves was taken from the preliminary plan put forth by Northern Dynasty Minerals in Ghaffari et al. (2011) and therefore was assumed to be realistic and to incorporate the mitigation measures that they deemed appropriate.

11.27 Another example involves EPA's assumption that pipelines would not be designed to accommodate flood levels near stream crossings. See Assessment at 11-9 ("Because flood flows are a potential cause of pipeline failure at stream crossings, this is a reasonable possibility."). Responsible engineering would account for flood levels at stream crossings. Again, EPA assumes a scenario that is unlikely with the use of commonplace modern engineering precautions.

EPA's projections about possible copper concentrate pipeline spills into specific streams that flow into Iliamna Lake are also highly speculative. See Assessment at 11-7 to 11-12. EPA draws speculative conclusions based on speculative assumptions:

- EPA uses an "estimated failure rate" that is derived from data that have absolutely no application to this project (citing two unrelated studies of old oil and gas pipelines in section 11.1) and fails to adjust that failure rate based on project specific engineering;
- EPA assumes, without explanation, that "the probability of a pipeline failure is independent of location"; and
- With no apparent justification, EPA "assume[s] that spills within 100 m[eters] of a stream could flow to that stream."

Id. at 11-10. From these unsupported premises, EPA concludes that "a spill would have a 14% probability of entering a stream within the Kvichak River watershed" and a "35% probability of entering a wetland." Id. Neither of these conclusions has scientific justification. In fact, EPA concedes that these speculative results "cannot be quantified with existing data and modeling resources." Id. at 11-9.

EPA goes on to claim that a "pipeline failure would contaminate 2.6 km of Knutson Creek or 14 km of Chinkelyes Creek and 7.6 km of Iliamna River …" Id. at 11-10. These assertions are not explained. EPA also speculates about the possible adverse effects of a copper concentrate pipeline spill flowing from Knutson Creek to Knutson Bay in Lake Iliamna. See id. at 11-17. EPA concludes that "the concentrate deposited in Knutson Bay would persist and could render a considerable area unsuitable for spawning and rearing for years." Id.

(emphasis added). However, EPA admits that "transport and deposition processes" associated with these failures "cannot be quantified with existing data and modeling resources." Id. at 11-9. The reader therefore has no basis to test the validity of EPA's assertions. If EPA has modeled these events, the text should disclose such modeling or other foundation for these assertions.

EPA Response: Despite responsible engineering, infrastructure is damaged by floods. All risk assessments address future events, and thus are speculative. Nonetheless, risk assessments are useful. Risk assessments must hypothesize specific scenarios, and for this assessment we hypothesized pipeline failures into two possible receiving streams. The results of the scenario spills were not fully quantified, primarily because the data presented in the PLP's Environmental Baseline Document are not adequate to support the sort of modeling demanded by this comment.

11.28 Even EPA's exaggerated projections of potential harm appear to be local. For example, EPA concludes that in the event of a copper concentrate pipeline failure in or near a stream, "copper is not predicted to cause a kill of adult salmonids in the receiving streams once mixing has occurred, but localized mortality might occur in the mixing zone in the absence of avoidance behavior." Id. at 11-13 (emphasis added).

EPA Response: We do not agree that the assessment is exaggerated.

11.29 EPA also speculates about potential diesel fuel pipeline failures. See id. at 11-20 to 11- 32. EPA acknowledges that diesel fuel "typically dissolves or evaporates within a day" (id. At 11-21) and that "biological effects" of diesel spills into streams and wetlands "are seldom determined and published." Id. at 11-25. Nonetheless, EPA concludes that any diesel pipeline "spill that released more than a trivial amount of diesel to a stream, would be expected to cause an immediate loss of fish and invertebrates, and the community would be likely to recover in 1 to 3 years." Id. at 11-28. This conclusion is both unsupported and undermined by EPA's acknowledgement that "the magnitude and nature of these losses would be highly uncertain …." Id. at 11-31.

EPA Response: The conclusion is supported by many studies of effects of diesel in both the laboratory and the field. The fact that effects of most diesel spills are not determined and published does not negate the literature that has been published.

Earthworks (Doc. #5556)

11.30 The failure scenarios identified in the Assessment are consistent with those found at other comparable mines, and conservative in that they underestimate the potential impacts associated with a worst-case failure scenario, and the assessment doesn't consider the impacts of full build-out (i.e., developing the full mineral deposit).

EPA Response: Comment noted; no change required.

L. Trasky (Doc. #5050)

11.31 5. It seems likely that there will be more pipeline breaks that impact fish and other aquatic life than EPA's analysis indicates. The slurry will be highly corrosive and abrasive and will eventually wear or corrode through the pipe unless the pipe is replaced regularly. The low spots in the pipeline will be at stream crossings. There have been dozens of pipeline breaks in the Prudhoe oil field due to corrosion, poor maintenance and inadequate State oversight. A simple Internet search for slurry pipeline spills turns up numerous recent slurry spills in the U.S. even with modern engineering and regulatory practices in place. None of these slurry pipelines were located in areas with the extreme freezing and thawing conditions and earthquake hazards present in the proposed Pebble Mine area.

<u>EPA Response:</u> Comment noted; no change required.

<u>K. Zamzow, Ph.D. (Doc. #5054)</u>

11.32 2. With respect to Figure 11-1 (concentrate), it is not clear what the box "Product Recovery" refers to.

<u>EPA Response:</u> Product recovery is discussed in Section 11.3.4.3.

11.33 3. The three models Figure 11-1 to 11-3 for concentrate, return water, diesel) should have included routes that lead to "no effect" on salmon (e.g., spills on land or on frozen creeks), or should have been described as models specific to a spill at sites such as Chinkelyes Creek or Knutson Creek which flow year round. In the Integrated Risk Section, Table 14-1 specifically notes that most pipeline failures would not affect fish, but the message did not come through in Chapter 11, although it was mentioned (Section 11.3.2).

<u>EPA Response:</u> As the comment acknowledges, the risk assessment mentions the possibility that no effects may occur if a spill is located far from a stream and prompt remedial action is taken. In conventional risk assessment practice, conceptual models show the potential routes from sources to effects. The rates for any of the processes indicated may be negligible.

11.34 4. The rate of spills per year seems low – does it include the probability of a spill in a "no effect" area (no stream or frozen stream)? The spill rate might be better presented as a range of potential failure rates, including rates by wall thickness (which is expected to vary in the concentrate pipeline).

<u>EPA Response:</u> The rates are presented for the entire pipeline and for spills near a stream or wetland. The second comment is puzzling. Why would the wall thicknesses vary in a concentrate pipeline except for the slight variance due to manufacturing variance?

11.35 Double-walls and protective pipeline thickness should be required on the entire length of concentrate and diesel pipelines.

<u>EPA Response:</u> Comment noted, but the assessment is a scientific document and does not contain recommendations for regulatory restrictions.

11.36 Stipulations on pipeline design and maintenance should consider pipeline life as the likely entire life of the mine based on one deposit size, not in the initial mining permit application.

<u>EPA Response:</u> The scenario is, as described, based on the production that is feasible with a conventional pit.

11.37 5. It would be helpful to provide a route map with locations where a spill would represent a high risk to salmon.

<u>EPA Response:</u> It is not clear what criteria the comment is referring to other than proximity to the lake and crossing of an anadromous stream, both of which are already depicted in maps.

11.38 Consider testing xanthates on relevant species and life stages, and test degradation conditions and toxicity of degradation products per the potential toxicity of a spill or of tailings leachate.

<u>EPA Response:</u> The assessment is based on existing data.

11.39 6. There should be a discussion that compares the spatial or temporal effects of the three types of spills. Spatially, a contrite spill could cause fish aversion and the effective loss of the entire stream above as well as below a spill (Section 11.3.4.4), but this would not be the case for diesel, where only the reaches below a spill would be lost due to toxicity. Temporally, downstream of both types of spills could be lost for many years, due to leaching of copper from concentrate of the generational toxicity of PAHs.[8]

<u>EPA Response:</u> Comment noted; no change required.

11.40 7. It could be difficult to follow the risk characterization (Section 11.3) of concentrate product, product leaching, and aqueous phase product, although it was summarized well at the end. For example, it appears from the text that there will likely be acute toxicity in small streams from spills, but in large stream flows or in Lake Iliamna there is likely low or no impact, yet this is not clear from tables and concept models.

<u>EPA Response:</u> Chapter 11 has been extensively edited. The summary in this comment applies to the potential toxicity of the carrier solution (the aqueous phase of the slurry).

11.41 8. Section 11.4 on return water pipelines should include a discussion of spills in winter, both from an underground pipeline (Section 11.5 discusses this with respect to diesel) and from an above ground pipeline.

<u>EPA Response:</u> The scenario is for a spill during non-freezing conditions.

11.42 9. The diesel spill section (Section 11.5) should have included a discussion on the toxicity of weathered oil, and of the effect of chemical and mechanical dispersion as described in the Shein et al article, one of the references.

<u>EPA Response:</u> We believe that the use of dispersants is unlikely in this spill scenario. Weathered oil is less of an issue with diesel than with crude oils.

11.43 10. The reference to the Rice (2007) study in "Analogous Spills" (Section 11.5.3.4) is relevant, in that it tracked the toxicity of polycyclic aromatic hydrocarbons (PAH) over generations of salmon in freshwater habitat; PAH toxicity is common to crude oil and diesel oil spills.

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[8] Note that a 1,400-2,200 gallon spill has already occurred in the Iliamna River, with the fuel being transported by Iliamna Development Corporation; the primary customer is PLP http://community.adn.com/node/148928; http://www.dec.alaska.gov/spar/perp/response/sum_fy09/090605201/090605201_index.htm

<u>EPA Response:</u> Comment noted; no change required.

<u>Northern Dynasty Minerals Ltd. (Doc. #3650)</u>

11.44 Geosyntec Section: 4.3

2012 Geosyntec Comment: Iliamna Lake should not be considered the main receptor for spills since a proportion of spill events will be distant from the lake and/or isolated and cleaned up before reaching a waterway.

Geosyntec Comment: An attempt to address this comment appears to have been made in the 2013 Assessment: 11-9 "Estimated mean velocities of the streams (1.8 m/s for Chinkelyes Creek and Knutson Creek and 1.1 m/s for the Iliamna River) are consistent with those described for these streams (PLP 2011), and are well above the transport velocities. Therefore, the fine sand sized concentrate would be carried downstream during typical or high flows, even given that the concentrate is denser (3.8 metric tons/m3) than typical rock (2.8 metric tons/m3 for granite) and would move less readily. Concentrate would be deposited in any backwaters, pools, or other low-flow locations. If the spill occurred during a period of high flow, it would be carried downstream immediately, potentially reaching Iliamna Lake within 4 hours (via Chinkelyes Creek or Iliamna River) or 0.5 hour (via Knutson Creek). Because flood flows are a potential cause of pipeline failure at stream crossings, this is a reasonable possibility. If the spill occurred during low flows, concentrate that is not collected would be spread downstream by erosion during subsequent typical or high-flow periods, eventually entering Iliamna Lake.

Discussion on Adequacy of 2013 Response: The 2013 Assessment described conditions under which transport of spilled product would occur. We note that the extreme failure scenario now has to occur during a period of significant flow in the creek in order for significant product to reach Iliamna Lake. Otherwise it is likely that cleanup operations could isolate the majority of the product. In relation to failure during high flows, the statement that "because flood flows are a potential cause of pipeline failure at stream crossings, this is a reasonable possibility" now creates an even more remote possibility that the extreme failure scenario would occur. Such a failure during flood flow (if the pipe were somehow now protected from such a condition) would most likely occur between the isolation valves, and hence they would shut down and the volume of product released would be far smaller than that assumed in the 2013 Assessment.

<u>EPA Response:</u> The comment misinterprets the assessment. The scenario does not require and is not based upon high flows. The transport of product concentrate in the two streams is based on mean flows (see the first sentence quoted). The mention of flood flows simply indicates that transport to the lake would be immediate under those conditions.

11.45 Geosyntec's 2012 Review pointed out that the pipeline release scenario, which is incorporated an assumption of 14 km between isolation valves resulted in an unrealistically high release volumes as 14 km worth of concentrate drained by gravity into the creek. Proper design would include more frequent and strategically placed points of isolation, which would work in concert with automatic leak detection to minimize potential leakage along critical stretches of the pipeline. The 2013 Assessment removes this 14 km scenario. In its place they include the following scenario: “In the concentrate pipeline failure scenarios, a single complete break of the pipeline would occur at the edge of the stream, just upstream of an isolation valve. These valves would be placed on either side of major crossings (Ghaffari et al 2011) and could be remotely activated. Pumping would continue for 5 minutes until the alarm condition was assessed and an operator shut down the pumps. The estimated total slurry volume draining to the stream would equal the pumped flow rate times 5 minutes, plus the volume between the break and local high point in the pipeline (i.e., the nearest watershed boundary (Table 11-2). During the entire spill, gravity drainage governs the flow rate based on the calculations for free-flowing pipes.” (Pg. 11-8) The 2013 Assessment replaces one unjustified scenario with another. The assumption that the “volume draining to the stream would equal the pumped flow times 5 minutes, plus the volume between the break and the local high point in the pipeline (i.e., the nearest watershed boundary)” completely disregards proper planning and design for the stream crossings. By forcing the failure upstream of the isolation valve and still allowing all the spilled material to enter the creek, the existence of isolation valves and any other features that might be designed to protect streams from failures on land are made obsolete. If the topography and alignment are such that this extreme scenario could exist, unlikely as it may be that a failure would occur in exactly the worst place for the creek, other engineering and/or operational control can be established to mitigate against it and protect the environment.

EPA Response: The configuration of isolation valves was taken from Northern Dynasty Mineral’s preliminary plan (Ghaffari et al. 2011) and therefore was assumed to be realistic and to incorporate the mitigation measures that they deemed appropriate.

American Fisheries Society (Doc. #3105)

11.46 4. It assumes that pipeline, truck, and treatment plant spills can be quickly controlled in a sub-arctic environment as in temperate regions (see studies of the Exxon Valdez spill regarding why this is a faulty assumption).

EPA Response: We did not make that assumption, and the assessment refers at several points to the potential difficulty of remediation during the winter.

Center for Science in Public Participation (Doc. #5657)

11.47 With regards to the duration of pipeline failure risks in the Assessment on pg. 11-30, “Diesel and natural gas pipelines would be retained after mine closure as long as fuel was needed at the mine site (e.g., for monitoring, water treatment, and site maintenance). Therefore, the diesel pipeline risks would continue for (sic) indefinitely,” the commenter states that “it is likely that the requirement for diesel after mine closure would decrease to the point where operating/maintaining a pipeline would not be economically viable, and on-site diesel requirements would be met by trucking.”

EPA Response: The costs of operating a pipeline are low relative to trucking and the demand for diesel could include multiple mines and villages. Therefore, the statement stands.

Chapter 12: Fish-Mediated Effects

United Tribes of Bristol Bay (Doc. #5275)

12.1 Chapter 12 details how negative impacts on salmon will in turn impact non-salmonid fish, terrestrial animals, and Alaska Natives. The information in this chapter is incredibly important because, as the authors point out, salmon are not only the foundation of the human subsistence diet – they are also a primary food source for other subsistence species.

EPA Response: Comment noted; no change required.

Bristol Bay Native Corporation (Doc. #5438)

12.2 *BBNC's 2012 Comments and Technical Submissions*: Salmon as a Keystone Species: "More attention should be focused on the impacts that loss of or damage to the salmon resource would have on these other wildlife resources – either as a food source or, more generally, as a source of nutrients for their habitat."

Revised Bristol Bay Watershed Assessment: The Revised Assessment devotes more attention to the impacts of salmon decline on other important species.

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC welcomes these changes to the assessment, as they further exemplify the importance of salmon to the entire Bristol Bay ecosystem.

EPA Response: Comment noted; no change required.

12.3 BBNC is pleased to see that the Revised Assessment contains a more comprehensive analysis of important subsistence resources in the Bristol Bay region and the impacts of varying mine proposal sizes on these subsistence resources. In particular, the Revised Assessment devotes more attention to important subsistence resources beyond salmon, including non-salmonid fishes (rainbow trout and char) and other wildlife (bear, moose, caribou, waterfowl). The Revised Assessment also recognizes the importance of these subsistence resources—acknowledging the importance of all salmonid species, various non-salmon fishes, caribou, moose, waterfowl, and berries. BBNC supports these revisions, as they further quantify the importance of maintaining small and diverse fish populations, preventing fish habitat degradation from trace metallic contaminants and dewatering, and ensuring pristine fish spawning and rearing habitat.

EPA Response: Comment noted; no change required.

12.4 *BBNC's 2012 Comments and Technical Submissions*: Assessing Mine Impacts on Wildlife: "the Draft Assessment does not address the potential for noise pollution or fugitive dust resulting from the mining infrastructure and what effects this might have on the behavior of key subsistence species like caribou, moose, and migratory bird and waterfowl. The Draft Assessment also does not examine the effects the transportation corridor might have on the movement and behavior of these species."

Revised Bristol Bay Watershed Assessment: The Revised Assessment devotes more attention to important subsistence resources beyond salmon, including non-salmonid fishes (rainbow trout and char) and other wildlife (bear, moose, caribou, waterfowl).

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC is pleased to see that the Revised Assessment contains a more comprehensive analysis of important subsistence resources in the Bristol Bay region and the impacts of varying mine proposal sizes on these subsistence resources.

EPA Response: Comment noted; no change required.

12.5 The Revised Assessment nevertheless still contains a more limited discussion of the socioeconomic impacts on local communities that would result from large-scale mine development and the resulting loss of subsistence resources in the Kvichak and Nushagak river basins. While rightfully stating that "[s]almon are integral to the entire way of life in these cultures as subsistence food and subsistence-based livelihoods, and are an important foundation for language, spirituality, and social structure," the Revised Assessment is narrow in that it does not analyze the inevitable adverse impacts on the Alaska Native way of life that would result if large-scale mining development proceeds in Bristol Bay. In earlier comments on the Draft Assessment, BBNC emphasized that the assessment "does not adequately discuss the very important socioeconomic impacts to local communities that would likely result from the potential environmental impacts of the development of the hypothetical mining scenario" and that "the Assessment would benefit from greater discussion and a more thorough and prominent discussion of these threats." Integrating the information cited in BBNC's comments would improve this area of the assessment.

EPA Response: The scope of the assessment is limited to potential risks to salmon from large-scale surface mining and resulting salmon-mediated effects to indigenous culture and wildlife, and does not include an analysis of direct socioeconomic impacts on local communities.

The Pebble Limited Partnership (Doc. #5536)

12.6 Report Section Identification: Chapter 5, 6, 7 and 8

Original Comment from State of Alaska: EPA fails to consider reclamation and closure scenarios where mines have successfully operated and closed without major, adverse environmental impacts. No potentials of success for wildlife/mining coexistence, wildlife habitat enhancement, or adaptable species such as sheep and fish incursions into active mining areas. For example, the Fort Knox Mine and the Red Dog Mine are the locations of the two of the most productive grayling habitats in the state. A Dall sheep ram has taken up residence on the organic stockpile from the Walter Creek Heap Leach Pad construction at the Fort Knox Mine. Exploration operations at the Pebble prospect were recently delayed because of migratory song bird nesting in a drill rig.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No discussion or reference to other mining examples with respect to wildlife in Chapters 12, 13 & 14. Because the document fails to address the comment, the document overstates expected impacts on wildlife.

EPA Response: The assessment actually understates expected impacts because it only considers salmon-mediated impacts, and not direct effects, on wildlife. Chapter 5 of the

first draft assessment did address the case in which operation is successful in avoiding failures of environmental mitigation and engineering design. In response to comments, the assessment no longer contains that no-failure scenario. The assessment does not address the potential for use of the site post-closure by adaptable species such as sheep, nor does it address constructed habitats for grayling or other species. Our objective was to characterize potential risks to natural fish populations associated with even the best mining practices (Chapter 5 in the draft assessment), including accidents and spills that have been observed at other (but certainly not all other) mines (Chapter 6 of the draft assessment). Those risks are addressed in Chapters 7 through 13 of the revised and final assessments.

12.7 *Original Draft Location*: Report Number ES.23, *Report Section Identification*: Executive Summary Fish-Mediated Risk to Wildlife, *Excerpt:* [blank]

Original Comment from State of Alaska: Aside from fish mediated risks to wildlife, it might also be pertinent to discuss other issues impacting wildlife including elimination or change in habitat due to avoidance or attractive nuisances of the mine.

Recommended Change: Discuss elimination or change in wildlife habitat due to avoidance or attractive nuisances of the mine.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No direct effects to wildlife from mine footprints were analyzed in the report; rather, direct effects of mining were considered beyond the scope of the assessment (page 12-5). This renders the analysis of wildlife impacts incomplete.

<u>EPA Response:</u> We acknowledge that the assessment is not a complete evaluation of all direct and indirect effects of large-scale mining on wildlife.

12.8 Original Draft Location: Page: 5.75, Report Section Identification: 5.5, Excerpt: [blank]

Original Comment from State of Alaska: Without some quantification of impacts to fish, it is impossible to quantify impacts to salmon-mediated effects on wildlife. It is not clear that impacts on wildlife would be proportional to impacts on salmon caused by the road because much wildlife can move long distances…as stated in the early sections of the Assessment. No analysis is made of roadway corridor effects on wildlife. This is purposeful, keeping impacts related to salmon, but may underestimate actual risks to wildlife. This could be stated in this section of the Assessment.

Recommended Change: Rewrite the Assessment with site specific information, or allow Pebble Limited Partnership to provide detailed permitting documents, then review/estimate likely impacts to fish and wildlife.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The following statement was added to the document "The magnitude of salmon-mediated effects on wildlife, subsistence resources, and indigenous cultures cannot be quantified at this time, and is uncertain." (page 12-16). No expanded analysis was provided. The comment stands.

<u>EPA Response:</u> We have not attempted to quantify salmon-mediated effects on wildlife. The scope of the assessment is focused on potential risks to salmon from large-scale surface mining and resulting salmon-mediated effects to indigenous culture and wildlife, but we do recognize the complexity of potential direct, secondary, and cumulative effects on wildlife in the mining area and transportation corridor.

12.9 The report largely fails to capture, in a balanced perspective, both the positive and negative impacts related to subsistence use and socio-economics as they relate to potential mining activities in the study area. Qualitative analysis of positive comments about potential for employment and increased infrastructure availability is present but very limited. Most of the qualitative discussion concentrates on the perceived negative impacts to subsistence use in terms of livelihoods, diet, and related cultural effects. The analysis presented, however, does not consider the positive benefits that responsible mineral development could deliver to a relatively remote region with little developed infrastructure and services, particularly one which has been suffering from out-migration and high unemployment for some time.

<u>EPA Response:</u> The scope of the assessment is limited to potential risks to salmon from large-scale surface mining and resulting salmon-mediated effects to indigenous culture and wildlife, and does not include an economic cost-benefit analysis of mining, commercial fishing, or subsistence activities. Census data does not support the comment's contention that the Nushagak and Kvichak River watersheds have experienced significant population out-migration (see Section 5.4.1).

12.10 In Chapter 12 – Fish-Mediated Effects, the Assessment incorporates discussions on human health effects as part of a range of impacts on Alaska Native cultures from changes to the salmon resources.

The qualitative assessment lacks a systematic methodology for robustly evaluating health impacts related to a major mine project scenario. The specific scenario for assessing the impacts on Alaska Native cultures is unclear and inconsistent. On one hand, the EPA states in Chapter 12.3 Uncertainties (p. 12-3) that the assessment "represents a conservative estimate of how these endpoints could be affected by mine development and routine operations". But throughout Chapter 12, the EPA discusses that human health and cultural effects would be significant in the context of a major non-routine event scenario, as described by phrases such as "large-scale releases"; "loss of salmon"; "significant reduction in salmon quality or quantity"; and "accidents and failures associated with large-scale mining".

<u>EPA Response:</u> The assessment is not a study of direct impacts on human health related to large-scale mining. It is a qualitative evaluation of the potential impacts on Alaska Native culture due to a loss of salmon resources. The assessment is conservative because it considers only one pathway (fish) by which Alaska Natives may be affected and mentions, but does not evaluate, direct effects of mining on Alaska Natives.

12.11 As the primary basis for identifying health effects, the Assessment references accounts of health issues documented in Appendix D – Traditional Ecological Knowledge and Characterization of the Indigenous Cultures of the Nushagak and Kvichak Watersheds, Alaska and studies/reports on other industrial development in Alaska (i.e., Red Dog Mine, oil and gas activity in the North Slope, and Exxon Valdez oil spill). Although these referenced studies/reports have limited comparability to the type of mine project upon which the

Assessment is based, the Assessment inappropriately asserts with high confidence that "other studies related to resource extraction industries (North Slope, Red Dog Mine) or environmental contamination (Exxon Valdez) in Alaska confirm that there certainly would be changes in human health and Alaska Native cultures" (Chapter 12.3 Uncertainties, p. 12-17). In actuality, the conclusion of a definite change in human health, specifically physical health, is not supported by the referenced studies/reports on the North Slope and Red Dog Mine. In the NRC (2003) study on Cumulative Effects of Oil and Gas in the North Slope, the "increased incidence of cancer and diabetes" was not based on epidemiological evidence, but rather on input by North Slope residents. And quantitative risk assessments on the Red Dog Mine by ADHSS (2001) concluded that heavy metal concentrations in drinking water and in subsistence foods were within acceptable limits and did not pose a health risk.

<u>EPA Response:</u> We revised this statement in the final assessment to clarify that the information in the NRC report was based on reports from North Slope residents. Case studies were included at the request of the peer reviewers after review of the draft assessment and they did not have any comments or concerns about this information in the revised draft.

12.12 Overall, the Assessment is deficient in that it lacks a baseline context (i.e., pre-mine context) as a reference point for determining potential changes in human health at the community level. For instance, published public health data indicate that the Bristol Bay Region currently has high burdens of nutrition related health problems (e.g., obesity and diabetes) and chronic diseases (e.g., heart disease and cancer) (UW's County Health Rankings, 2012; ANTHC, 2008). Furthermore, the Assessment asserts an oversimplified pathway of health effect that does not take into account existing modifiable risk factors (such as alcohol use, smoking, lack of access to fresh vegetables, consumption of sugary beverages, etc.) that influence the physical health of the individual and community. Without accounting for these various factors that contribute collectively to human health, the Assessment is inaccurate in asserting a high certainty for anticipating changes in physical human health effects (e.g., nutrition-related diseases) from the hypothetical mine scenario.

<u>EPA Response:</u> The assessment is not a health study or cumulative risk assessment. It only evaluates risks associated with large scale surface mining through effects on fish. There is sufficient basis (cited in the assessment) for statements on the nutritional value of salmon in relation to processed foods, the centrality of salmon as a subsistence food source in the region, and the risks of increased reliance on processed foods if subsistence salmon resources are compromised.

12.13 Lastly, the Assessment lacks appropriate or representative assumptions that would provide a more balanced view of the potential health and cultural effects. For instance, the Assessment asserts in Chapter 12.2 Effects on Alaska Natives (p. 12-6) that "A shift from part-time to full-time wage employment in mining or mine-associated jobs would affect subsistence-gathering capabilities by reducing the time available to harvest and process subsistence resources". This provides an imbalanced assessment because it does not take into account the positive effects of cash income from employment on a community's overall subsistence-gathering capabilities, as well as, harvest-sharing capabilities; cash income from employment is often used for costly subsistence inputs (i.e., gasoline, boats, snow machines, ammunition, etc.) according to Kerkvliet, JNW (1997). In addition, the Assessment does not consider subsistence leave policies for local employed residents, which is an industry best practice to provide flexible work schedules to accommodate subsistence harvest periods. Overall, the Assessment lacks discussion of potential positive effects associated with industrial development, which were reported by North Slope residents as documented in the NRC 2003 study.

<u>EPA Response:</u> The mention of potential direct effects on Alaska Native cultures and a subsistence way of life were moved to a text box in Chapter 12. The discussion of potential economic impacts from a loss of salmon resources (Section 12.2.3) now includes an acknowledgement that this is a complex issue and that there are positive impacts in communities such as increased economic opportunities for cash income that could be used to purchase equipment and supplies for subsistence.

12.14 *Page:* 12-6, *Section*: Effects on Alaska Natives: 12.2

Excerpt: A shift from part-time to full-time wage employment in mining or mine associated jobs would affect subsistence-gathering capabilities by reducing the time available to harvest and process subsistence resources.

Technical Comment from ERM: While it is reasonably possible, as the Assessment states, that this may reduce the time available to harvest and process subsistence resources, the Assessment fails to also state that it may also increase the time available. For example, those employed or contracted could have more time for subsistence use harvesting as a result of favorable rotational periods; also, more income could also enable harvesters to purchase better equipment (e.g., faster snow machines, bigger boats, better rifles) enable them to be more time efficient.

General Subject Area: Subsistence use.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> See response to Comment 12.13.

12.15 *Page:* 12-6, *Section*: Effects on Alaska Natives: 12.2

Excerpt: Social networks are highly dependent on procuring and sharing salmon and wild food resources, so the current social support system would be significantly degraded.

Technical Comment: The Assessment makes subjective statements in this regard, without presenting sufficient evidence that changes to social networks in the area due to mining will be “significant”.

General Subject Area: Cultural.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> Text in the final assessment was revised to remove the qualifier. There is sufficient basis, presented in the assessment and Appendix D, to conclude that the current social support system is highly dependent on procuring and sharing salmon and other wild food resources. We stand behind the statement that the current social support system would be degraded if there is a loss of salmon resource.

12.16 *Page:* 12-6, *Section*: Effects on Alaska Natives: 12.2

Excerpt: A shift from part-time to full-time wage employment in mining or mine associated jobs would affect subsistence-gathering capabilities by reducing the time available to harvest and process subsistence resources.

Technical Comment: This statement is an inaccurate assumption and does not take into account mitigation measures such as subsistence leave policies for local employed residents, which is an industry best practice to provide flexible work schedules to accommodate subsistence harvest periods. Furthermore, the statement provides an incomplete picture on the potential effects of employment on subsistence activity. Subsistence activity these days has become modernized to require costly inputs (e.g., ammunition, boats, snow machines, etc.). A study of Alaska's North Slope Iñupiat people found that while there can be an inverse relationship between active subsistence harvesting and wage labor time for the individual worker, cash from employment is often used for subsistence inputs (i.e., gasoline, boats, ammunition)(Kerkvliet, JNW, 1997). Thus, employment can positively support a community's overall subsistence-gathering capabilities, as well as harvest-sharing capabilities.

Citations: Kerkvliet JNW. Whaling and wages on Alaska's north slope: a time allocation approach to natural resource use. Economic Development and Cultural Change. 1997. 45:651.

General Subject Area: Subsistence use.

Comment Category: Conclusions are based on unrealistic or non-representative assumptions.

EPA Response: See response to Comment 12.13. The reference provided in the comment has been cited in the final assessment.

12.17 *Page:* 12-11, *Report Section*: Effects on Alaska Natives: 12.2

Technical Comment from ERM: Box 12.1, dead link at www.epa.gov/bristolbay

Comment Category: Link not working.

EPA Response: The link has been repaired in the final assessment.

12.18 *Page:* 12-11, *Report Section*: Effects on Alaska Natives: 12.2

Excerpt: Some residents have expressed a desire for jobs and development related to large-scale mining and a market economy, whereas other residents have expressed concerns that this type of economic shift would be detrimental to their culture (Box 12-1, Appendix D).

Technical Comment from ERM: The only comments provided in Box 12-1 are concerns about culture, but nothing about "desire for jobs and development" as indicated in this excerpt.

General Subject Area: Socio-economic.

Comment Category: Conflicting or Inconsistent Information

<u>EPA Response:</u> Statements from residents supporting large-scale mining development have been added to Box 12-1.

12.19 *Page:* 12-12, *Report Section*: Effects on Alaska Natives: 12.2

Excerpt: However, increases in personal income may not be the best measure of benefits, and should be considered over the long term, as oil and gas resources are exhausted and future opportunities –

Technical Comment from ERM: Comment speaks about "oil and gas resources", but the start of the paragraph and other paragraphs above this refer to large-scale mining development, not O&G development. Should also point out for greater balance that the mine upon which the Assessment is based would likely have decades of operational potential, not just a few years, as may be more typical of the O&G sector.

General Subject Area: Socio-economic.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> In the context of 4,000 years of salmon harvest, the differences between an individual large-scale mining project and regional O&G operations is not significant. The case studies do reference activities that have lasted for decades, however the assessment was further clarified to demonstrate the effects of other resource extraction activities on Alaska Native communities.

12.20 Original Draft Location: Page:5.76, Section:5.5, Excerpt: 1st full paragraph

Original Comment from Environ: The assumption that subsistence users will be displaced is unfounded. Once a road is available, the most likely outcome is that subsistence use will increase.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Acknowledgement of greater accessibility in made in Page 12-8 paragraph 4, but with enough caveats to make it of little significance. The comment stands. Unless the comment is addressed, the analysis does not accurately reflect changes in subsistence use expected with changes in access.

<u>EPA Response:</u> We addressed the original comment in the revised assessment. The cited statement (page 12-8) recognizes the complex and unpredictable effects of the transportation corridor on subsistence use, including negative environmental effects as well as increased access for subsistence users. Neither effect is quantified or compared.

12.21 Some comparisons to other mines in northern and western Alaska have been made. However, the material presented is largely negative. More detailed and balanced information on mines in Alaska such as Red Dog and oil and gas development studies on the North Slope would be useful to more accurately demonstrate and predict how subsistence practices will change with mining development and perceived impacts. In the Assessment, more comparative material on other mining and oil and gas projects has been provided. However, this material is limited in volume (pp. 12-9 and 12-10).

EPA Response: **Case studies were added to the revised assessment based on peer reviewer and public comments on the draft assessment. The comment suggested no additional references for inclusion.**

12.22 Subsistence use in the Assessment focuses predominately on salmon fishing, with many of the other kinds of subsistence use activities not discussed.

EPA Response: **This is correct. As stated throughout the assessment, its scope is focused on salmon and salmon-mediated effects on wildlife and Alaska Natives. Other subsistence use activities are discussed but not evaluated in detail.**

12.23 Because the Assessment lacks sufficient analysis, much of EPA's discussion on the impacts to subsistence users is speculative. For example, in Section 12.2.1 Subsistence Use (p. 12-9) the EPA states that, "It is not possible to predict the magnitude of effects from the loss of salmon as a subsistence food, nor is it possible to predict what level of subsistence resource loss would be necessary to overcome the adaptive capacity of these cultures". Based on this conclusion, it necessarily follows that definitive statements of significance cannot be made regarding the negative impacts. Yet, the term "significance" is often used in the Assessment to indicate definitive assessments have been made, which is misleading.

EPA Response: **The comment provides no specific references to statements which are "misleading," so no changes are possible.**

12.24 *Page:* 12-9, *Section:* 12.2.1 Subsistence Use

Excerpt: On a physical level, the loss of salmon as a highly nutritious wild food, and the substitution of purchased foods, would have a negative effect on individual and public health (Appendix D). Salmon is especially valued around the world for nutrition and disease prevention. Dietary transition away from subsistence foods in rural Alaska carries a high risk of excess consumption of processed simple carbohydrates and saturated fats.

Technical Comment from ERM: The assessment does not take into account the diverse traditional foods (including other non-salmon fish, caribou etc.) in the diet of the subsistence communities that can mediate (to a certain extent) the need to subsistute [subsidize]substitute with purchased foods. Nor does the assessment account for the existing higher rates of consumption of processed market foods observed among rural Alaskans that influence the health of the community. For instance, rural Alaskans have been found to drink three times as much soda per day as their urban counterparts, and two-year olds in northern and southwestern regions of the state are twice as likely to regularly consume sugar-sweetened beverages as two-year-olds statewide (Fenaughty A., 2009; CDC, 2010). High consumption of these beverages is associated with a number of health problems such as obesity, diabetes, and cardiovascular disease.

Citations:

Fenaughty A, Fink K, Peck D, Wells R, Utermohle C, Peterson E. The Burden of Overweight and Obesity in Alaska, Summary Report. December 2009. Anchorage, AK: Section of Chronic Disease Prevention and Health Promotion, Division of Public Health, Alaska Department of Health and Social Services.

CDC Guide to Strategies for Reducing the Consumption of Sugar-Sweetened Beverages. Centers for Disease Control and Prevention. March, 2010. Accessed online at http://inhealthyweight.org/files/StratstoReduce_Sugar_Sweetened_Bevs.pdf

General Subject Area: Subsistence use.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> The practice of harvesting salmon is a traditional and customary practice with benefits that extend beyond the arena of human health. There is sufficient basis (cited in the assessment) for statements on the nutritional value of salmon in relation to processed foods, the centrality of salmon as a subsistence food source in the region, and the risks of increased reliance on processed foods if subsistence salmon resources are compromised. The comment seems to suggest that, based on the current use of non-salmon subsistence resources and the current rate of consumption of processed foods, potential loss of salmon would not have a negative effect on the health and welfare of local residents. However, it provides no basis for this suggestion. The high consumption rate of processed foods amplifies the need for continued access to healthy subsistence foods. No change required.

12.25 *Page:* 12-9, *Section:* 12.2.1 Subsistence Use

Excerpt: A study of the cumulative environmental effects of oil and gas activities on Alaska's North Slope reports that subsistence hunting areas have been reduced, the behavior and migratory patterns of key subsistence species have changed, and that there is increased incidence of cancer and diabetes and disruption of traditional social systems (NRC 2003).

Technical Comment from ERM: The discussion does not accurately represent the findings in the NRC 2003 report, suggesting that there is an actual link between oil and gas activities and the increased incidence of cancer and diabetes. The NRC 2003 study did not base the effect of increased incidence of cancer and diabetes on epidemiological evidence; but rather, on reports by North Slope residents, as indicated in the following excerpt from the NRC 2003 report: "North Slope residents also reported that traditional subsistence hunting areas have been reduced, the behavior and migratory patterns of key subsistence species have changed, and that there is increased incidence of cancer and diabetes and disruption of traditional social systems."

General Subject Area: Alaska Native Culture.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> See response to Comment 12.11.

12.26 The qualitative assessment lacks a clear systematic methodology for robustly evaluating health impacts related to a major mine scenario.

The Assessment's treatment of potential impacts on Alaska Native cultures is deficient in that it lacks a baseline (i.e., pre-mine context) as a reference point for determining potential changes in human health at the community level. For instance, published public health data indicate that the Bristol Bay Region currently has high burdens of nutrition-related health problems (e.g., obesity and diabetes) and chronic diseases (e.g., heart disease and cancer) (UW's County Health Rankings, 2012; ANTHC, 2008). Furthermore, the Assessment uses an oversimplified pathway of health effects that ignores modifiable risk factors (such as alcohol use, smoking, lack of access to fresh vegetables, consumption of sugary beverages, etc.) that influence the health of the Native community. Without accounting for these confounding factors, EPA's assessment is inaccurate in asserting a high certainty for adverse human health effects (e.g., nutrition-related diseases) from the mine project scenario.

<u>EPA Response:</u> The assessment is limited to the potential effects on human health and culture which would result from impacts to salmon and does not include an evaluation of direct or cumulative human health risks. The nutritional value and high consumption rates of salmon in the Bristol Bay region are well-documented. Therefore, there is a high certainty that there would be nutritional losses and subsequent health effects if salmon were impacted by large-scale mining. We have not attempted to quantify these effects in the assessment. The fact that there are other nutrition-related health problems in the region is not relevant to our evaluation and, in fact, amplifies the need for continued access to healthy subsistence foods.

12.27 *Page:* 12-10, *Section:* 12.2.2 Perception of Food Security

Excerpt: Aside from actual exposure to environmental contamination, the perception of exposure to contamination is also linked to known health consequences, including stress and anxiety about the safety of subsistence foods and avoidance of subsistence food sources (CEAA 2010, Joyce 2008, Loring et al. 2010), with potential changes in nutrition-related diseases as a result.

Technical Comment from ERM: The Assessment asserts a pathway of effect that does not take into account existing modifiable risk factors for nutrition-related diseases (such as alcohol use, smoking, lack of access to fresh vegetables, consumption of sugary beverages, etc.) that influence the health of the community. Without accounting for these co-founding factors, the Assessment is inaccurate in asserting a high certainty for anticipating changes in human health, specifically physical health, during the Mine Project scenario. Overall, Chapter 12 lacks a discussion on baseline conditions (i.e., pre-mine context) as a reference point for determining potential changes in human health at the community level. For instance, published public health data indicate that the Bristol Bay Region currently have high burdens of nutrition-related health problems (e.g., obesity and diabetes) and chronic diseases (e.g., heart disease and cancer) (UW's County Health Rankings, 2012; ANTHC, 2008).

Citations:

County Health Rankings, 2012. Profiles for Lake and Peninsula Borough and Dillingham Census Area.

ANTHC, 2008. Regional Health Profile: Bristol Bay Health Corporation. Alaska Native Epidemiology Center, Alaska Native Tribal Health Consortium.

General Subject Area: Alaska Native Culture.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

<u>EPA Response:</u> The assessment excerpt quoted in the comment is a conclusion of a cited reference and is cited correctly. See responses to Comments 12.12 and 12.26.

12.28 To this point, the Executive Summary states that, "This assessment does not consider all impacts associated with future large-scale mining in the Bristol Bay watershed". This is true particularly of the potential positive impacts on socio-economics, as well as to a lesser extent on subsistence use. An example of a positive socio-economic aspect is mentioned on page ES-4 of the Assessment: "However, it is recognized that a large-scale mine development could induce the development of additional support services for mine employees and their families, recreational facilities due to increased access, vacation homes, and transportation infrastructure beyond the main corridor (i.e., airports, docks, and roads)". While this is a valid point, it is not discussed at length in the Assessment. Instead, the Assessment leaves the impression that any economic benefits will be limited. The Assessment also focuses on the generally negative assumed socio-economic impacts on the commercial salmon fisheries, and does not analyze positive impacts of mining employment and contracting to the same degree.

<u>EPA Response:</u> See responses to Comments 12.5 and 12.13.

12.29 The only economic information discussed is for the commercial salmon industry, and to a lesser extent, sport fishing and subsistence fishing. The predicted economic effects of mining are not assessed at all. Direct (mainly positive) impacts of the mine through jobs and opportunities for regional and local development are also not discussed, and are critical to understanding the overall potential impact of mine development and its associated activities on Native Alaskans. These aspects of the development of a project like the hypothetical mine scenario are discussed in the May 2013 study entitled The Economic and Employment Contributions of a Conceptual Pebble Mine to the Alaska and United States Economies (IHS 2003).

<u>EPA Response:</u> See responses to Comments 12.5 and 12.13.

12.30 On page 12-11, citing Goldsmith (2007) it is mentioned that, "Although large-scale mining would inject some market-based economic benefits for a period, it would likely have only modest direct employment benefits in the local region, based on resource extraction experiences in other rural Alaska areas". The comparison made to Red Dog Mine is largely negative, stating that the Northwest Alaska Natives (NANA) Regional Corporation shareholders disproportionately hold the mine's lower-skilled positions, and that employment at the Red Dog Mine may have facilitated community residents to relocate to Anchorage for lifestyle or economic reasons. Although it is mentioned that NANA shareholders accounted for approximately 56% of the mine's 464 full-time employees and 91% of the 78 part-time employees, this is not commented on as a major direct benefit to the region. Even lower-skilled positions in the mining sector are typified by higher than average wages. Increased household income would also be expected to occur in communities throughout the Bristol Bay study area due to increased economic activity in key economic sectors.

<u>EPA Response:</u> We do not disagree that there are economic benefits related to the Red Dog Mine, especially for those who are employed by the mine. We have provided

additional clarification in the assessment that those who would be employed by a mine would have increased resources to purchase equipment and supplies for subsistence activities. The purpose of citing the information from this study and a study from the North Slope is to demonstrate that, even when there is an express agreement with an Alaska Native Corporation, employment benefits would likely not be available to all residents.

12.31 No analysis has been conducted on predicted taxes and revenues to state and local governments as a result of the Pebble Mine. The Project would pay state mining license taxes, Alaska corporate income taxes, state royalties, and local severance taxes. Taxes are discussed only in reference to the Bristol Bay salmon fishery.

EPA Response: See responses to Comments 12.5 and 12.13.

12.32 The Assessment links impacts to salmon populations to wildlife populations, but acknowledges that impacts cannot be quantified on page 12-1 of the Assessment: "Lower salmon production would likely reduce the abundance and production of wildlife in the mine area and presumably in the range areas of the affected species, but the magnitude of those effects cannot be quantified." Nevertheless, the Assessment states that "…on a cultural level, a significant loss of salmon would result in negative stress on a culture that is highly reliant on this resource" (p. 12-13) without defining what "a significant" loss would be. Without comparing baseline salmon and wildlife populations to current subsistence gathering levels, and evaluating how Project related impacts would affect those populations (i.e., evaluating if the impact is significant or not), the Assessments is simply conjecturing about potential impacts to wildlife and Native Alaskan cultures without substantiating them.

EPA Response: The assessment does not attempt to quantify potential effects that salmon losses may have on Alaska Native cultures. The statement that a significant loss of salmon would result in negative stress on the culture is well-supported in the assessment. Without reliable salmon or wildlife abundance data, it is not be possible to compare current salmon and wildlife populations with reported subsistence harvest levels, or to undertake a quantitative analysis of potential effects from large-scale mining.

12.33 With the exception of a few of tables in Appendix E of the Assessment, Bristol Bay Wild Salmon Ecosystem Baseline Levels of Economic Activity and Values (p. 29-30, 1.2 Definition of Study Area), very limited information has been provided on the demographics of the region and its communities. There is no information on changes to human population levels over time, including growth or decline as a consequence of birth and death rates and in- and outmigration rates. It is not possible to assess impacts on socio-economics or subsistence use without understanding the local and regional population dynamics. The Assessment fails to report that statistics show that the Lake & Peninsula Borough has a low and declining population (in 2009, the population was 1,547, down 11 percent from 2000). For a comprehensive assessment of impacts to these components, this type of information is required, as is a discussion on relevant findings such as population decline. There is also no information presented on the historical labor profile of the study area, including trend lines of the past 10 years minimum for employment/ unemployment/ underemployment and earnings.

<u>EPA Response:</u> Information on village population in the Nushagak and Kvichak River watersheds (the focus of the assessment) is included in Appendix D and summarized in Chapter 5 of the assessment. The assessment is not a socioeconomic cost-benefit analysis, so it does not include labor profiles.

12.34 Very little to no information has been provided on local and regional infrastructure and services except in the context of induced development, which is depicted in a mainly negative light. A fulsome analysis in the socioeconomic section would require a discussion of the context of the availability and capacity of existing social and health infrastructure and services, including schools, health clinics/hospitals, emergency services, utilities, and government, among others. Similar to demographics, it is not possible to assess impacts on socio-economics without first characterizing infrastructure and services at a baseline level.

<u>EPA Response:</u> See response to Comment 12.5.

12.35 Several other economic and social benefits could have been more thoroughly discussed. For example, improved and new road and airport access in the area could give some residents better access to services and goods that previously were difficult to obtain, either by short-term winter road or by air.

<u>EPA Response:</u> The final assessment clarifies that there would be individual and community benefits from mining, based on case studies from other Alaska resource extraction activities.

12.36 Impacts on time available for subsistence use by those employed in mining are not well analyzed. More emphasis should have been paid to the trade-offs associated with subsistence use and employment in mining. For example, in Chapter 12: Fish Mediated Effects (p. 12-12) the EPA states that, “Some of the companies did not have subsistence leave policies, so workers conducted subsistence activities during their weeks off or would take personal time. Where the companies did have policies for subsistence leave, an average of 46% of respondents were unsure whether or not the policy worked”. However, experience from diamond and other mines in northern Canada, for example, have shown that time available to harvest and process subsistence resources for those working in mining may be less affected than initially assumed. For example, those employed or contracted could have more time for subsistence use harvesting as a result of favorable rotational periods. Also, more income will enable harvesters to purchase better equipment, enabling them to be more time efficient. Workers with more disposable cash will have the ability to purchase more amenities such as vehicles and recreational vehicles for pursuing traditional cultural activities, such as trapping and hunting. They may make improvements to their housing or the quality of food and clothing. Additional income and time off during the long rest periods could allow some workers from the villages to engage more in traditional activities, including hunting, fishing, and trapping. Without discussion of these tradeoffs, the Assessment fails to capture the full spectrum of positive and negative impacts to subsistence users, and thus fails to accurately characterize impacts to this population.

<u>EPA Response:</u> The comment does not provide references related to the “diamond and other mines in northern Canada,” so that information could not be reviewed or included in the assessment. Also see response to Comment 12.35.

12.37 *Page:* 12-14, *Section:* 12.2.4 Social, Cultural, and Spiritual Impacts

Excerpt: According to NRC (2003), increased alcoholism, drug abuse, and child abuse have resulted from the stresses inherent in integrating traditional and new ways of life. Health effects also are apparent, as the incidence of diabetes has increased with higher consumption of non-subsistence foods (NRC 2003).

Technical Comment \from ERM: Section overall does not provide a balanced view of findings from the NRC 2003 report. The following excerpt from the NRC 2003's Report in Brief indicates that the North Slope residents also recognized the positive health impacts associated with oil and gas activities: "Most North Slope residents have positive views of many of the economic changes that have resulted from revenue generated by petroleum activities, such as access to better medical care, availability of gas heat for houses, improved plumbing, and higher personal incomes."

Citations: NRC, 2003. Report in Brief: Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. Washington, DC: The National Academies Press.

Comment Category: Information is presented out of context or in a misleading way.

<u>EPA Response:</u> See response to Comment 12.35.

12.38 *Excerpt:* The magnitude of effects on Alaska Native cultures resulting from any mining-associated changes in salmon resources is unknown, but other studies related to resource extraction industries (North Slope, Red Dog Mine) or environmental contamination (Exxon Valdez) in Alaska confirm that there certainly would be changes in human health and Alaska Native cultures.

Technical Comment: The assertion of a high certainty for anticipating changes in human health, specifically physical health, is not supported by the studies referenced in this section (North Slope and Red Dog). These studies do not provide epidemiological evidence that supports an association between the resource extraction activity and physical health outcomes (e.g., diabetes, cancer, etc.). But rather, for the Red Dog study, quantitative risk assessment indicated no health risks as mentioned in the statement from this section: "These concerns persist even though studies by the Alaska Department of Health and Social Services found that heavy metal concentrations in drinking water were low and did not pose a risk (USEPA 2009)." In addition, ADHSS (2001) conducted a site-specific human health risk assessment on the Red Dog Mine that estimated the risk from exposure to metals through subsistence food consumption and concluded that the risk was within acceptable limits. Overall, Chapter 12 lacks a discussion on baseline conditions (i.e., pre-mine Project context), including existing modifiable risk factors for diseases, as a reference point for determining potential changes in human health at the community level. Without accounting for these cofounding factors, the assessment is inaccurate in asserting a high certainty for anticipating changes in human health, specifically physical health, during the Mine Project scenario.

Citations: ADHSS. 2001. Public Health Evaluation of Exposure of Kivalina and Noatak Residents to Heavy Metals from Red Dog Mine. October 25, 2001, Environmental Public Health Program Section of Epidemiology, Alaska Division of Public Health.

General Subject Area: Alaska Native Culture.

Comment Category: Insufficient analysis or technical basis from which to draw the conclusions presented.

EPA Response: The assessment does not attempt to quantify potential salmon-mediated impacts from large-scale mining. The final assessment text was revised to further clarify some of the case studies. We were encouraged to use case studies from Alaska resource extraction activities by our peer reviewers, and the inclusion of these studies is helpful in identifying possible effects to Alaska Native culture from large-scale mining.

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12.39 EPA has acknowledged "uncertainties" associated with its assessment of the potential harm to Alaska Natives' subsistence resources. Among other uncertainties, the authors note that the "magnitude of effects on Alaska Native cultures from any mining-associated changes in salmon resources is unknown." Assessment at 12-17. Indeed, EPA's entire discussion of potential fish-mediated effects is speculative. EPA speculates that "[l]ower salmon production would likely reduce the abundance and production of wildlife in the mine area and presumably in the range areas of the affected species," but acknowledges that the "magnitude of those effects cannot be quantified" at this time. Id. at 12-1. The Assessment acknowledges that "[f]actors such as the magnitude, seasonality, duration, and location of the salmon loss would influence the specific wildlife species affected and the magnitude of effects." Id. at 12-2. Because specific population information regarding salmonids is generally not available (see id. at ES-28), EPA could not quantify actual fish-mediated effects in its assessment and the Agency's commentary on Native subsistence is entirely speculative.

EPA Response: As the comment notes, the assessment does not attempt to quantify salmon-mediated effects on Alaska Native cultures. The basis for the qualitative evaluation of potential effects on Alaska Native cultures is clearly cited and not speculative. The comment suggests no additional references or information that would supplement or contradict the conclusions of the assessment.

12.40 Moreover, much of this portion of the Assessment simply assumes that the Pebble Mine would give rise to "lower salmon production." Id. at 12-1. As described above, there is no basis for EPA to assume that there would be any reduction in salmon. Even setting aside the reality that mitigation will be required to offset impacts to salmon habitat, the quantitative information on salmon populations in the watershed and the streams affected by EPA's mine scenarios demonstrate that the mine could not have a material effect on salmon populations. As described above, the sockeye salmon in the area of the mine represent less than one-quarter of one percent of the sockeye harvested annually from Bristol Bay. Plainly, impacts on such a tiny percentage of the population would not materially affect Alaska Natives' supply of the fish.

EPA Response: Although the subsistence fishery is small relative to the commercial fishery, it sustains a way of life for local residents and is integral to the social and spiritual aspects of the Alaska Native cultures in the region. The assessment recognizes the importance of localized subsistence resources: "Because the Alaska Native cultures in this area have significant ties to specific land and water resources that have evolved

over thousands of years, it would not be possible to replace the value of lost subsistence use areas elsewhere, or to relocate residents and their cultures, making compensatory mitigation infeasible." Also see response to Comment 5.36 for a discussion of fish abundance issues.

12.41 EPA suggests that mining activities might directly cause habitat fragmentation. Id. at 12-5. For most terrestrial and avian species that inhabit the vast Bristol Bay ecosystem, it is inconceivable that the mine footprint would constitute a barrier to the maintenance of genetic variability or cause a reduction in habitat connectivity or dispersal characteristics. Again, the authors provide no basis for this conclusion.

<u>EPA Response:</u> Contrary to the comment, the assessment actually does not suggest or evaluate how habitat fragmentation would affect genetic variability, habitat connectivity, or dispersal characteristics, and in fact does not even mention these potential effects. Habitat fragmentation is simply listed as one of several potential direct impacts on wildlife from large-scale mining not evaluated in the assessment.

12.42 The text also notes that "there are no subsistence salmon fisheries documented directly in any of the mine scenario footprints." Id. at 12-8. Thus EPA has no basis to conclude that there will be any direct, negative effect upon Native Alaskans' subsistence. The authors instead simply recount the undocumented assumption that there will be "[n]egative impacts on downstream fisheries from headwater disturbance." Id. at 12-8. These "downstream impacts" apparently entail another undocumented assumption: that there will be a "reduction in downstream seasonal water levels." Id. In fact, as described below, no evidence supports any assumption that there will be a reduction in downstream water levels. And nothing in this portion of the Assessment indicates any reason to assume that water levels in areas used for Alaskan Natives' subsistence would be lower as a consequence of the Pebble Mine.

<u>EPA Response:</u> The complete sentences selectively quoted in the comment state: "Although there are no subsistence salmon fisheries documented directly in any of the mine scenario footprints, *other fish are harvested in these locations, and the areas are identified as being important for the health and abundance of subsistence resources (PLP 2011: Chapter 23)*. Negative impacts on downstream fisheries from headwater disturbance (Section 7.2) *could affect subsistence salmon resources beyond the mine scenario footprint*" [emphasis added]. Both of these statements are correct and properly cited in the assessment, rather than "undocumented assumptions." The likelihood of water flow alteration from large-scale mining at the Pebble site is discussed in Chapter 7.

12.43 The Assessment implies that Pedro Bay, "the village closest to the transportation corridor" would be affected. Id. Yet, the text provides no explanation as to how the presence of the transportation corridor would affect subsistence uses. Rather, the authors apparently retreat to an assertion that "[t]he effects of the transportation corridor on subsistence resources would be complex and unpredictable." Id. In fact, EPA has no grounds to assert that subsistence use at Pedro Bay would be harmed. (Indeed, in the absence of an actual proposal from PLP, EPA is left to speculate as to the location and nature of the transportation corridor itself.)

<u>EPA Response:</u> The assessment actually states, based on the documented high per-capita use of salmon for subsistence, that Pedro Bay is "…particularly vulnerable to

losses of salmon resources." The comment does not provide any evidence to refute this statement. The assessment does not include a statement that "subsistence use at Pedro Bay would be harmed." No change required.

As the comment notes, the assessment is clear that the effects of the transportation corridor on subsistence would be complex and unpredictable, and goes on to explain that there would be effects related to habitat loss as well as to increased accessibility and subsistence use. This acknowledgement was made in the revised assessment in response to a comment from the Alaska Department of Natural Resources, which pointed to both the positive and negative effects on subsistence use from a transportation corridor. The statement is not a "retreat," but is the most accurate evaluation that can be made based on the available information.

Our evaluation applies to the scenarios presented in the assessment, which include a transportation corridor in the location indicated in the preliminary plan put forth by Northern Dynasty Minerals in Ghaffari et al. (2011).

12.44 The Assessment's citation to the effects of the Red Dog mine are not quantified and may well be taken out of context. For example, the document refers to "limited, localized" effects on caribou movement and distribution and the loss of nine caribou. Id. at 12-9. Neither of these references would suggest a material effect upon subsistence hunting. Nor does this text suggest how the experience at the Red Dog mine might be translated to the Pebble Mine's transportation corridor. Absent consideration of mitigation measures and the nature of the corridor, EPA is left to speculate about its impact. Similarly, the authors' reference to Alaska's North Slope does not provide any quantitative data and neglects to suggest how the experience on the North Slope is relevant to potential impacts from a Pebble Mine.

<u>EPA Response:</u> Case studies were added to the revised assessment based on peer review and public comments on the draft assessment. Case study information in the final assessment has been further clarified in response to this comment.

12.45 EPA suggests that based upon the Red Dog Mine experience, development "would directly affect wildlife subsistence resources within and around the mine scenario footprint." Id. at 12-9. Yet, EPA also acknowledges that there are no salmon-based subsistence activities within the Pebble Mine scenario footprint. Id. at 12-8. Nor do the authors suggest that there are hunting subsistence activities of any scale in the area of the mine site footprint. Thus, the Assessment provides no basis to infer that the Red Dog Mine's impact upon resources within that mine site's footprint is even relevant to this inquiry.

<u>EPA Response:</u> The ADF&G data cited in the assessment show the mine footprint to be within subsistence use areas. In addition, earlier in Chapter 12, we cite PLP subsistence use information as follows: "Although there are no subsistence salmon fisheries documented directly in any of the mine scenario footprints, other fish are harvested in these locations, and the areas are identified as being important for the health and abundance of subsistence resources (PLP 2011: Chapter 23)." The comment provides no evidence to refute either the ADF&G data or the data in the PLP EBD, which both indicate that the mine footprint area supports subsistence activities. Also see response to Comment 12.44.

12.46 The authors are reduced to reliance on speculation about subjective "perceptions" that, of course, cannot be quantified. Reports of "subtle changes" of "color, texture, and taste of the flesh" of unspecified species, id. at 12-9 to 12-10, taken from the North Slope provide no basis for any conclusions about a Pebble Mine. The Assessment notes experience from the Red Dog Mine and Alaska's North Slope that, "localized changes in resource movement can affect that resource's availability and predictability to subsistence users, even when the overall pattern or abundance of the resource may not be affected by development activities." Id. at 12-10. This subjective perception is not documented or quantified, nor is there any indication that subsistence users were unable to adapt to these "localized" changes. Indeed, the suggestion that the "overall pattern or abundance" was unchanged may be a strong indication that, even on the North Slope, the impact upon subsistence use is not profound.

EPA Response: We did not attempt to quantify perception issues related to fish and other subsistence resources. Nevertheless, this effect has been documented and does occur. Information on this topic was added to the revised assessment at the suggestion of peer reviewers. No change required.

12.47 Finally, the Assessment relies on "perceptions" of the toxicity of the food supply. Noting that some residents near other development have inaccurate perceptions of the security of their food supply, EPA suggests that this inaccurate perception should weigh against allowing development. This phenomenon suggests instead that these residents should be provided greater access to information that could dispel unfounded fears.

EPA Response: See response to Comment 12.46. The assessment makes no suggestion or statement about the "weight" of this factor. No change required.

The Pebble Limited Partnership (Doc. #5534)

12.48 On behalf of the Pebble Limited Partnership ("PLP"), I submit the attached MS Global Insight report The Economic and Employment Contributions of a Conceptual Pebble Mine to the Alaska and United States Economies, as part of the comment record concerning the April 30, 2013 U.S. Environmental Protection Agency's ("EPA's") report entitled "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska (Second External Review Draft)" ("the Assessment"). The MS Global Insight report was commissioned by the PLP to evaluate the economic impact in the state of Alaska associated with development of the Pebble copper deposit.

EPA Response: Reference noted. The economics of fish resources are considered briefly in the assessment because those resources represent the main assessment endpoint of interest; the economic value and jobs associated with the mine are also mentioned (Chapter 1 of the final assessment). The assessment is not a cost-benefit analysis and does not compare the value of fish versus mineral resources.

12.49 While presenting the economic benefits of the ecological resources in Bristol Bay (pages ES-9), the EPA makes no such valuation of any mining economic benefits. The Assessment states: "These economic data provide background only. The economic effects of mining are not assessed" (page ES-9). However, it does not justify the inclusion of benefit valuation of the ecological resources while excluding the benefit valuation of potential mining operations.

The Assessment does not include a valuation of direct benefits that a copper, gold and molybdenum mine could provide to the local area, such as employment, income, and purchases from and payments to local vendors, and benefits to Native Alaskans. Other assumptions regarding mining operations are made throughout the report, but no economic benefit assumptions are included. The report appears to dismiss this contradiction by stating: "This assessment is not an environmental impact assessment, an economic or social cost-benefit analysis, or an assessment of any one specific mine proposal." This statement runs counter to the fact that the economic benefits of the ecological resources were indeed introduced, with no other potential benefits considered.

As such, the Assessment represents an incomplete assessment of the overall impacts. Some key findings of IHS Global Insight report are summarized below and should be considered as part of the EPA assessment.

EPA Response: See response to Comment 12.48.

12.50 The IHS Global Insight study is based on a conceptual mine plan using an iteration of the ongoing engineering work undertaken by the Pebble Limited Partnership. The study estimated the state and national economic benefits associated with a five-year construction phase, followed by a 25-year production phase, and the potential for three subsequent 20-year development phases.

Some highlights from the economic study indicate the following:

- The potential for nearly 5,000 construction jobs and nearly 3,000 operating jobs in Alaska (combining direct, indirect and induced jobs)
- Pebble workers on-site could earn approximately $109,500 per year on average, with about 75 percent of the workers expected to be Alaska residents.
- The potential for nearly 12,000 jobs in the Lower 48, providing goods and services to the project
- Annual taxes and royalties to Alaska of $136 - $180 million
- Annual taxes to the Lake and Peninsula Borough of $29 - $33 million
- An estimated operating budget of $1 billion per year

This report indicates that Pebble is a substantial state asset, and could be an important economic driver long in to Alaska's future. For perspective, the report indicates Pebble development alone would pay more in annual taxes to the state than the entire fishing industry combined. At the local level, Pebble could provide a dramatic increase in potential revenues to the borough. This sort of project can create an economic transformation in a region that currently faces economic challenges, due largely to a serious lack of year-round jobs. This clearly shows that the Pebble development could be an important economic driver for Alaska's future. We hope that EPA will endeavor to address the omission of economic impacts in the current draft.

EPA Response: See response to Comment 12.48.

<u>Center for Biological Diversity (Doc. #2922)</u>

12.51 EPA's Bristol Bay Assessment failed to analyze impacts to the Iliamna Lake seal, despite stating their interest in analyzing salmon-dependent species and species that would be directly impacted by Pebble Project.

i. The Pebble Project would have major adverse impacts on freshwater and anadromous fish in the Bristol Bay watershed and on Iliamna Lake seals.

Iliamna Lake seals, as well as brown bears, wolves and bald eagles, depend on salmon for a large fraction of their summer diets (Hauser 2007, EPA 2012, 2013). Anadromous salmon are considered a keystone species because the entire freshwater ecosystem depends on the marine-derived nutrients that are released from carcasses of spawned-out salmon (Hauser 2007). The decomposing carcasses of salmon raise the productivity of the entire freshwater ecosystem, providing essential nutrients (Hauser 2007, EPA 2012, 2013). Non-anadromous, freshwater species of fish also depend on this increase in primary productivity from salmon-derived nutrients, and are a key prey item for Iliamna Lake seal year round, and are important to the winter feeding ecology of the Iliamna Lake seals (Hauser et al. 2008). Decreases or losses in quality or quantity of salmonids and freshwater fish in the lake would lead to reduced body condition and possibly precipitous population declines of Iliamna Lake seal. A loss of productive salmon runs would also impact ecosystem dynamics of the wildlife in the area, increasing predation risk for the lake seals by both brown bears and eagles, species that are otherwise highly dependent on salmon runs. Increased mortality would be an especially serious concern because the Iliamna Lake seal is a species already at risk of extinction from climate change, ocean acidification and from stochastic influences, due to low population size (Canadian Science Advisory Secretariat 2008, Hutchings et al. 2012).

<u>EPA Response:</u> Potential direct or secondary impacts to Cook Inlet beluga whales and Iliamna Lake seals were not evaluated in the assessment, but information about these species is included in Appendix F. Chapter 5 of the final assessment includes a reference to the appendix and an update related to the NOAA status review.

12.52 ii. The Pebble Mine would have severe and long-term impacts on habitat quality

Multiple unavoidable and/or highly likely impacts from the Pebble Project threaten the habitat and consequent viability of the Iliamna Lake seal. Sedimentation, changes in water levels in the lake, toxic effluents and mine failure or accidents would cause severe degradation of habitat quality for Iliamna Lake seals and salmon (EPA 2012, 2013). Siltation of the lake from construction and use of the road is inevitable, and road traffic, erosion, and dust production will degrade water quality and reduce primary production of organisms consumed by fish and survival of fish eggs (EPA 2012, 2013). Erosion and siltation would be greatest during road construction. This would result in lower reproductive rates for salmon, reductions in numbers of freshwater fish in the lake, and reduced water quality, impacts that would travel up the food chain to Iliamna Lake seal (Fall et al. 2006, Hauser 2007).

Degradation of water quality, including increased turbidity, would limit salmonid use of clear-water spawning habitat near islands in the eastern part of the lake and near stream outlets. This would in turn limit the availability of fishing habitat for Iliamna Lake seals (Hauser et al. 2008). The seals' haul-out sites year round could also be limited, especially if road construction, changes in drainage and landscape-level impacts result in alteration of preferred winter habitat or haul-out sites. The ice caves that may be utilized by Iliamna Lake seals for shelter and resting during the winter months would be especially vulnerable to alterations from Pebble Project especially if the timing of water level drops shift, so that drops in water level over the winter do not occur, or solid ice formation fails to take place, or there is a variation in timing of ice formation. Loss of this critical winter haul-out habitat would likely threaten the continued viability of the Iliamna Lake seal population.

<u>EPA Response:</u> See response to Comment 12.51.

12.53 iii. Toxic Effects

Seals are sensitive to environmental toxins which cause increased mortality, immunotoxicity, and decreased reproductive success (Harding 2000, Baird 2001). Toxic chemicals leached from the Pebble Project could directly impact the seals' survival through poisoning, and would also adversely impact salmon and fish populations in the lake (EPA 2012, 2013), which would impact nutritional status and survival rates of the seals. In subsistence surveys, the possibility of Pebble Project development has led residents to bring up concerns about contamination of the Kvichak River system fish species, and contamination of the Iliamna Lake seal population (Fall et al. 2006).

Leakage of copper is inevitable at a porphyry copper mine like Pebble (Saunders and Sprague 1967, EPA 2012, 2013). Because copper does not biomagnify, copper-contaminated fish are not considered a significant risk to wildlife consuming them. However, copper pollution could have major impacts on the ability of salmon to successfully spawn by affecting the salmon's sense of smell and navigation (Hansen et al. 1999, Baldwin et al. 2003, EPA 2012, 2013). Salmon that are unable to smell would be vulnerable to predation and also would not be able to find their way back to their natal stream for spawning (Hansen et al. 1999). Additionally, even trace amounts of copper in a creek could cause salmon with intact senses of smell to refuse to travel up river to spawn even if the salmon can find their natal stream (Saunders and Sprague 1967, Hansen et al. 1999). This would reduce spawning salmon numbers in the Iliamna Lake system and could ultimately result in the loss of entire salmon runs. (p. 3-4)

<u>EPA Response:</u> See response to Comment 12.51. Sensory effects of copper are assessed in Chapter 8.

<u>Natural Resources Defense Council (Doc. #5436)</u>

12.54 Interactions between salmon and other wildlife species are "complex and reciprocal," and reduction in wildlife would be expected from the mine scenario footprint and from routine operations under each scenario. The highly productive Pacific salmon runs also directly contribute to the large wildlife populations in the region. Salmon are a "cornerstone" species, with deep importance to the greater ecosystem. They affect ecosystem productivity and regional biodiversity through nutrient transportation. A wide number of animals feed on salmon, including brown bears, bald eagles, other land birds and wolves. These animals would suffer direct effects by a reduction in salmon abundance. The effects of reduced salmonid production on wildlife would be complex, difficult to quantify, and may not be linearly proportional. The loss of salmon – and brown bears as a result – would result in "significant changes in the productivity, diversity and physical structure of their communities far beyond just their 'food chain' interactions."

<u>EPA Response:</u> Comment noted; no change required.

12.55 Alaska Natives and Bristol Bay residents in the watershed also depend – and have for generations – on salmon for their subsistence. Alaska Natives are "particularly vulnerable" to any changes in the quantity or quality of salmon resources, and reduced salmon stocks would seriously threaten their health, way of life, and the survival of their communities. Subsistence-based living is vital to Alaska Native identity, and it plays a central economic, social, and cultural role. Any change in salmon resources would likely have detrimental adverse effects on human health, spiritual well-being, the social support system of food sharing, cultural continuity, and mental health.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Wilderness League (Doc. #5656)</u>

12.56 EPA also found that large-scale mining could have both direct and indirect effects on wildlife and Alaska Native cultures. Salmon are the backbone of the entire Bristol Bay ecosystem. The Bristol Bay watershed provides habitat for numerous species, including 29 fish species, more than 190 bird species and 40 animal species – many of which depend on salmon. Because many species feed on salmon – and because salmon affect ecosystem productivity and regional biodiversity due to nutrient transportation – large-scale mining would result in foreseeable harm to wildlife.

<u>EPA Response:</u> Comment noted; no change required.

12.57 Large-scale mining would also pose serious threats to Alaska Natives. Because Alaska Native cultures are intimately related to the local landscape and the resources it provides, any change to salmon or other subsistence resources would affect indigenous health, welfare, and cultural stability.

<u>EPA Response:</u> Comment noted; no change required.

<u>American Fisheries Society (Doc. #3105)</u>

12.58 There is insufficient attention paid to the cumulative and interactive effects of food web alterations that are likely to result from altered primary and secondary production in response to the additional physical and chemical stressors produced from mining operations (see Naiman et al. 2013. Developing a broader scientific foundation for river restoration: Columbia River food webs. Proceedings of the National Academy of Sciences of the United States of America 109: 21201-21207).

<u>EPA Response:</u> The scope of the assessment is limited to potential risks to salmon from large-scale surface mining and resulting salmon-mediated effects to indigenous culture and wildlife, but we do recognize the potential for complex interactive and cumulative food web alterations in response to large-scale mining.

12.59 EPA also found that large-scale mining could have both direct and indirect effects on wildlife and Alaska Native cultures. Salmon are the backbone of the entire Bristol Bay ecosystem.

The Bristol Bay watershed provides habitat for numerous species, including 29 fish species, more than 190 bird species and 40 animal species – many of which depend on salmon. Because many species feed on salmon – and because salmon affect ecosystem productivity and regional biodiversity due to nutrient transportation – large-scale mining would result in foreseeable harm to wildlife.

EPA Response: Comment noted; no change required.

V. Wilson III (Doc. #5529)

12.60 Consider the ongoing National Marine Fisheries Service study of the potential mining impacts on freshwater seals of Lake Iliamna in the final Watershed Assessment. This study will help guide future EPA actions. These seals are currently under review by the National Oceanic and Atmospheric Administration for potential listing as a protected species under the Endangered Species Act. These marine mammals are an important part of the Bristol Bay ecosystem, as well as for Alaska Native cultures for subsistence purposes. The 404(b) (1) Guidelines of the Clean Water Act prohibit the authorization of discharges where they would jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify its designated critical habitat. These same provisions should be considered for the endangered Cook Inlet beluga whales which could be adversely impacted by Pebble's potential infrastructure and activities in Cook Inlet.

EPA Response: See response to Comment 12.51.

Region 10 Tribal Operations Committee (Doc. #5658)

12.61 The Assessment clearly establishes that the Bristol Bay salmon fishery is a resource that deserves protection and that the Tribal Communities in the area are dependent upon the continued healthy existence of these important resources. Any impact to these salmon will irreversibly impact the Tribal Communities in the area that depend upon healthy runs of fish for subsistence and cultural uses. Tribal Communities in this area depend upon salmon as a significant part of their diet – loss of this resource impacts health and community economies. Lost salmon means increased expenses of buying food that is shipped into the area. Added household expenses could result in migration out of these communities – furthering the loss – loss of salmon and loss of home. To avoid impacts to Tribal Communities, EPA must take action to prevent adverse impacts to the fishery and its habitat.

EPA Response: Comment noted; no change required.

R. L. Farmer (Doc. #6807)

12.62 A road from Tidewater (Williamsport) to Lake Iliamna (Pile Bay) and along the coastal region of Easterly Lake Iliamna to Iliamna Village (…) will be used for transportation of mining equipment, materials, a condensate pipeline, power lines, and various appurtenances for villages en route. This will also provide incentive for entrepreneurs to access Liams & Watdys [illegible] for hunting and fishing, thereby impacting the Alaska Native subsistence lifestyle by competition for finite resources.

EPA Response: Section 12.12.1 includes a statement about the potential increase of access resulting in greater competition for resources.

12.63 Adverse effects to the Alaska Native subsistence lifestyle will primarily affect Pedro Bay, Iliamna, Newhalen, and Nondalton. There will be youth influenced by people to work on the early stages of development of the mine, but unskilled laborers will not be a part of the highly skilled work force used to develop the mine. These skilled workers will be transferred from existing mines worldwide. It is not in the best interest of the above partnership to train unskilled workers to operate their equipment such as loads, trucks, and [illegible] electric shovels of which 3 to 5 or more will be used. Production is a highly skilled workforce.

<u>EPA Response:</u> Comment noted; no change required.

<u>M. Andrew (Doc. #0016)</u>

12.64 Subsistence is our inherited way of life, but today it may be accepted as a preferred choice in our way of life in the region, as Dr. Alan Borass stated in his Presentation of Fish, Family, Freedom and Sacred Water. Today many choose subsistence as part of their preferred way of life knitted and woven together with work. I believe a subsistence way of life cannot operate effectively without some sort of income or economy. Commercial fishing man not sustain today's high cost of living AND subsistence way of life. In a household, one or more members may have to include some type of income to support the commercial fishing income AND subsistence fishing, hunting, and gathering. If we continue this trend in declining economy, we may stand to lose our subsistence way of life, triggering a beginning and chance of losing our culture and identity!

<u>EPA Response:</u> Comment noted; no change required.

12.65 Pebble's EBD study in Subsistence included study in 20 communities compared to EPA's Subsistence study with 7 communities.

Pebble's EBD study includes 448 interviews in 18 communities (EBD, SRB&A) compared to 53 interviews with EPA's Subsistence study (Dr. Alan Borass).

Both Studies included past Subsistence studies with Pebble's EBD utilizing 10 years of Subsistence study by other agencies including ADF&G.

As one Keystone ISP reviewer has stated, "I believe a more intense study in this particular discipline is needed to fully support the regions voice and a more accurate model".

Even several elders have expressed concern over the extent and accuracy of this particular discipline.

<u>EPA Response:</u> Appendix D of the assessment was not a subsistence study. It was a characterization of the importance of salmon for the health and well-being of Alaska Native cultures within the Nushagak and Kvichak River watersheds. This study complements the work that was done for the Pebble EBD study.

12.66 EPA's DBBWA gives some weight on Subsistence and Cultural traditions and it may benefit the region if a more intense and further study is done in this particular subject that defines us. This may be as important as the continuing Fish & Water studies.

As several individuals have defined the real meaning of 'Subsistence' as "Imagine if some comes from behind you and begin choking your throat, that's how we defend it"

These are my observations and recommendations coming from a person who participates in subsistence hunting, fishing, and gathering WHILE attempting to keep some sort of income to support it WHILE defending it!

EPA Response: We agree that additional information on subsistence use and Alaska Native cultural traditions is necessary for a full evaluation of potential impacts from large-scale mining. Any such study should be developed in close consultation and coordination with the affected communities.

Earthworks (Doc. #5556)

12.67 Significant Adverse Effects on Human Health or Welfare

"Salmon as subsistence food and as the basis for Alaska Native cultures are inseparable." This connection between the people, the fish, and the wildlife of the Bristol Bay region and the threat to it posed by the Pebble Mine is not only relevant to a determination under section 404(c), but it implicates the federal government's trust responsibilities and raises significant environmental justice concerns.

EPA Response: Comment noted, but the assessment is a scientific document, not a regulatory document.

12.68 Indigenous people in Bristol Bay continue to rely extensively on the wild salmon as a primary source of food. In the Bristol Bay region, salmon constitute approximately 52% of the subsistence harvest. The subsistence-based way of life is a key element of Alaska Native identity and it serves a wide range of economic, cultural and social functions in Yupik and Dena'ina societies.

Under routine operations with no major accidents or failures, the predicted loss and degradation of salmonid habitat in South and North Fork Koktuli Rivers and Upper Talarik Creek would be expected to have some impact on Alaska Native cultures of the Bristol Bay watershed.

No alternative food sources are economically viable to these communities. Continued access to high-quality subsistence resources is therefore necessary for survival of the Alaska Natives and other local residents.

Under these circumstances, EPA can properly find that the adverse environmental effects of the Pebble Mine will significantly jeopardize human health and welfare.

EPA Response: Comment noted; no change required.

Alaska Community Action on Toxics (Doc. #5541)

12.69 In addition to cultural impacts, EPA rightly underscores the potential impacts on food security, through a salmon-mediated ecosystem, where impacts to salmon could have broad impacts on other wildlife and wild foods, such as berries and plants, that are an essential part of the diet of many in Bristol Bay.

EPA Response: Comment noted; no change required.

Iliamna Village Council (Doc. #5784, #5488, and #5837)

12.70 In addition, the mining infrastructure will change forever the cultural and social environment of the region. Additional development is a possibility, but it is difficult to imagine what would be the economic basis for this development. Fisheries will probably be gone, sporting activities that are attractive to wilderness lovers will be very limited due to mining damages to the landscape. Economic survival in the post-mining environment could be much more difficult than it is at present.

EPA Response: Doc. #5837 rescinded this comment; no change required.

12.71 The Iliamna Village Council is not in favor of closure of lands for exploration and development of surface and subsurface lands of the Bristol Bay Watershed Impact areas. Closure of such Bristol Bay lands will cause hardship to many Native families of the impact area.

EPA Response: No change suggested or required. The assessment is not a regulatory document and does not recommend any restrictions or prohibitions.

Curyung Tribal Council (Doc. #5619)

12.72 I appreciate that the assessment considers the socioeconomic value in our Subsistence Resources. For our family of 5 in Dillingham we hunt, gather, and process subsistence foods with a financial value of almost $60,000 per year as estimated based on prices of similar products in the local stores. Practicing subsistence activities is a financial necessity to augment our living expenses in a place where gasoline costs $6.24 per gallon, heating fuel costs $5.42 per gallon, and milk costs $7.00 per gallon.

We practice these subsistence activities as an extended family just as our ancestors did before us, keeping us connected with our family, friends, and community and we share what we have reaped with others throughout the year. Subsistence activities is the one cultural tie that many of us continue that keeps us connected with our culture and teaches us to respect and appreciate Mother Earth.

EPA Response: Comment noted; no change required.

12.73 Finally, as the list below shows, we are afforded a healthy, nutritious diet without chemicals and additives through the array of available subsistence foods [***table deleted here; see original public comment for table***].

EPA Response: Comment noted; no change required.

Newhalen Tribal Council (Doc. #7427)

12.74 The EPA's preemptive veto will only increase the level of government regulations and create more hurdles for projects intended to develop our natural resources. More restrictions to our lands is more hazardous to the people who have lived there all of their lives, and their families for centuries. More restrictions will consequently change our culture and our ability to use our natural resources.

<u>EPA Response:</u> The assessment is not a regulatory document and does not propose a "veto."

<u>Native Village of South Naknek (Doc. #9133)</u>

12.75 Our point of view has not been heard. We are concerned that our village is dying. South Naknek, at the end of the 20th Century, had over 180 residents, a school, and a library. Our youngest children were able to attend the first sixth grades at home in South Naknek. However, with the advent of the 21st Century, the fishing industry collapsed. Fish processors closed their facilities in South Naknek. The fishing industry itself collapsed under the weight of sharply-increased costs and dramatically reduced catch values. No longer was the Bristol Bay fishery able to sustain our community.

As a result, our population declined. First, families moved to the urban centers in order to find work as the price of fuel escalated, and the choice was either to freeze in the village or to find new employment elsewhere. As families with young children moved out, the Bristol Bay Borough reduced services to our village. Our elementary school was closed and our local teacher lost her job. The few children who remained, as young as five, are now flown each day in small planes across the Naknek River to Naknek to attend school. When weather is bad, the children are either unable to attend school, or are unable to return to their parents' homes in South Naknek at the end of the school day.

<u>EPA Response:</u> The assessment is not a regulatory document and does not restrict or prohibit any type of development. Chapter 5 of the assessment includes a discussion of population in the two watersheds (Nushagak and Kvichak) and acknowledges that some villages have lost population. South Naknek is outside of the study area of the assessment, but we recognize that villages throughout the Bristol Bay region have both lost and gained population over the last census period. We acknowledge that many communities are faced with community sustainability and resiliency concerns.

12.76 Many of our residents first sold permits before moving to Anchorage. They sold their fish permits, their livelihood, in order to provide for the families' welfare in the short term, believing things would get better. Things have gotten worse. The fishery is not expected to get better. Indeed, a recent article in the Anchorage Daily News expressed concern about this summer's fishery, given the glut of cheap farm salmon now on the market.

Accordingly, from a governmental standpoint, the South Naknek Village Council is concerned that opportunities that might lead to new economies in Bristol Bay, including mining and support industries for mining, are not foreclosed. We do not want our village to die. For that reason, we believe new opportunities ought to be encouraged, not discouraged. Frankly, we are concerned that the watershed assessment, which is based upon hypothetical models that do not presently exist, represents just such an inhibition.

<u>EPA Response:</u> We recognize (and mention in the assessment) that some residents in the Bristol Bay region have expressed the desire for jobs and development related to large-scale mining and a market economy. We acknowledge the challenges facing communities throughout Alaska with respect to community sustainability and resiliency, but the focus of this assessment is the risk of proposed mining activities on the salmon and water resources within the Nushagak and Kvichak River watersheds.

The assessment is not a regulatory decision and does not recommend any restrictions or prohibitions.

12.77 We are also concerned about the watershed assessment in terms of the value of our ANCSA lands. As you are aware, our village corporation is Alaska Peninsula Corporation. Alaska Peninsula Corporation has a statutory mission to own, hold, and manage lands received through ANCSA for and on behalf of our village and for other villages within the APC family. We believe that the watershed assessment almost certainly constitutes a threat to the ANCSA value of our village corporation's lands and our village corporation's ability to develop its lands. For, in exploring what is basically at present a fiction, large scale mining, as a threat to the environment, the EPA is signaling that any politically-perceived threat to wild salmon, regardless of the science, must be thoroughly studied before regulators can undertake review of permitting, permitting that is required by law before development can occur. EPA's present undertaking therefore appears to us to have a chilling affect on economic development. In South Naknek's opinion, that chilling affect has a direct impact, negative in nature, on our village's ability to survive.

<u>**EPA Response:**</u> **We recognize the reported uncertainty related to potential future mining in the region. The assessment is not a regulatory decision and does not recommend any restrictions or prohibitions.**

12.78 The Bristol Bay region is among the poorest regions, economically, in the state of Alaska. Energy costs are among the highest in the nation. Unemployment is also among the highest in the nation. The fishery no longer provides. BBNC's political posturing is going to impact the ability of the region to fulfill one of the most significant goals of ANCSA – the sharing of the wealth of the resources with Natives throughout the state. More importantly, in my opinion, is that it could be a death knell to my village.

<u>**EPA Response:**</u> **Comment noted; no change required.**

<u>**Environmental Entrepreneurs (Doc. #4512)**</u>

12.79 The revised Watershed Assessment provides a detailed analysis of the Bristol Bay watershed's natural resources and the annual economic benefits associated with those resources – including the largest sockeye salmon fishery in the world. EPA found that Bristol Bay's wild salmon fishery and other ecological resources provide at least 14,000 full and part-time jobs and is valued at about $480 million annually. With an annual return of 37.5 million sockeye, Bristol Bay represents 46% of the world's sockeye salmon.

An economic report recently released by the University of Alaska Institute of Economic and Social Research (ISER) similarly quantified the extraordinary economic value of the Bristol Bay commercial sockeye fisheries and found that Bristol Bay's economic impact is critical to the regional economy of the Pacific coast states. Specifically, the ISER report concluded that Bristol Bay commercial fishing activities account for $1.5 billion annually, including $500 million in direct income. Additionally, Washington, Oregon and California benefit $674 million in annual economic activity from Bristol Bay salmon fishing and processing. The Bristol Bay fishery also generates about 6,000 jobs in Washington, Oregon and California alone.

Commercial and sport fishing clearly play an integral role in the economy of Pacific coast states. In order to maintain fishing and processing jobs – and the jobs supported by associated businesses like gear manufacturers, shipbuilders, suppliers and other maritime businesses – we must maintain healthy, sustainable fishery resources.

<u>**EPA Response:**</u> **See response to Comment 3.1.**

<u>**American Sportfishing Association (Doc. #1371)**</u>

12.80 According to the EPA's assessment, sustainable fish and wildlife-related activities in the Bristol Bay watershed, including those that are recreational, commercial and subsistence in nature, provide an annual impact of $480 million to Alaska's economy and support 14,000 jobs. Sportfishing alone, through the 29,000 fishing trips taken to the Bristol Bay region each year, generates $60 million annually and is an economic sector wholly dependent on healthy and abundant fishery resources. While mining the Pebble deposit presents substantial short-term economic gains, these gains are neither sustainable nor compatible with the continuance of the current fish and wildlife resource based activities of the region.

<u>**EPA Response:**</u> **Comment noted; no change required.**

<u>**IUCN SSC Salmonid Specialist Group (Doc. #5435)**</u>

12.81 Based on the scenarios outlined in the EIS, a mining operation of this scale and magnitude will very likely result in declines in abundance of salmonids and introduce greater instability in the fishery which could have significant socioeconomic repercussions. In addition, it is important to acknowledge how the proposed mine could threaten the vital ecosystem services that salmon perform throughout the region such as movement of marine nutrients into freshwaters, providing forage for bears, eagles and many other wildlife, and distributing and mixing stream gravel beds.

<u>**EPA Response:**</u> **Comment noted; no change required.**

<u>**T. F. King (Doc. #6636)**</u>

12.82 Although EPA's assessment of impacts on the biological aspects of ecosystems appears to me to be balanced and professional, it is bothersome at best that the cultural aspects of these ecosystems seem to be given short shrift. Although the assessment acknowledges the intimate and intricate relationships between the area's tribes and the salmon and other fauna of Bristol Bay, these relationships tend to be cast in crude economic and quantitative terms, which may mask the cultural, historical, and spiritual value of the watersheds and their plants, animals, minerals, water, air, and other qualities. The potential impacts of mining should be carefully assessed on the full range of the ecosystems' cultural values, as part of understanding their impacts on the ecosystems themselves. This analysis should be done in consultation with the area's tribes and other residents and users.

<u>**EPA Response:**</u> **The assessment attempted to acknowledge the complex cultural, historical, and spiritual connection between the Alaska Native cultures and salmon. Tribal Elders were interviewed and the results are presented in Appendix D. The revised assessment took into account input and comments from tribal governments and local residents. The focus of the assessment is on salmon and impacts to Alaska Native**

cultures through effects on salmon. The assessment does not attempt to evaluate the full range of Alaska Native cultural connections to the landscape and ecosystems. EPA invited 31 federally recognized tribal governments to participate in consultation and coordination throughout the development of the assessment. Additionally, public meetings were held in the area so that local residents could engage in the development of the assessment.

12.83 Mitigation and Adaptation Impacts to the salmon subsistence resource – permanent and in perpetuity – resulting from any of the mine scenarios will in turn represent a loss to traditional Alaska Native communities. "The importance of salmon to Alaska Native cultures is well documented." Because Alaska Natives have "significant ties to specific land and water resources that have evolved over thousands of years, it would not be possible to replace the value of lost subsistence use areas elsewhere, or to relocate residents and their cultures, making compensatory mitigation infeasible." These adverse effects are unacceptable under Section 404(c).

EPA Response: Comment noted; no change required.

Chapter 13: Cumulative Effects of Large-Scale Mining

Natural Resources Defense Council (Doc. #5436 and #5378)

13.1 Specifically, EPA responded to public comment and peer review by supplementing its analysis to include: (…) (6) enhanced analysis of cumulative impacts. Each of these additions contributes to the force of the analysis and lends additional support to the request for 404(c) protection.

EPA Response: Comment noted; no change required.

13.2 EPA "[e]xplicitly recognize[d]," as requested by the peer review panel, "that the transportation corridor and all associated ancillary development – including future resource developments made possible by the initial mining project – will necessarily and inevitably have impacts" which will "expand geographically through time with further 'development.'" [PEER REVIEW, supra note 44, at 8] Defined as cumulative and induced effects, EPA carefully details the expansive impacts foreseeably associated with the development of an initial mine, providing a chilling image of a mine-bearing Bristol Bay watershed—an industrial dystopia that 404(c) was enacted to prevent.

The threshold for consideration of cumulative and induced impacts is "reasonable foreseeability." Cumulative impacts are defined as "the impact on the environment [that] results from the incremental impact of the action when added to other past, present, and *reasonably foreseeable* future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions." [40 C.F.R. § 1508.7 (2012) (emphasis added)] Induced effects contribute to the cumulative effects of an action, and are those "caused by the action and are later in time or farther removed in distance, but are still *reasonably foreseeable*." [43 C.F.R. § 1508.8(b) (2012) (emphasis added)]

Cumulative and induced impacts are acute in the mining industry, and this is especially so in areas that are, like the Bristol Bay watershed, previously undeveloped and difficult to access. Once “the infrastructure for one mine is built, it [is] likely to facilitate the development of additional mines.” Currently, the mineralized areas of Bristol Bay lack infrastructure, such as roads, utilities, and airports. This economic barrier to access and development would diminish upon construction of a first mine, making it reasonably foreseeable, if not inevitable, that the development of one will lead to the development of others.

EPA Response: Comment noted; no change required.

13.3 EPA provides a rigorous analysis of the effects of additional mine development at several sites in the Nushagak River watershed, including the Pebble South/PEB, Big Chunk South, Big Chunk North, Groundhog, AUDN/Iliamna, and Humble claims. These were adeptly chosen as reasonably foreseeable mine sites, because they each contain copper deposits and have already generated exploratory interest. If the six mine sites were developed, the cumulative area covered by their footprints could be 8,600 to 13,000 acres. Stream habitats lost to eliminated or blocked streams could extend 25 to 40 miles, and cumulative wetland losses could make up 1,800 to 6,100 acres. These are conservative estimates that do not include the hydrologic drawdown zones around each mine pit as was done for the Pebble scenarios. As a comparison, inclusion of the drawdown area in even the smallest Pebble 0.25 scenario increased the area of stream and wetlands losses by 84%.

EPA Response: Comment noted; no change required.

13.4 Furthermore, not only are impacts from the day-to-day operations of multiple mines cumulative, but also the cumulative probability of failures – now and in the future – increases as the number of facilities increases. For example, “historical data suggest a 100% cumulative probability of failure in one of the four pipelines over the life of the Pebble 2.0 scenario.” The existence of multiple mines also increases the chance that a single severe event could result in “common mode failures” (multiple failures with a common cause), such as earthquakes. The passage of time further enhances cumulative impacts, as post-closure site management considerations apply to each additional mine – each with its own ownership structure. Mines exist in perpetuity; human institutions do not.

EPA Response: Comment noted; no change required.

13.5 EPA next reviews projected impacts from operational failures. The agency documents the “catastrophically damaging” impacts of a tailings dam failure to both fish and waters. Either standing alone or coupled with anticipated cumulative impacts, these devastating impacts unquestionably support a conclusion that 404(c) action is needed to prevent the foreseeable harm attendant to large-scale mining in the Bristol Bay watershed.

EPA Response: Comment noted; no change required.

13.6 Presumably without intending to draw attention to the considerable additional non-mining impacts that a first mine would make possible, PLP called on EPA to focus less “narrowly on the Pebble deposit and future mining operations,” because doing so “ignores other stressors, impacts, and activities of concern” and fails EPA’s “‘commitment to addressing water quality problems in a comprehensive, holistic fashion.’” The agency delivered.

Cumulative impacts from induced development, or development resulting from the introduction of industry, roads, and infrastructure associated with mining, is a significant risk to Bristol Bay because it is "an iterative phenomenon." Each impact of development is itself an additional stressor. For example, increased employment opportunities lead to nearby community growth, which boosts housing demand, community infrastructure, and amenities. Enhanced accessibility from road and port construction reduces the cost of shipping fuel and freight to nearby areas; reduced shipping costs, in turn, make construction, business operation, recreation, tourism, and cost of living more affordable, again facilitating increased growth.

Each of the effects described in this section are reasonably foreseeable, would compound the impacts of mining well beyond their individual direct effect, and cumulatively are "unacceptable" under Section 404(c) of the Clean Water Act.

EPA Response: Comment noted; no change required.

13.7 Cumulative and induced impacts are acute in the mining industry (…) Anadromous fish are particularly susceptible to regional scale effects, because they migrate among freshwater habitats seasonally or between life stages. Suitable habitat in spawning areas, rearing areas, and along migration corridors is required for population stability. Loss or degradation of habitat in one location can therefore diminish the ability of other locations to support these species, and adverse impacts can accrue even when fish are absent from a particular area. Large-scale, human-caused modification of the landscape has contributed to the extinction risk for many native salmon populations in the Pacific Northwest. It must not be permitted to do so in Bristol Bay.

EPA Response: Comment noted; no change required.

13.8 Demonstration of Substantial Negative Impacts

In its comments, NDM argues that although the 2013 Assessment predicted harmful impacts from mine development, there was 'no direct cause and effect linkage between mine development and impacts on Bristol Bay fisheries" and that "not a single negative impact on any fishery is demonstrated…" Based on our review of the 2013 Assessment and our collective expertise in aquatic ecology and fisheries biology, this statement is not credible. It is not supported by the analytical methods or the results reported in the 2013 Assessment and, frankly, flies in the face of decades of scientific research and on-the-ground experience with the effects of mining activities on aquatic ecosystems, fisheries in general and salmon in particular

EPA Response: Comment noted; no change required.

13.9 Additional mines would also impact the region's wildlife, and its Alaska Native communities. Thirteen of the fourteen villages located in the watersheds would experience some impact on traditional subsistence use areas. More broadly, mine development would have cultural impacts on these communities, which until now have relied on fish and wildlife for subsistence.

EPA Response: Comment noted; no change required.

The Wilderness Society (Doc. #5486)

13.10 The characterization of potential cumulative effects not just of multiple large-scale mines but of the interaction with climate change is largely missing. Work done on Bristol Bay by Wobus et al. (in review) and Prucha et al. (2012) shows how warmer temperatures will completely disrupt the winter and summer hydrologic systems in southwestern Alaska. We should not consider the uncertainty in the magnitude and timing of future climate change impacts on watersheds as potentially negligible; there is enough solid science to show that as our climate moves outside of the historic range of variability for temperature and precipitation, we will experience events that we cannot imagine, nor contain.

EPA Response: The assessment briefly discusses potential interactions between mine development and operation and climate change (e.g., Section 3.8, Box 14-2), but full evaluation of potential climate change impacts is outside the scope of the assessment. We have added the following sentence to Section 13.5 of the assessment: "As the genetic and life history diversity within and among the Bristol Bay salmon populations will likely be crucial for maintaining the resiliency of salmon stocks under a future environment characterized by climate change and increased anthropogenic stressors (Section 3.8.2), the potential effects of additional mines on genetic diversity and the portfolio effect could exacerbate impacts of climate change on Nushagak-Kvichak salmon stocks."

Earthworks (Doc. #5556)

13.11 When the agency evaluates the potential effects of a particular project, it must also consider the collective consequences of those impacts, in combination with other past or future discharges. The section 404(b) (1) guidelines require that factual findings "predicted to the extent reasonable and practical" be made regarding cumulative effects on the surrounding landscape, "attributable to the collective effect of a number of individual discharges of dredged or fill material." These findings should then be considered in the agency's determination of whether a particular discharge would result in unacceptable adverse effects on the environment.

Other projects – proposed or authorized – that might contribute to additional adverse environmental effects in the vicinity of where the particular discharge would occur, as well as past or present projects that may have affected the current baseline conditions of the region, form part of this analysis.

The cumulative effects of the discharges directly associated with the proposed Pebble Mine – and the additional development that will necessarily accompany large-scale metallic sulfide mining in the region – are significant and adverse.

EPA Response: Comment noted; no change required.

13.12 The watershed assessment analyzes the potential impacts associated with an additional six mines. It found that routine operations would result in [Table 13-8 in Assessment]:

- 35 to 53 km^2 of ground disturbance, depending on whether or not tailings ponds are built at each of the mines.

- The direct loss of an additional 41-64 km of streams by the mine footprints.
- Direct loss or degradation of downstream habitat due to water withdrawal, mine pit dewatering, etc.

<u>EPA Response:</u> Comment noted; no change required.

13.13 Elimination of substantial habitat across the watersheds would contribute to diminishing the biological complexity of salmon stocks. In addition to the effects associated with the sheer quantity of lost or degraded habitat, the impacts of large-scale mining could cumulatively threaten biological complexity of the Nushagak-Kvichak salmonid stock complex. Impacts on genetically distinct populations of salmon across the watersheds can reduce biological complexity and lead to salmon population declines. For anadramous fish the potentially affected waters would include at least 10 different rivers and 20 feeder stream systems. Given the extent of stream loss and habitat degradation, it is reasonable to assume that loss of genetic and life-history diversity would occur as part of the development of multiple large-scale mines.

<u>EPA Response:</u> Comment noted; no change required.

13.14 Moreover, as EPA has recognized, "once the infrastructure for one mine is built, it would likely facilitate the development of additional mines." With additional structures and mining projects also comes a heightened likelihood and frequency of failures – from small to catastrophic. Further, though EPA elected to exclude from its Assessment the effects of secondary development associated with multiple mines, the agency recognized – and should emphasize in a 404(c) deliberation – that their cumulative impacts would contribute to adverse effects on fish, wildlife, and Alaska Native culture.

<u>EPA Response:</u> Comment noted; no change required.

<u>Center for Science in Public Participation (Doc. #5540)</u>

13.15 The new cumulative effects Chapter (13) provides the public a more realistic picture of probable fisheries trade-offs relative to mining, specifically, development of a much larger mining district facilitated by Pebble infrastructure. Such development could potentially eliminate, block or dewater more than 200 km of streams (Pebble 6.5 scenario + development of 6 smaller claims) and eliminate up to 44 km^2 of wetlands (Pebble 6.5 scenario + 6 smaller claims). Water withdrawals would impact 54 km^2 in the 6.5 Pebble; similar impacts are unclear for the cumulative impact section.

<u>EPA Response:</u> Comment noted; no change required.

<u>S. L. O'Neal (Doc. #5528)</u>

13.16 p. 13-6: "In the Pacific Northwest, habitat degradation and loss related to human land use have obviously been a major factor in salmon declines by reducing population productivity, adult densities, and early life-stage production over large geographic areas (Ruckleshaus et al. 2002)." This also relates to the erosion of the Portfolio Effect further driving stocks toward extinction. The success (or rather failure) of costly attempts to restore Pacific salmon populations warrants discussion here [United States General Accounting Office. 2002.

Columbia River Basin salmon and steelhead: Federal agencies' recovery responsibilities, expenditures and actions. Report to the Ranking Minority Member, Subcommittee on Fisheries, Wildlife, and Water, Committee on Environment and Public Works, U.S. Senate.].

EPA Response: Comment noted. Restoration is not the focus of the assessment. Rather, the assessment is intended to identify potential impacts of large-scale mining on salmon resources.

13.17 p. 13-24: "Surveys of fish use in the Chulitna River drainage have been rather limited to date." A handful of surveys have been conducted by ADFG (see general comment No. 8) and The Nature Conservancy.

EPA Response: Data in the final assessment are current to 2012.

13.18 Table 13-5: See general comment No. 8 [If available, update figures, tables, and text referring to anadromous fish distribution with the 2013 ADFG Anadromous Waters Catalog. Several additions of anadromous distribution where made along the road corridor and in the Chulitna River.]. Dolly Varden also occur in the Chulitna River drainage.

EPA Response: See response to Comment 13.17.

13.19 p. 13-35 "Development in the Pacific Northwest has followed this pattern for over 100 years and has led to the near complete loss of wild salmon. Even in the coastal population centers of Alaska, hatcheries are supplementing the salmon returns." Restoration efforts have been costly and ineffective, and hatcheries pose significant risks to wild populations.

EPA Response: Comment noted. In response to other comments that development in the Pacific Northwest is not analogous to mining in Bristol Bay, the quoted sentences have been deleted.

United Tribes of Bristol Bay (Doc. #5275)

13.20 Chapter 13 discusses the cumulative impacts multiple mines would have in the region. [The United Tribes of Bristol Bay] UTBB would like to specifically thank EPA for this important chapter. This chapter confirms what many UTBB members already suspected – the Pebble deposit is so large, and will require so much infrastructure, that its development could serve as the impetus for a region wide mining district. There are at least fifteen other large mining claims surrounding the Pebble deposit. Many of these mines are too small to operate independently or provide the necessary infrastructure to profitably operate. However, these smaller mines would be able to utilize many of the amenities that a fully developed Pebble project would bring.

EPA Response: Comment noted; no change required.

13.21 The possibility of a full scale mining district in the region would bring large power generation facilities extensive road systems, and industrial facilities – features not yet seen in Bristol Bay. With these "improvements" there will be, among other things, an increase in traffic, noise, and competition for hunting and fishing access between neighboring communities. The cumulative effect of region wide mining will exacerbate those impacts from the Pebble deposit already being felt by the villages in the Nushagak and Kvichak watersheds.

<u>EPA Response:</u> Comment noted; no change required.

13.22 Region-wide mineral development would further decrease traditional hunting and fishing areas while also reducing the amount of fish and game located within those areas. No matter how many amenities mining brings to the region, the loss of subsistence fish and game species from cumulative mining-related stressors will be devastating to the Yup'ik and Dena'ina subsistence cultures.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

13.23 The revised Assessment compounds and overstates the risks from additional mining projects in the area. The original Assessment listed four potential mining projects in the Bristol Bay drainages and the revised Assessment lists six: Pebble South/PEB, Big Chunk South, Big Chunk North, Groundhog, AUDN/Iliamna and Humble. However, none of these projects have progressed beyond preliminary exploration and experience indicates that few exploration projects progress to development. Yet, the revised Assessment has estimated individual impacts from the development from these six prospects, totaled those impacts, and presented that total as a reasonably foreseeable event. This approach is statistically indefensible and does not constitute a reasonable consideration or analysis of potential cumulative effects.

<u>EPA Response:</u> The Bristol Bay Area Plan for State Lands, published in 2005 by the Alaska Department of Natural Resources, provides information on reasonably foreseeable mining in the Nushagak and Kvichak River watersheds and designates a number of areas for mineral development. The mining prospects we considered in Chapter 13 of the assessment are known mineral deposits with potentially significant resources and active exploration in 2011 and 2012. Although we cannot predict which, if any, mining prospects will be developed, it is prudent to evaluate the potential for development of more mines once the first one brings in needed infrastructure, particularly given interest by the state and private companies to develop mineral resources in the watersheds.

13.24 Any qualified or quantified risk associated with developing any other deposit outside of the Pebble project area should be removed from future drafts of the document. These projects at present consist of mineral claims with minimal exploration activity. Unlike the Pebble deposit, there are no site-specific environmental baseline data on these projects. Any future drafts of this Assessment should make no assumptions about or characterize risks from these mining claims. Limited information on these projects is available and any long-term risk from any of them would be addressed in future NEPA and permitting review.

<u>EPA Response:</u> Prudent resource development with a goal of preserving ecosystem integrity, functions and services must evaluate reasonably foreseeable development.

G. Y. Parker (Doc. #5615)

13.25 Moreover, developing the infrastructure for the Pebble deposit would probably lead to developing several additional mines at other metallic sulfide deposits in the area, and related development. This would have a multiplier effect on unavoidable and likely impacts.

EPA Response: Comment noted; no change required.

Bristol Bay Native Corporation (Doc. #5438)

13.26 Additionally, the inclusion of the 0.25 billion tons of ore scenario allows EPA to quantify the cumulative effects from development of multiple similar-sized deposits surrounding Pebble and to quantify the impacts associated with "different stages in the potential process of mining the Pebble deposit," as discussed further below. It is, nevertheless, important to note EPA's acknowledgement that estimated impacts of aquatic habitat loss "would differ across different deposits, based on the size and location of mine operations within the watersheds."

EPA Response: Comment noted; no change required.

13.27 In earlier comments on the Draft Assessment, BBNC noted that EPA's cumulative analysis underestimated cumulative habitat losses by excluding certain areas from the mine footprint and by underestimating stream reaches and wetlands delineations. In addition, BBNC noted that the Draft Assessment underestimated cumulative impacts by assuming joint use of facilities by multiple mining operations. BBNC thus notes that the Revised Assessment remains conservative with regard to these two points as well. *See* Revised Assessment, at 13-9 (showing that EPA's methods for estimating cumulative impacts from other mines utilizes wetlands and stream data underestimates aquatic impacts, and that EPA further assumes that four additional mining facilities included in its cumulative impacts analysis would utilize the mill, tailings storage facility, and other facilities developed at Pebble Mine).

EPA Response: Box 6-1 provides a discussion of the cumulative footprint of large-scale mining. It is true that for the cumulative effects analysis we limited the mine footprint to the essential elements (mine pit, waste rock and tailings facility), because it is impossible to foresee all the facilities that will be included at a mine site and we wanted our discussion to be reasonable and conservative. However, contrary to this comment, we did estimate the footprints of each of the mines except Pebble South without assuming they would share facilities with Pebble. As discussed in Box 13-1, we estimated an upper bound and a lower bound footprint. The upper bound represents stand alone mines with no shared facilities.

13.28 Moreover, the Revised Assessment's treatment of ancillary development is similarly improved, and remains conservative. EPA properly expands its analysis of the potential transportation corridor to include an analysis of diesel pipeline spills, product concentrate spills, truck accidents involving process chemicals, and culvert failures. Indeed, in response to peer reviewer requests, the Revised Assessment contains an extensive discussion of culverts in Chapters 6 and 10 and an entire Appendix devoted to road and pipeline development on water quality and freshwater resources. At the same time, the Revised Assessment remains conservative because it does not include a more detailed accounting of other types of inevitable ancillary development. In fact, EPA openly acknowledges that it "does not consider all impacts associated with future large-scale mining in the Bristol Bay watershed." Specifically, EPA points out that the Revised Assessment confines its scope of analysis to exclude impacts associated with the following mining-related infrastructure and ancillary development: construction and operation of a deepwater port in Cook Inlet; "one or more large-capacity, electricity-generating power plants that would be required to power the mine and port;" induced development (such as support services for mine employees and families); increased access to recreational resources; and an increased transportation infrastructure throughout the Bristol Bay region. EPA also admits that it has used "conservative estimates of lost habitats, because we did not estimate the hydrologic drawdown zones around each pit mine."

<u>EPA Response:</u> Comment noted; no change required.

13.29 *BBNC's 2012 Comments and Technical Submissions*: BBNC Recommendation: "EPA should add a greater explanation of the key terms 'quality,' 'diversity,' and 'portfolio effect,' as they are used with respect to fish." (BBNC Part I Comments, at 3)

Revised Bristol Bay Watershed Assessment: EPA re-organized the chapters and appendixes in a manner that makes the Revised Assessment even more understandable and accessible than the previous draft.

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC welcomes these revisions and EPA's acknowledgment that the losses of streams and wetlands would affect genetically unique populations of salmon, undermining the stability of the overall Bristol Bay fishery that depends on the genetic diversity of individual populations.

<u>EPA Response:</u> Comment noted; no change required.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

13.30 As part of the Assessment, EPA identified 15 potential mineral deposits in the Bristol Bay Watershed. No mine plan has been put forth in relation to any of these deposits, so it is unrealistic to determine if cumulative effects of mining could be an unacceptable risk. Furthermore, it is important to note that the permitting of a single mine, such as the one described in the Assessment, would not guarantee that additional mines would also be permitted; any such additional mines would be subject to their own individual approvals processes.

<u>EPA Response:</u> Chapter 13 of the assessment considers potential impacts of multiple mines on salmon resources and resulting effects on wildlife and Alaska Native cultures; it makes no assumptions about the permitting of those mines. Also see response to Comment 13.31.

13.31 Long-term, holistic approaches are essential if piecemeal decisions, which neglect cumulative impacts, are to be avoided. Consultative processes are important in order to address the concerns and optimize the outcomes. These are difficult decisions between development options and conservation objectives. Because no mine plan has been put forward and data and information is limited it is unrealistic that any conclusions can be made at this time. After any of these potential mine projects go through the NEPA EIS process then future potential mine projects would follow and have to go through the same rigorous (and always evolving) NEPA EIS process and be evaluated for cumulative impacts.

<u>EPA Response:</u> We agree with the first statement, but the comment goes on to infer that the cumulative impact evaluations assess only projects that are currently in the permitting process and projects that have been permitted. This is the piecemeal decision process that the comment says is to be avoided.

13.32 *Original Draft Location:* Page 7.9, Section 7.4 - 7.4.7, page 7-9 - 7-16

Original Comment: Section 7.1-7.3 (p. 7-9 – 7-16) Section 7.1 - 7.3 discusses the probability that additional mining deposits would be developed in such a way as to make use of the existing Pebble deposit infrastructure (TSF, pipelines, roads, etc.) thus creating an economy of scale of development in the area. The potential for other mine developments to combine resources and share infrastructure is a very real possibility, given the cost of development in rural Alaska. Creating a shared infrastructure network could also have a positive impact on the environment by reducing the foot print of projects in the watershed. Although sharing infrastructure is hinted at in the first sections, in Section 7.4 - 7.4.7, the report ignores their earlier assertion and assumes that each mine development would build their own transportation corridors and TSF, thus increasing the cumulative effects substantially.

Citation: Comment reference:

Hughes, A. (2010) Disturbance and Diversity: An Ecological Chicken and Egg Problem. Nature Education Knowledge 1(8):26

A. Randall Hughes * and John J. Stachowicz PNAS June 15, 2004 vol. 101 no. 24 8998-9002

Ruth Young. Feb 9th, 2010. Biodiversity: what it is and why it's important. Talking Nature.com

Garry Peterson, Craig R. Allen and C. S. Holling. Ecological Resilience, Biodiversity, and Scale. Ecosystems Volume 1, Number 1 (1998), 6-18, DOI: 10.1007/s100219900002

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Infrastructure sharing is mentioned only a few times in Chapter 13 Cumulative Effects, in one case it is part of a shared/unshared scenario, and in another only partial sharing is assumed. The analysis does not make an adequate attempt to consider all possible scenarios in this assessment.

<u>EPA Response:</u> We do evaluate shared facilities in Chapter 13 for both footprints and roads wherever practical. Box 13-1 explains that only shared facilities were evaluated for Pebble South/PEB, whereas both shared and stand-alone facilities were evaluated for Big Chunk South, Big Chunk North and Groundhog. We considered the AUDN/Iliamna and Humble prospects too far from Pebble for facilities to be shared. The potential Pebble transportation corridor was used for other facilities wherever practical, as discussed in the description of each mine in Chapter 13.

13.33 *Excerpt:* The ADF&G management strategy, based on maximum sustainable yield, is considered a success in maintaining sustainable salmon harvests (Hilborn et al. 2003, Hilborn 2006).

Technical Comment: The assessment relies on ADF&G assessments on yield to establish sustainable levels. These data are obtained from observer reports of escapement. It is unclear in the Assessment what defines sustainable harvests. Furthermore, it is not clear what level of industrial fishing is necessary to influence the sustainability of salmon stocks.

Citations: ADF&G data, Hilborn et al. 2003, Hilborn 2006.

<u>EPA Response:</u> The peer reviewed references cited serve to illustrate that harvest hasn't caused salmon stock declines in Bristol Bay, which were at record levels when the references were published.

13.34 On page 13-35 of the Assessment, the concern is raised about the Pacific Northwest and how traditional development patterns in Washington, Oregon, and Idaho have led to the near complete loss of wild salmon. To conclude based on the available information that the hypothetical mine scenarios put forward by EPA, along with the other listed deposits, could have a similar effect on the Bristol Bay fishery is not supportable.

<u>EPA Response:</u> Additional mines in the Nushagak and Kvichak River watersheds would each result in direct impacts, which would accumulate over a much greater area than the single initial mine. This would exacerbate the direct impacts of the mines by increasing the number of distinct salmon populations affected and thereby threatening the genetic variability that leads to the resiliency of Nushagak/Kvichak and Bristol Bay salmon stocks. Cumulative risks to the fisheries are real and must be addressed as mining or other major development activities move forward. However, we agree that development patterns in the Pacific Northwest are not completely analogous with mining in Bristol Bay. We have deleted the statement in Section 13.5.

13.35 The assumption that all mines would be similar is unfounded. The statement and the assumption results in over-estimation of cumulative effects of other mine developments in the area.

<u>EPA Response:</u> The mineral prospects considered in Chapter 13 are all porphyry copper deposits, and mines developed at those sites would share many similarities. For example, it is likely that they would all require a mine pit, tailings storage facilities, and waste rock piles. However, we agree that they will not all be the same size or alike in every way.

It is unclear why the similarity of the potential mines in our analysis would necessarily result in overestimation of effects. Mines larger than those we evaluated would likely have greater impacts. The cumulative effects discussion is not meant to be a definitive, quantitative evaluation. We have presented a plausible example of how a mining district could develop and a simple estimate of potential impacts to aquatic resources and fish. It is intended to shed light on whether cumulative effects of multiple mines are a significant concern.

The Pebble Limited Partnership (Doc. #5752)

13.36 (…) Peer reviewer Dirk van Zyl concluded that the hypothetical mine scenario is "not sufficient for the assessment" because differences from the actual mine plan will change the expected impacts to salmonid fish. Final Peer Review Report at 39. Dr. van Zyl described EPA's discussion of cumulative mining impacts as "speculation":

> The cumulative assessment is very conceptual at best, as there are no specific proposals from any of the other potential resource areas. Cumulative impacts can only be evaluated once further details about other potential mines and their plans are available. At this time, this section can at best be seen as speculation. Id. at 97.

EPA Response: The cumulative effects discussion is not meant to be a definitive, quantitative evaluation. We have presented a plausible example of how a mining district could develop and a simple estimate of the impacts to aquatic resources and fish. It is intended to shed light on whether cumulative effects are a significant concern. We have used existing information on the number of mining claims, the extent of recent exploration activities, local and state land use plans, and the ubiquitous nature of fish habitat in the watersheds to evaluate whether significant concerns exist. Definitive, quantitative risk assessments of future mines must wait for more information on those mines and on the resources they could potentially impact.

World Wildlife Fund, Arctic Field Program (Doc. #5537)

13.37 This current Assessment evaluates the potential for up to six additional mines to be developed in the watershed, with increases of stream and wetland losses by up to 84%. These additional mines could potentially have a total footprint of 13,000 acres, with up to 39 miles of streams eliminated as a result (Table 13-8, page 13-21). Presenting this information about the potential for growth of mining activities is a valuable aspect of the Assessment, as decision-makers must be able to consider the potential cumulative impacts on Bristol Bay's diverse freshwater habitats.

EPA Response: Comment noted; no change required.

13.38 Responding to peer review comments in its second draft, EPA presents the potential impacts of secondary development such as power generation, support infrastructure and other activities (i.e., housing, more human access to hunting and fishing areas, etc.) associated with constructing and operating a mine in this remote location.

EPA Response: Comment noted; no change required.

13.39 We believe that the current draft Assessment is an important step toward a fuller understanding of the cumulative impacts of large-scale mining on fish and other wildlife. These impacts must be considered in conjunction with other cumulative stressors on the bay's fish and wildlife such as climate change and ocean acidification.

EPA Response: Comment noted; no change required.

National Parks Conservation Association (Doc. #5558)

13.40 Cumulative Effects and the Chulitna River watershed

Regarding Chapter 13. Cumulative Effects of Large-Scale Mining, we appreciate the expanded and improved analysis of a possible mining district that could emerge as other deposits beyond the Pebble Mine prospect become more viable to develop once access and infrastructure are available.

<u>EPA Response:</u> Comment noted; no change required.

13.41 We are concerned that state lands adjacent to Lake Clark National Park and Preserve are being promoted for intensive mining development. The Assessment confirms that, if Pebble Mine is built, more mines could follow. Combined with additional transportation networks, tailings storage facilities and other infrastructure, the cumulative effects of a mining district could be "widespread and extensive."

The Chulitna River, north of the Pebble Mine prospect, is the largest freshwater tributary of Lake Clark National Park and Preserve. The Assessment correctly notes on page 13-22 that this watershed is "one of the most important subsistence areas for Nondalton," the closest Alaska Native village. The Chulitna area is often called the "breadbasket" of Nondalton as traditional subsistence activities occur here throughout most of the year. Cultural resources and historic sites are layered throughout the valley. Two commercial lodges are located along the river and it is a popular recreation destination for sport fishing, hunting, and floating.

Yet, the revised Assessment shows that the State of Alaska has allowed mining claims to be staked across 132,000 acres (534 km^2) of the Chulitna River valley. Three mine prospects now exist here: Groundhog, Big Chunk South, and Big Chunk North. According to Figure 13.1, these sites are located approximately 5-33 miles upstream of Lake Clark National Preserve's boundary. Conservatively, the Assessment projects that, within the Chulitna River valley, 9-24 miles of stream loss and 4,000 to 7,700 acres of wetland loss could occur if these prospects are developed.

<u>EPA Response:</u> Comment noted; no change required.

13.42 Very few references to Lake Clark National Park and Preserve are found within the Assessment. On page 13-22, in the description of the Big Chunk South mining prospect, it is accurately noted this 35,000 acre claim block is located 100% within the Chulitna River valley, "which flows into Lake Clark National Park and Preserve and then into the Lake itself." Please include the same national park reference in the descriptions of the Big Chunk North and Groundhog mining prospects.

<u>EPA Response:</u> Similar references were added to Sections 13.2.3.2 and 13.2.4.2.

<u>American Fisheries Society (Doc. #3105)</u>

13.43 Although the draft discusses the likelihood of a mining region, the total area of active mining claims near Iliamna Lake exceeds 2,070 km^2 (see AK DNR. 2013, May 24). Alaska Mapper: Mining claims online: http://dnr.alaska.gov/MapAK/browser?id=3143&set=map&gsid=A8413F2CA249ACC93B170CC64F5F4159.tomcat-90). The discussion of a select few of these "piggy-back" mines does not begin to cover the potential cumulative impacts of licensing the Pebble project.

<u>EPA Response:</u> Comment noted; no change required.

13.44 Although the draft indicates that additional infrastructure would be needed to create the second largest city in the Bristol Bay region, it does not quantify the impact of urban development on the aquatic ecosystems, an effect area likely comparable to that of the mines and thus doubling the actual footprint of the development and further increasing downstream effects and widespread anthropogenic disturbance. (For an example of the effects of urbanization on salmonids, see Wang et al. 2003. Impacts of urban land cover on trout streams in Wisconsin and Minnesota. Transactions of the American Fisheries Society 132: 825–839.)

EPA Response: Comment noted. Box 6-1 does provide a discussion of the cumulative footprint of a single mine. The conceptual model (Figure 13-2) includes impermeable surface, which is a measure of urbanization, and we added further discussion of impermeable surface to Section 13.2.7.2.

13.45 Also, the spatial scale of multiple mining claims throughout the basin increases the likelihood of salmonid population-level impacts and decreases the ability of metapopulations to recover from stochastic events whether they are anthropogenic or natural in origin (see NRC. 2005. Superfund and mining megasites – lessons from the Coeur d'Alene River Basin. National Academies Press, Washington, D.C.)

EPA Response: Comment noted; no change required.

Northern Dynasty Minerals Ltd. (Doc. #3650)

13.46 *2012 Geosyntec Comment:* The report calls into question the ability of the Red Dog Mine operator to meet the obligations of its approved permit for perpetual operation. The ability to operate a water management system for 200 years can only be proven with absolute certainty following 200 years of demonstrated operation. By placing doubt on the ability to operate perpetually, the BBWA creates an unrealistic standard that is impossible to meet.

How 2013 Assessment Responds to Comment: 13-31 "In light of the relatively ephemeral nature of human institutions over these timeframes, we would expect that monitoring, maintenance, and treatment would eventually cease, leading to increased release of contaminated waters downstream."

Discussion on Adequacy of 2013 Response: Geosyntec's 2012 comments remain unchanged. By adding new text in additional locations in the 2013 Assessment that cast doubt on the ability to operate in perpetuity, the Assessment continues to create an unrealistic standard that is impossible to meet. The bias of the report remains clear.

EPA Response: There is uncertainty that a water management system can be operated for 200 years. There is even more uncertainty around perpetual treatment. It is this uncertainty that leads to risks that must be evaluated and addressed in an objective risk assessment. It is not biased to point out that the major features of a mine (pit, waste rock, and tailings) would persist in perpetuity. The record of mining environmental failures and permit violations demonstrates that operation in perpetuity is doubtful, if not "impossible to meet."

<u>Center for Biological Diversity (Doc. #2922)</u>

13.47 During Pebble Project construction, the population of just 1,500 people in the [Iliamna] Lake and Peninsula Borough would more than double. Northern Dynasty Minerals (2011) states that construction of the Pebble mine would take 4 years, with a peak labor force of 2,080 (Northern Dynasty Minerals Ltd 2011). Total workforce for mine operations is projected at 1,120 over the initial 25-year life of the mine. This influx of workers will result in direct disturbance of the seals through human presence and also through the construction, transportation, and other activities associated with the Pebble Project.

<u>EPA Response:</u> Comment noted; no change required.

<u>Wild Salmon Center (Doc. #5782)</u>

13.48 Beyond the Pebble Mine footprint, even more troubling and potentially devastating to the region are the cumulative effects that will result from the creation of a mining district. The lack of infrastructure in the Bristol Bay region has deterred smaller mining ventures from developing additional metallic sulfide deposits.

The Pebble Mine, if approved, would provide the deep water port, access road, power supply and additional necessary infrastructure and access to the region that would make these smaller claims economically viable.

<u>EPA Response:</u> Comment noted; no change required.

13.49 Human land use activities have caused widespread habitat modifications in the Pacific Northwest over the last 150 years. Each incremental project, while perhaps small in nature, and evaluated and approved in isolation, added to the overall destruction and modification of whole salmon ecosystems.

The Pacific Northwest offers a historical record of how habitat disturbance and destruction can put wild salmon populations in peril. EPA notes that, "[i]n the Pacific Northwest, habitat degradation and loss related to human land use have obviously been a major factor in salmon declines by reducing population productivity, adult densities, and early-life-stage production over large geographic areas." *Id.* at 13-6. We have learned so much about salmon and how sensitive salmon are to changes to habitat and water quality over the last 150 years. We implore EPA to not repeat history in Bristol Bay.

<u>EPA Response:</u> Comment noted; no change required.

<u>North Coast Rivers Alliance (Doc. #5061)</u>

13.50 Although the Assessment as written already provides an ample basis for disapproving the Pebble Mine, we encourage EPA to expand the breadth and depth of its analysis. (…) Second, the Assessment does not consider the additional development that would accompany mining projects.

<u>EPA Response:</u> Section 13.3 of the revised assessment does include a qualitative discussion of the potential impacts from induced development, or additional development that would accompany mining projects.

<u>IUCN SSC Salmonid Specialist Group (Doc. #5435)</u>

13.51 We would like to highlight one potential threat to salmonids that does not seem to be addressed in the EIS. In any development that involves infrastructure and road building, formerly remote sites become easily accessible. Chapter 13 of the revised EIS addresses many cumulative impacts, including flow alteration, elimination of habitat, and water quality degradation, but the increased fish mortality from humans that is likely to happen with improved access to these rivers is not addressed. This may be a significant factor. For example, Walters (1986) estimated for a proposed James Bay Hydro development in Canada that fishing by construction workers and people using the new access roads would have at least 10 times the impact on fish (particularly lake trout Salvelinus namaycush) than any direct effects of the dams and diversions. We found a brief reference to increased hunting and fishing pressure in the 13.5 Summary, but we recommend that it be elevated into one of the major cumulative impacts in 13.2.7, and perhaps highlighted elsewhere in the EIS (e.g., Chapter 10, including exposure and exposure response evaluations).

<u>EPA Response:</u> Section 13.3 provides a brief qualitative description of the impacts from induced development, including improved access. The assessment states: "Transportation corridors associated with large-scale mines likely would increase vehicle access throughout the two watersheds, thereby increasing unregulated access, both lawful and unlawful, to currently remote sites. Access to all-terrain-vehicles (ATVs) and snow machines would be greatly enhanced by a road system, and areas in the two watersheds that are essentially never accessed by humans would become available. This increased access would extend fishing and hunting pressure and make areas along any transportation corridor more susceptible to trespassing, poaching, and illegal dumping (ADOT)." We believe that this expresses the seriousness of this potential impact.

<u>K. Zamzow, Ph.D. (Doc. #5054)</u>

13.52 It might be helpful to add another map of the location of the 6 deposits considered in the Cumulative Risks section immediately following.

<u>EPA Response:</u> The six deposits are included in Figure 13-1.

Chapter 14: Integrated Risk Characterization

<u>Alaska Marine Conservation Council (Doc. #5065)</u>

14.1 The assessment addresses critical considerations for the watershed including loss of wetlands and other habitat modification, loss of streams, altered stream flow, reductions in downstream water quality, and changes to surface and groundwater flow. Such impacts from mining operations, the transportation corridor and failures of the tailings dam and pipelines will have direct and indirect, acute and cumulative effects on fish productivity and the ecosystem services that drive our economy.

<u>EPA Response:</u> Comment noted; no change required.

<u>The Wildlife Society (Doc. #5272)</u>

14.2 The assessment should also acknowledge uncertainties regarding changes in food webs that could result if the salmonid food base is reduced, such as possible increased predation on moose and caribou if the salmonid prey base for brown bears is diminished.

<u>EPA Response:</u> The complexity of salmon-based foodweb interactions is now discussed in Chapter 5.

<u>Natural Resources Defense Council (Doc. #5436 and #5378)</u>

14.3 EPA has done an extraordinary job of addressing the range of questions raised during the public comment and peer-review process. In particular, it (1) expanded the range of mine scenarios, (2) added a review of potential mitigation measures, (3) incorporated the risks and unknowns attendant to projected climate change, (4) strengthened its analysis of the complex and interconnected hydrology of the region, (5) added “day-to-day” operational risks, and (6) enhanced its analysis of cumulative impacts. The result is a well-documented scientific analysis of the myriad unacceptable adverse effects that would result from mining. The analysis ultimately supports 404(c) protection.

<u>EPA Response:</u> Comment noted; no change required.

14.4 In its revised Assessment, EPA clarifies the risks that large-scale mining poses to the Bristol Bay watershed, focusing on impacts to the region’s salmon and other fish populations, wildlife populations, and Alaska Native cultures. The agency underscores that even with no human or system failure (impossible in the long-term), a mine of any foreseeable size will reduce water flow in the region, directly eliminate up to 4,800 acres of wetlands, and dewater up to 90 miles of streams. With inevitable operational failures, EPA finds these risks would increase significantly, even catastrophically, in the event of a tailings dam failure.

<u>EPA Response:</u> Comment noted; no change required.

14.5 In fact, the regulatory mechanisms developed to protect against corporate irresponsibility cannot realistically be expected to hold these mining companies to their environmental obligations over the long term. Though operators of hardrock mining facilities in Alaska are required to demonstrate financial assurance for reclamation, waste management, and dam safety costs as a way of anticipating future need for remediation, the requirement cannot promise to guard against the risks associated with mine existence in perpetuity. First, the mine developer is required only to demonstrate financial assurance. When the human institution responsible for developing the mine is no longer in existence – a reasonable probability over the thousands of years that the mine will persist – such assurances mean little. Indeed, of the 10 operating, proposed, or closed Alaskan mines today, one has already gone into bankruptcy without adequate bonding to cover mine closure (Illinois Creek). Furthermore, even assuming long-term corporate management, financial assurance does not require coverage for chemical or tailings spills. Inevitably, where financial assurance is inadequate, it is the taxpayers who are left holding the proverbial bag for significant clean-up costs, unpaid by the mining companies whose assurances, however enthusiastically given, were never realized. And it is the local residents who must live with the environmental consequences.

EPA Response: **Comment noted; no change required.**

14.6 Furthermore, as EPA has recognized, accidents and failures always happen in complex and long-lasting mining operations. Indeed, over the centuries-long existence of a mine, some sort of failure is expected. Including potential failures in the Assessment analysis reveals adverse impacts that are even more unacceptable – and indeed catastrophic.

EPA Response: **Comment noted; no change required.**

14.7 With mitigation infeasible, the ability of Alaska Natives to adapt to an impaired salmon and subsistence landscape is important, but unknown. Even assuming that adaptation is possible, it would come with significant losses to both a centuries-old traditional culture and to the regional environment. Traditional languages, patterns of behavior, economic activities, skills and capital improvements that would no longer be relevant may be lost, and use of non-renewable resources within the new development would augment the induced mining effects described above.

EPA Response: **Comment noted; no change required.**

14.8 Specifically, EPA breaks its analysis down to "routine" (failure-free) mining operations with "unavoidable" adverse effects, and those resulting from failures – both day-to-day and severe, including human error, mechanical failure, accidents, and other unplanned events. Unavoidable effects are expected to occur even if the mine is flawlessly built, operated, and closed. The Assessment reveals that these alone are sufficient to trigger 404(c). When potential failures are added to this analysis, impacts are even more extreme, and projections of adverse effects are dire. Mining impacts are fundamentally pessimistic because over the extreme long-term, even those failures with low statistical probability become "likely." Their low probability derives from a very low rate of occurrence, but over the centuries-long existence of a mine, some sort of failure is expected.

EPA Response: **Comment noted; no change required.**

The Wilderness Society (Doc. #5486)

14.9 There are no examples of mining operations that have achieved mitigation of impacts, and the risk assessment in Chapter 14 seems to understate the potential for destruction of habitat.

EPA Response: **We do not know of any understatement of habitat destruction, and the comment is not sufficiently specific to formulate a response.**

Earthworks (Doc. #5556)

14.10 With as many as five new chapters, EPA clearly responds to peer review questions and concerns on issues relative to the mine scenario, risk assessment, understanding the hydrologic nature of the watershed, cumulative impacts for other mines and development, and long term impact of climate change. By doing so, EPA provides a more thorough understanding of Bristol Bay's complex water system and notes that impacts from water use and water treatment could have dramatic impacts on wetlands, fish spawning, and fish rearing habitat. Finally, EPA clearly shows that in short and long term, climate change will magnify these impacts, particularly when considering water and waste management in perpetuity post-mine closure.

EPA Response: Comment noted; no change required.

14.11 The Assessment also provides substantial information to support the conclusion that even under a best-case, no failure scenario, fisheries would be adversely affected by large scale metallic sulfide mining.

EPA Response: Comment noted; no change required.

14.12 The Assessment identifies "inevitable" and "foreseeable" adverse impacts that would occur even from routine mine operation, including, toxic effects primarily due to the inevitable leakage of leachates, habitat loss and modification would occur due to destruction of streams and wetlands and water withdrawals. As a result, the watershed assessment finds that "local populations of salmonids would decline in abundance and production." Local habitat loss is significant because losses of stream habitat leading to losses of unique, local populations will erode the population diversity that is key to the stability of the overall Bristol Bay salmon fishery.

EPA Response: Comment noted; no change required.

14.13 Furthermore, EPA should consider not only the direct impacts of the disposal of dredge and fill material into the disposal site, but also the secondary impacts on the surrounding landscape. In other words, EPA must take a broad view of the environment when it evaluates the impacts associated with a potential discharge. The Watershed Assessment accomplishes precisely these goals, and finds that mining would lead to significant degradation.

EPA Response: Comment noted; no change required.

Center for Science in Public Participation (Doc. #5657)

14.14 As a final observation on the Second External Review Draft, Chapter 14, Integrated Risk Characterization, is probably the most concise and important chapter in the Watershed Assessment. If I didn't read anything else (including the Executive Summary), I would want to read this chapter. Is there any way to get this chapter to the reader earlier in the document?

EPA Response: The chapter is a synthesis, which we believe is correctly placed.

Aleknagik Traditional Council (Doc. #2917)

14.15 I am very concerned if the Pebble Mine happens, through flash flood rain, and dumping of the copper metal toxic waste elements would seep through the tundra moss and into the inland streams, creeks, ponds, and lake systems and kill off the salmon egg incubation habitat areas in the Iliamna Lake area and the Kvichak River connecting to the Kvichak and Naknek Bay salmon fishery.

EPA Response: Comment noted; no change required.

14.16 Moreover, the fresh environmental air that gives us humans and animals healthy oxygen would become polluted from the Pebble Mine copper toxic waste and toxic dust from the mining excavation year-round activities. The Pebble Mine would also disturb the important natural habitat, breeding, calving/nesting, and foraging areas for caribou, moose, wolves, songbirds, seagulls, waterfowl, and most of all our edible and medicinal traditional plants consumed by Bristol Bay Alaska Natives.

EPA Response: We acknowledge these concerns, but effects on terrestrial plants and wildlife, other than those mediated by salmonid fish, are outside the scope of this assessment.

Nushagak-Mulchatna Watershed Council (Doc. #0693)

14.17 In 2010 the Nature Conservancy released a report entitled An Assessment of Ecological Risk to Wild Salmon Systems from Large-scale Mining in the Nushagak and Kvichak Watersheds of the Bristol Bay Basin, Ecology & Environment (October, 2010). The results of the assessment strongly suggest that metallic sulfide mines have unavoidable risks with uncertain consequences for the salmon of Bristol Bay - risks that will be eternally present. http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/alaska/explore/ecological-risk-assessment-nushagak-kvichak.pdf. A summary of this report and the implications it draws for salmon in Bristol Bay can be found at http://www.nature.org/idc/groups/webcontent/@web/@alaska/documents/document/prd_046281.pdf.

EPA Response: We are aware of The Nature Conservancy's assessment.

American Fisheries Society (Doc. #3105)

14.18 There is insufficient attention paid to the cumulative and interactive effects of altered nutrient, organic matter, energy, water, sediments, and thermal sources and flows, and the chronic or long-term fragmentation of critical habitats across the riverscape (see Fausch et al. 2002). Landscapes to riverscapes: bridging the gap between research and conservation of stream fishes. BioScience 52: (483-498).

EPA Response: Fragmentation of streams and its potential to extirpate populations is addressed in Chapter 10. The mine itself would be in the headwaters, where it would not be a stream fragmenting agent. The importance of headwater streams in terms of the delivery of water, organic matter, and other materials to downstream areas is addressed in Chapter 7 of the assessment.

H. Neumann (Doc. #0238)

14.19 The literature is filled with examples of metals mining operations that led to extensive pollution of water, soils, and air resources, resulting in severe impacts to fishery and terrestrial resources. These examples extend back in time over the entire history of mankind's mining/mineral processing activities. (Hughes, 1994; Turner, et al., 1990; Vutukuri, 1986; and Smith, 1987)

EPA Response: Comment noted; no change required.

<u>Center for Science in Public Participation (Doc. #5657)</u>

14.20 Chapter 14.1.2.1 Tailings Dam Failure "Each TSF has multiple dams, but the probability of a spill from a TSF would not increase in proportion to the number of dams for an individual TSF, because failures would not be independent events." (p. 14-7)

Recommendation: Rather than say "… but the probability of a spill from a TSF would not increase in proportion to the number of dams for an individual TSF, because failures would not be independent events," I believe it would be more correct to say "… but since available data on tailings dam failures does not include dam length, the probability of dam failure as related to dam length cannot be made."

<u>EPA Response:</u> The suggested statement does not negate the quoted sentence from the assessment, which concerns the number of dams rather than the length of a dam. The point about dam length has been added.

<u>Alaska Community Action on Toxics (Doc. #5541)</u>

14.21 For these and many others, it is clear that large-scale mining would also pose serious threats to Alaska Natives. Because Alaska Native cultures are intimately related to the local landscape and the resources it provides, any change to salmon or other subsistence resources would affect indigenous health, welfare, and cultural stability.

<u>EPA Response:</u> Comment noted; no change required.

<u>V. Wilson III (Doc. #5529)</u>

14.22 Finally, it's important for regulators to understand the potential human health impacts for Alaska Natives and other residents of the region. This includes potential mining impacts on municipal water supplies and fisheries that people depend on for food. Since wild salmon is considered by many nutritionists as a "superfood" that is full of heart-healthy omega-3s and a great source of protein, it's important to understand how this would affect the health and wellbeing of people in the region and consumers worldwide. For example, if the mining company has an accident and damages the salmon runs, the Food and Drug Administration may have to issue warnings for people to not eat as much salmon from the Bristol Bay watersheds. Therefore it is important to understand the risks that mining could bring to human health and both the current integrity and marketing of wild Alaska salmon.

<u>EPA Response:</u> Comment noted; no change required.

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

14.23 For the other identified endpoints, the revised Assessment takes the additional data from PLP and other sources to populate multiple models that are then used to calculate impacts and assign risk. EPA, at page ES-28, discusses the uncertainties and limitations in a summary:

- lack of quantitative information concerning salmonid populations in freshwater habitats; "Estimated effects of mining on fish habitat thus become the surrogate for estimated effects on fish populations" (emphasis added);

- the standard leaching tests on tailings and waste rock material from the Pebble deposit are "uncertain predictors of the actual composition of leachates;"
- capture efficiencies for leachates are uncertain;
- the effects of tailings and concentrates [assumed from unintentional spillage?] deposited in spawning and rearing habitat are uncertain;
- probability of tailings dam failure is uncertain; historical experience is presumed to provide an upper bound; and
- the proportion of tailings spilled during a dam failure could be larger than the largest value modeled and the long-term fate of spilled tailings could not be quantified.

<u>EPA Response:</u> Comment noted; no change required.

<u>S. L. O'Neal (Doc. #5528)</u>

14.24 P. 14-8: "Assuming ADF&G aerial survey counts reflect the proportional distribution of Chinook salmon within the Nushagak River watershed, the tailings dam failure would eliminate 29% of that run due to loss of the Koktuli River salmon population; an additional 10 to 20% could be lost because tailings deposited in the Mulchatna River would affect its tributaries.

Comment: This is particularly concerning in light of the status of Chinook populations worldwide.

<u>EPA Response:</u> Comment noted; no change required.

14.25 P. 14-14: "The occurrence of salmon species in rivers and major streams is generally known."

Comment: This is contrary to dozens of statements made previously in the document.

<u>EPA Response:</u> The previous statements addressed the many smaller streams that are not well represented by current surveys.

14.26 P. 14-14: "The assessment is limited by its focus on the effects of mining on salmonids and the indirect effects of diminished fish resources on wildlife and people."

Comment: Although not a primary focus of the revised Assessment, it should be mentioned that indirect effects on resident fishes important to salmonids foodwebs will also produce negative feedback for salmon.

<u>EPA Response:</u> Such secondary indirect effects may occur, but were judged outside the scope of the assessment.

14.27 P. 14-17: "To provide reasonable realism and detail, this assessment largely addresses the potential effects of a single mine, at three different sizes, on the Pebble deposit."

Comment: More justification of this decision is warranted here (most advanced in exploration, best characterized deposit, plans on file with SEC, etc.).

<u>EPA Response:</u> The points about the Pebble deposit being most advanced and best characterized have been added to the assessment.

14.28 P. 14-18: "As a result of their particular susceptibility, anadromous salmonids fisheries have declined in most of their range due to the combined effects of habitat loss and degradation, pollution, and harvesting."

Comment: Again, restoration efforts have proven costly and ineffective.

<u>EPA Response:</u> This point has been added to Chapter 14.

<u>North Coast Rivers Alliance (Doc. #5061)</u>

14.29 The Assessment also underestimates the foreseeable environmental impacts of mining development by assuming that there will be "no significant human or engineering failures." Assessment ES-11. However, failures – both human and engineering – are eminently foreseeable and, in the case of massive resource extraction projects in hostile environments, commonplace. And when they happen, they can trigger catastrophic and irreversible ecological damage. Therefore, the Assessment should evaluate the possibility of foreseeable human and engineering failures, discuss the foreseeable impacts of such failures, and analyze the feasibility of responding to and mitigating them and rectifying the damage caused.

<u>EPA Response:</u> The assessment evaluates potential impacts of several failure scenarios, including water collection and treatment failures, tailings dam failures, culvert failures, and pipeline failures (see Chapters 8 through 11).

<u>Alaska Chapter of The Wildlife Society (Doc. #7415)</u>

14.30 The risks associated with contamination of aquatic habitats by routine mine operations are realistic. It was appropriate for the Assessment to consider large-scale impacts that result from failure of tailings storage facilities given that there is little precedent for maintenance of mine waste over a period of centuries.

<u>EPA Response:</u> Comment noted; no change required.

14.31 We recommend that the Summary of Uncertainties and Limitations in the Assessment (ES-28) be amended to better elucidate the uncertainty of mine impacts to terrestrial wildlife in the project area. Large scale mine operations and infrastructure could affect terrestrial wildlife in a number of ways. These include (1) effects on distribution and movements of large mammals, (2) alteration of aquatic habitat on waterbirds, (3) effects that changes in salmon abundance could have on populations of their terrestrial predators such as brown bears and wolves, and (4) the potential for increased human sport and subsistence harvest of wildlife that could occur with improved access to the region. The Assessment should also acknowledge uncertainties regarding changes in terrestrial food webs that could result if the salmonid food base is reduced. This includes possible effects of increased predation on moose and caribou if salmonid prey base for brown bears is reduced. Although some of these uncertainties cannot be addressed until more specific mine plans are in place, baseline studies are needed to facilitate future assessments.

EPA Response: Although we acknowledge that large-scale mining could have significant direct effects on terrestrial wildlife in the project area, these effects are outside the scope of the assessment (as defined in Chapter 2). A discussion of the limitations of the assessment has been included in the Executive Summary.

American Sportfishing Association (Doc. #1371)

14.32 If mining is permitted in Bristol Bay, even under no fail scenarios, the watershed will inevitably experience eliminated and blocked streams, reduced water flow, severe wetland loss and decreased water quality. This proposed mining complex presents unacceptable impacts to the valuable water and fisheries resource in the Bristol Bay watershed and is not worth the risk. The EPA's Assessment finds that even in an impossibly optimistic best-case scenario - without a catastrophe or series of harmful spills – up to 90 miles of salmon streams and up to 4,300 acres of vital salmon habitat will be destroyed by mining the deposit. If mining failures do occur, in a worst case scenario fish, invertebrates and wetland areas could be exposed to ten billion tons of toxic waste and the watershed would experience permanent habitat degradation.

EPA Response: Comment noted; no change required.

C. Borbridge (Doc. #5066)

14.33 Both fewer fish and tainted fish will impact the health of the local population of Bristol Bay. Fewer fish means less healthy salmon in the diet of the local population. This has been mentioned in the draft study, but more information is needed on the impact of fish with various higher levels of pollutants entering the diet of the local people. In areas outside Alaska with salmon that have experienced mining and industrialization, residents are often warned to limit their consumption of salmon. In Bristol Bay, some residents eat salmon every day. It is likely that whatever pollutants become present in the salmon as a result of large scale mining would also enter the diet of those that eat the fish on a regular basis. This needs to be addressed. Providing a warning would likely have little if any impact since consumption of salmon is so much a part of living in Bristol Bay and the salmon people catch and consume will not have labels on their bodies that indicate their origin or the levels of pollutants. If salmon from some river systems are polluted, those pollutants will enter the diet of the local people.

EPA Response: Potential health effects due to loss of salmon from the subsistence diet are discussed in Chapter 12 of the revised assessment, but a complete evaluation of human health effects of large-scale mining is outside the scope of the assessment.

The Pebble Limited Partnership (Doc. #5536)

14.34 Original Draft Location: Report Section Identification: Chapter 5, 6 and 7

Original Comment from State of Alaska: EPA discusses impacts on fisheries from normal operations and the probability of tailings dam failures and potential negative impacts from single and multiple mines, but fails to compare those statistics with probabilities of other potential negative impacts such as disease, blights, droughts, or over-fishing. Consequently, there is no frame of reference for understanding the magnitude of the risk.

Draft Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: An adequate assessment of project risk to salmon is not included in the document.

<u>EPA Response:</u> Comment noted; no change required.

14.35 *Original Draft Location*: *Page:* 8.11, *Section:* 8.5 Summary of Uncertainties and Limitations in the Assessment

Excerpt: The proportion of the tailings that would spill in the event of a dam failure could be larger than the largest value modeled (20%).

Original Comment from Knight Piésold: Interesting statement. Based on the size of the ultimate impoundment, the estimated volume of ponded water from preliminary water balances and the consolidation characteristics of the tailings (deeper and denser tailings will not liquefy and flow out of a hypothetical breach), it is actually more likely that the proportion of tailings that 'would spill' should be assumed to be significantly less than 20% rather than more.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft Section 14.5 second bullet - the same statement remains without explanation. The comment has therefore not been addressed.

<u>EPA Response:</u> In our judgment, a 20% spill is a reasonable scenario. It is large, but not worst-case.

14.36 In Section 14 Integrated Risk Characterization, the Assessment provides a summary of uncertainties and limitations. In effect, doubt is placed on the entire analysis for effects to subsistence use and socio-economics. For example, on page 14-14: The same comment applies to cultural practices, or physical and mental health. The authors have largely dismissed standard social and cultural heritage impact analysis and assessment techniques, and in so doing have thrown doubt on any assertions they have made concerning the responsiveness or adaptability of Alaska Native cultures to mine scenario impacts.

<u>EPA Response:</u> The assessment considered effects on Alaska Native cultures that were directly related to salmon. Thus, a complete socioeconomic or cultural heritage analysis was outside the scope of the assessment. We acknowledge that Alaska Native cultures have the ability to adapt. However, we have heard from Alaska Native people that any loss (or even the fear of loss) of their salmon resources would have a direct impact on their way of life, regardless of their ability to adapt. Further, uncertainties and limitations are an inevitable part of risk assessment. If we claimed that there were no uncertainties, <u>that</u> would cast doubt on the entire analysis.

14.37 *Original Draft Location*: *Page:* ES.26, bullet 3, last sentence, *Report Section Identification:* Executive Summary, Summary of Uncertainties and Limitations in the Assessment

Original Comment from State of Alaska: Overly simplistic to believe that "Estimated effects of mining on habitat become the available surrogate for estimated effects on fish populations." There are many examples showing fish habitat is not a good measure of fish abundance or population dynamics.

Recommended Change: Consider including ways to assess and/or gather insights into fish abundance and population dynamics that are less cumbersome than those stated in the report and better than habitat surrogate.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: pg 14.14 first bullet, the paragraph in question remains unchanged with no evidence that the comment has been addressed.

EPA Response: The assessment endpoints include salmon abundance, productivity, and diversity. The comment is correct that habitat is not always a *complete* measure of fish abundance, productivity and diversity—but habitat is *essential*. The conceptual frameworks and associated discussions presented in subsequent chapters acknowledge the many other factors influencing these salmon endpoints. Many of the pathways identified cannot be quantitatively linked to salmon endpoints, given the available data, without making unsupportable assumptions. Given these limitations, and given that salmon abundance, productivity and diversity inevitably depend on the availability of habitat, we believe that habitat is an appropriate surrogate for evaluating impacts to these endpoints.

14.38 A key element to an ERA is to transparently present the known uncertainty. Perhaps the greatest uncertainty for the Assessment relates to the mine scenarios on which EPA bases its evaluation. Every finding and conclusion in the Assessment is based on a hypothetical (Pebble) mine design. However, the Assessment summarily dismisses this issue by stating that the lack of an actual mine design is "not a source of uncertainty, but an inherent aspect of a predictive assessment" (p. ES-27). While it is certainly possible to conduct an impact assessment on a hypothetical scenario, EPA's Assessment dismisses all of the unknowns (including important mitigation measures that a standard mine would implement) associated with the mine design and operations plan as having any potential effect on its findings.

EPA Response: The comment misrepresents the statement from the assessment. All predictive assessments are based on hypothetical scenarios. This assessment is based on the plan put forth by Northern Dynasty Minerals in Ghaffari et al. (2011). An assessment of any mine plan submitted in the NEPA process would also be predictive in nature, and would be modified by permitting agencies, by advances in technology, and by unanticipated events and conditions. The actual operation of a mine would inevitably deviate from any plan.

14.39 *Page:* 14-16, *Section Number*: 14.6, *Section Title:* Summary of Uncertainties in Mine Design and Operation

Excerpt: The performance of modern technology in the construction of tailings dams is untested and unknown in the face of centuries of extreme events such as earthquakes and major storms.

Technical Comment from Knight Piésold: The same can be said for the construction of any major civil works, including bridges and buildings. Modern dam design technologies are based on proven scientific/engineering principles and there is no basis for asserting that they will not stand the test of time.

General Subject Area: Tailings Dam/TSF.

Comment Category: Unqualified Statement.

EPA Response: We agree that all major civil works are subject to extreme events, despite proven principles.

14.40 *Page:* 14-16, *Section Number*: 14.6, *Section Title:* Summary of Uncertainties in Mine Design and Operation

Excerpt: The promises of today's mine developers may not be carried through by future generations of operators whose sole obligation is to the shareholders of their time.

Technical Comment from Knight Piésold: Speculative. What is important is the basis for which the facilities are permitted by State agencies, not the promises made by today's mine developers of future owners.

General Subject Area: Risk and Uncertainty.

Comment Category: Unqualified statement.

EPA Response: The wording of the comment is ambiguous. A risk assessment is inherently speculative (see response to Comment 14.38).

14.41 *Page*: 14-17, *Section*: 14.7, *Section Title:* Summary of Risks under the Mine Scenarios

Excerpt: Reduced flow from water use would significantly degrade additional stream reaches (Table 14-2) and an unquantifiable area of wetland habitat.

Technical Comment from Knight Piésold: Speculative and unqualified. Pebble is conducting extensive flow reduction and aquatic habitat studies to scientifically assess the possible effects of flow reductions. In some instances, flow reductions, both with and without mitigative flow releases, can enhance habitat usability.

General Subject Area: Flow Reductions.

Comment Category: Unqualified statement.

EPA Response: The assessment acknowledges the importance of the Pebble baseline flow studies and gage network, and acknowledges the need for flow requirement studies during the permitting process. We have elaborated on water management assumptions to clarify this point.

14.42 *Page*:14-17, *Section*: Table 14-2, *Section Title:* Summary of Risks under the Mine Scenarios

Excerpt: >20% flow reduction Stream length affected: 15 km, 26 km, 54 km for the three different mine sizes considered.

Technical Comment from Knight Piésold: It is not specified how these channel lengths were computed. It was likely done on the basis of basin area reduction, but detailed watershed modeling studies have shown that potential flow reductions are not directly related to drainage area and also can vary at one location throughout the year.

General Subject Area: Flow Reductions.

Comment Category: Invalid assumption.

EPA Response: **Streamflow alterations resulting from mine operations were estimated by reducing the streamflows recorded at existing stream gages in the mine scenario watersheds by the percentage of expected surface area lost to each mine footprint and water yield efficiencies for each watershed. Reductions also included losses to the drawdown zone, caused by the cone of depression at the mine pit, or other locations of dewatering. Discharges through the WWTP resulted in streamflow additions. Net effects on resulting streamflows were mapped and summarized for individual stream and river segments delineated by gage locations or tributary junctions. Chapters 6 and 7 of the final assessment provide additional details of water balance calculations and assumptions.**

14.43 *Original Draft Location*: Page 7.1, Section 7.0, *Excerpt:* [blank]

Original Comment from State of Alaska: Cumulative impacts are a potential concern, and the development of infrastructure for the Pebble Mine does make it more likely for other roads and infrastructure. However, assessing the impacts of these extremely hypothetical mines is even more difficult than for the Pebble Mine deposit. It would seem to be important to better predict the risks from the Pebble Mine before cumulative effects are examined.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Cumulative effects continue to be a significant part of the revised document regardless of the veracity of the information used.

EPA Response: **As the comment suggests, the potential risks from development of a large mine at the Pebble deposit are evaluated in greater detail in the revised assessment. We agree that cumulative impact assessment is important and difficult. Prediction of cumulative impacts may improve with additional data from both the Pebble deposit areas and other mining claims. The assessment of cumulative risks is not intended to be a quantitative risk assessment. It is intended to provide an evaluation of impacts based on available information.**

Appendix A: Fishery Resources of the Bristol Bay Region

S. L. O’Neal (Doc. #5528)

A.1 General comment: When discussing the global distribution of all fishes, it is worthwhile to discuss hatchery production of those species as well. See general comment No. 5 above. [5. The lack of hatchery fish currently present in Bristol Bay and the risks to wild fisheries from hatcheries warrant significantly more emphasis in the main volume of the report. Bristol Bay is one of very few salmon watersheds remaining worldwide that is unimpacted by hatchery production. Hatcheries currently operate not only on significantly impaired rivers such as the Columbia, but in the Copper River basin, on the Yukon River, and Russia's Kamchatka Peninsula. Risks from hatcheries are well described in Appendix J of the revised Assessment. They include well known genetic risks and loss of fitness, competition between wild and hatchery fish in both freshwater and marine environments, predation of wild fish by hatchery fish, higher risk of disease outbreak, hatchery straying and other issues….]

<u>EPA Response:</u> The negative effects of hatchery fish on wild fish populations are mentioned in Chapters 3 and 7 of the assessment.

A.2 General comment: Given commercial and sport management are discussed, should subsistence management be included?

<u>EPA Response:</u> Subsistence fisheries and their importance are discussed in the main body of the Assessment (Chapters 5 and 12), and are now noted in the introduction.

A.3 General comment: The Appendix should include citations to the updated IUCN Red List assessment for sockeye salmon (Rand et al. 2012).

<u>EPA Response:</u> Previously cited data from Rand (2008) has been supplemented with updated data provided by Rand et al. (2012).

A.4 Figures 2-6. It should be clarified that documented streams likely underestimate actual distribution to a lack of data. Also see general comment No. 8. [8. If available, update figures, tables, and text referring to anadromous fish distribution with the 2013 ADFG Anadromous Waters Catalog. Several additions of anadromous distribution were made along the road corridor and in the Chulitna River.]

<u>EPA Response:</u> Reference to the discussion of caveats associated with interpreting AWC distribution data has been added. Data in the final assessment are current to 2012.

A.5 Table 1. "commercial" is misspelled in caption.

<u>EPA Response:</u> Correction made.

A.6 P. 17: "Set gillnets have a maximum length of 150 fathoms…" Should read "Drift gillnets"

<u>EPA Response:</u> Correction made.

A.7 P. 23: "Approximately five billion juvenile salmon are released annually from hatcheries around the North Pacific."

It is worth mentioning here that there is evidence of density dependence in the North Pacific (work by Ruggerone).

<u>EPA Response:</u> Acknowledged and cited.

A.8 P. 28: It should be noted that Chinook salmon in the Fraser River system, Copper, etc. are hatchery supplemented as opposed to Bristol Bay Chinook.

<u>EPA Response:</u> Hatchery supplementation and the fact that Bristol Bay stocks are entirely wild is recognized in Chapter 3 of the assessment.

A.9 Table 6: Consider adding a column for number of fish per km^2 of watershed area (density). Also, Chinook salmon harvest is likely UNDER-reported, which warrants discussion.

<u>EPA Response:</u> We were unable to adequately evaluate the proportion of total watershed area accessible to anadromous salmonids, so do not report density.

A.10 P. 37: “The decline in Yukon and Kuskokwim Chinook stocks that began in the late 1990s may have resulted from the 1997-1998 El Nino.”

I believe this is a topic of much controversy, and several other factors have been cited as possibilities.

<u>EPA Response:</u> Alternative hypotheses are now recognized.

A.11 P. 37 and 38: “Salmon enhancement programs for Chinook salmon in British Columbia are significant…”

Replace “enhancement” with “supplementation”

<u>EPA Response:</u> Word choice; no change required.

A.12 P. 39 and 40: If possible, list total number of existing (non-listed) population units.

<u>EPA Response:</u> No change required.

A.13 P. 41: The discussion of hatchery impacts can be expanded. See general comment No. 5 above.

<u>EPA Response:</u> Hatchery impacts are discussed at numerous additional points throughout the appendix.

A.14 P. 50: The Whited et al. paper cited in the last paragraph is now published in Fisheries.

<u>EPA Response:</u> Correction made.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

A.15 *Original Draft Location: Page* 32.36, *Report Section Identification*: Appendix A, Threatened and endangered salmon and conservation priorities.

Original Comment from State of Alaska: This section does not seem relevant to the stated scope of this assessment. There are no endangered species of salmon in Alaska, including Bristol Bay. Policies in regulation (e.g., 5 AAC 39.222, 5 AAC 39.223) and philosophy of assessing and managing the State’s salmon stocks as dictated in statutes and the State Constitution provide mechanisms to detect and be proactive to address dramatic declines in salmon abundance.

Recommended Change: Delete pages.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Not Addressed.

EPA Response: **We recognize the value of State of Alaska management of salmon fisheries. The fact that no salmon species in Alaska are endangered is a notable fact. The Bristol Bay fisheries are a resource of global interest, and the status of salmon globally is relevant as context for the particular value of Alaskan, and Bristol Bay, salmon populations.**

A.16 Original Draft Location: Page AA.9, Section Appendix A, Excerpt Chum Salmon P2

Original Comment from Environ: This statement not clearly supported by 2 tables on referenced pages which show Nushagak area harvest vs. Nushagak River escapement. Unclear the point of this generalization from one year of data.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Not Addressed. One year of data is insuffi[ci]ent to support the statements in this section.

EPA Response: **Reference and associated sentence have been removed.**

Appendix B: Non-Salmon Freshwater Fishes of the Nushagak and Kvichak River Drainages

Northern Dynasty Minerals Ltd. (Doc. #3650)

B.1 It is also apparent that EPA did not complete a detailed evaluation or review of the large volume of fish data contained in Chapter 15 of PLP's EBD. As a result, the BBWA2 did not examine the most recent and site specific fish data available on which to base their ecological risk assessment for fish. In fact, neither Appendix A (anadromous fish) or Appendix B (resident fish) contain any reference to the 6,500 pages of site specific fish information from Chapter 15 of the EBD. If EPA had examined these sources, they would have concluded, for example, that sockeye salmon, the focus of the BBWA's "portfolio effect" discussion do not spawn in the TSF 1 watershed, any of the SFK watersheds directly impacted by the mine development scenarios, and that sockeye spawning is intermittent and occasional in the upper portion of the UT. Instead, EPA relied on generalized literature for fish from the Bristol Bay area and misinformed modeling to develop their ecological risk assessment. Failure to use the best available science is in direct opposition to the requirements of the ERA guidelines. By failing to use the best available scientific data, EPA over estimated the quantity and quality of fish habitats lost from their mine development scenarios. Yet the magnitude of loss is stated in Appendix J as one of the factors which led to their erroneous conclusion that mitigation, specifically on-site, was not available in the affected watersheds.

EPA Response: **Responses to this comment pertinent to Appendix B are included here. Also see responses to Comments 5.36, 7.3, and 7.36 for additional information pertinent to the use of fisheries data in the assessment.**

Appendix B utilizes a wide variety of sources to document fish distributions within the region, including the Alaska Freshwater Fish Inventory (AFFI). The AFFI identifies

locations where particular freshwater fish species and life stages have been observed and provides access to supporting field data and observations, including data presented in PLP EBD Chapter 15. The author of Appendix B has extensive experience sampling fish assemblages throughout the Bristol Bay region, and during the time he worked for ADFG was responsible for entering sampling data into the AFFI.

S. L. O'Neal (Doc. #5528)

B.2 Authors chose not to focus on resident fishes, though included a thorough appendix discussing their life history and ecology. The decision was reasonably justified by the paucity of information regarding resident fishes as well as the economic and cultural importance of the salmonid species central to the revised Assessment (P. 5-1).

EPA Response: Comment noted; no change required.

B.3 General comment: Are rainbow trout redundant since they are covered in Appendix A? If this section remains in final version of the Assessment, information from the PLP radio-telemetry study warrants discussion.

EPA Response: Information from PLP radio-telemetry study has been added.

B.4 P. 1: Nonadramous and resident are not synonymous (e.g., catadromy).

EPA Response: Patterns of migration are defined in footnote 1 on page 1.

B.5 Table 1: Eliminate abundance column is information is not available. Also, provide a citation for footnote No. 8.

EPA Response: First comment not clear; no change. Referenced footnote is now No. 9 on page 3, and a reference has been added.

B.6 P. 4: It should be stated that pike are not native to the Susitna River.

EPA Response: Now noted.

B.7 P. 5: Provide a citation regarding anadromy of Bristol Bay Dolly Varden.

EPA Response: Several citations are provided.

B.8 P. 32: It is worth noting that Pacific lamprey are likely under-reported due to a lack of directed study.

EPA Response: Statement is generally true for most species, and this is now explicitly acknowledged in the introduction. However, we note that although it is possible that Pacific lamprey are under-reported, the author of Appendix B commonly encountered Arctic/Alaska brook lamprey in his fish community work but has never collected a Pacific lamprey. Russell reported that after a roughly 40-year period of detailed observation in Bristol Bay, he saw Pacific lamprey only once.

B.9 P. 38: Eulochon life-cycle and predator-prey relationships should be included.

EPA Response: Due to the lack of specific observations within the Nushagak and Kvichak river drainages, eulachon are not examined further here.

B.10 P. 47: Can coastrange sculpin exhibit anadromy?

<u>EPA Response:</u> Coastrange sculpins appear to be nonanadromous freshwater residents, as noted on page 49.

Appendix C: Wildlife Resources of the Nushagak and Kvichak Watersheds, Alaska

<u>Bristol Bay Heritage Land Trust (Doc. #5317)</u>

C.1 The Citizens' Alternative recommends at a minimum the State adopt a Habitat (Ha) co-classification for all management units that contain essential habitat. A table of this analysis listing each management unit in Regions 5 through 10 and the habitat characteristics it contains and the extent of those characteristics is submitted with these comments. The bottom line is that the most current information available on the use of State lands within the Nushagak and Kvichak Watersheds supports managing these lands primarily for its habitat values. The State's own information about the resources of these watersheds supports EPA protection.

<u>EPA Response:</u> Comment noted; no change required.

<u>Center for Biological Diversity (Doc. #2922)</u>

C.2 (…) We were disappointed that EPA's assessment and the Appendix including the United States Fish and Wildlife Service's (USFWS) report on Wildlife Resources in the Nushagak and Kvichak River Watersheds, did not consider impacts to the unique and vulnerable population of freshwater Iliamna Lake seals. This vulnerable population of seals is highly dependent on marine-derived resources and on the salmon runs themselves.

Lake Iliamna Freshwater Seals

The Iliamna Lake seal is a rare and unique freshwater seal found exclusively in Iliamna Lake, the largest and deepest body of freshwater in Alaska. Iliamna Lake seals are generally considered to be a population of the Pacific harbor seal (*Phoca vitulina richardsi*). Seals in the lake are isolated from other seal populations through a combination of ecological, behavioral and geographical factors, and constitute a distinct population segment (DPS) of Pacific harbor seal eligible for listing under the Endangered Species Act (ESA).

On November 19, 2012, the Center filed a formal a petition with the National Oceanic and Atmospheric Administration (NOAA) to protect the Iliamna Lake seals under the Endangered Species Act (ESA). In response to this petition, the federal government announced in a positive 90-day finding released May 16, 2013, that Iliamna seals may warrant protection under the ESA. The agency will now complete a 12-month status review and issue a proposed decision on whether to list the species by Nov. 19, 2013.

The location of the proposed Pebble Mine area is about 40 km (17 miles) northwest from major Iliamna Lake seal haul outs on the Seal/Flat Island group southwest of Pedro Bay and Thompson Island group north of Kokhanok. Many important salmon streams flow into Iliamna Lake from the Pebble Mine area and the mine would impact major spawning sites used by the salmon on which Iliamna Lake seals feed, along with direct degradation of water quality and habitat (Pebble Partnership 2011, EPA 2012). If the proposed Pebble Project goes forward, construction and operations of the mine site and transportation infrastructure for the mine would have major and population-level impacts on Iliamna Lake seal. These impacts include (1) major adverse impacts to quality and quantity of anadromous and freshwater fish in the lake; (2) severe and long-term impacts on habitat quality especially water quality; (3) toxic effects resulting in direct mortality and decreased survival and reproductive rates from mine contaminants; (4) increased pressure and competition for fish and wildlife resources because of increased human access to the area; and (5) increased stress levels and disturbance from higher human activity and industrial activity levels in the area, especially low-flying aircraft. These impacts would substantially increase in level and duration by accidents or failures of the Pebble Project. There are multiple sites in the Nushagak and Kvichak River watershed being considered for long-term mining development. Risks of mining development on salmon and other fish populations would increase as a result of cumulative impacts of multiple mines (EPA 2012). Failures or accidents have never been avoided at any other open pit mines of similar size throughout the world and are thus almost guaranteed to occur at Pebble Project (Hauser 2007, EPA 2012).

EPA's Bristol Bay Assessment failed to analyze impacts to the Iliamna Lake seal, despite stating their interest in analyzing salmon-dependent species and species that would be directly impacted by Pebble Project.

<u>EPA Response:</u> Iliamna Lake seals were not a species selected for characterization in the US Fish and Wildlife Report. As a marine mammal, this species is under the jurisdiction of the National Oceanic and Atmospheric Agency (NOAA) per the Marine Mammal Protection Act. We recognize that this species, as well as many others that were not characterized, are an important part of the salmon-based foodweb. As the comment (and the assessment) note, NOAA is currently completing a status review of harbor seals in Iliamna Lake.

The purpose of Appendix F was to identify marine species known to prey upon salmon that reside in estuarine and marine waters of Bristol Bay. In that context, harbor seals that reside in Bristol, Nushagak, and Kvichak Bays were identified and discussed in Appendix F. The section of Appendix F regarding Iliamna Lake seals has been amended to include additional information and reference NOAA's current review.

C.3 According to the EPA, accidents and failures of some kind at some point in the Pebble Mine operations, or post operations, are almost guaranteed. Location in an active seismic zone further increases this risk. Because they are highly dependent on habitat that would be directly impacted by any accident or failure, the population viability of Iliamna Lake seals would be at risk in the event of a major accident or failure. This is because (1) they are highly dependent on fish species that would be directly impacted by this event, (2) they are limited in population size and in ability to adapt or survive any major mortality events or changes to the ecosystem.

<u>EPA Response:</u> Comment noted; no change required. See response to Comment C.2 regarding Iliamna Lake seals.

The Pebble Limited Partnership (Doc. #5536)

C.4 Original Draft Location: Page: Report Number 2.15 through 2.17, *Report Section Identification*: Sections 2.2.2 and 2.2.3, *Excerpt*: [blank]

Original Comment from State of Alaska: Draft Comment: Consideration of threatened or endangered species is an important aspect of the ecological risk assessment, but yet they are not discussed in these sections.

Draft Recommended Change: List known of suspected threatened species within the study area.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No additional baseline info specific to species was added, and additional citations to Appendix C have not been provided. Failure to adequately address listed species represents a major shortcoming in the analysis.

EPA Response: The revised assessment clarifies that there are no known breeding or otherwise significant occurrence of any species listed by USFWS as being threatened or endangered under the Endangered Species Act within the Nushagak and Kvichak River watersheds. There also is no designated critical habitat within these watersheds. Note that the scope of the assessment, and this conclusion, does not extend to marine resources.

C.5 *Original Draft Location*: *Page:* 5.16, *Section*: 5.2.1.2 and Appendix C, *Excerpt*: [blank]

Original Comment from Environ: The assessment states that the loss of upstream waters (pg.5-21, pg. 1) would "greatly reduce inputs of organic material, nutrients, and water macroinvertebrates to reaches downstream…" The report also states that 65% of the nitrogen flux is attributed to headwater contributions. Appendix C (p 16-18) documents the tremendous importance of Marine- derived nutrients to the Bristol Bay watersheds coming in from salmon swimming upstream.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The discussion on nutrient contribution of headwater steams is largely unchanged. The marine-derived nutrients provided by salmon swimming upstream was only considered in terms of potential impacts to wildlife, but not an overall addition/loss of nutrients in the system. Hence, the analysis remains incomplete; all sources of nutrients need to be included in the assessment.

EPA Response: These statements are not contradictory. Headwater streams provide important inputs to downstream waters, including the many streams that do not have documented anadromous fish populations. Marine-derived nutrients (MDN) can play an important role where anadromous fish occur, but this does not negate the contributions of headwater nutrient sources, particularly for streams without large runs of salmon. The relative role of MDN to other sources is highly context-dependent (Wipfli and Baxter 2010). Streams above the upstream limit of salmon distribution or

receiving low abundances of returning salmon are much more reliant on watershed sources, whereas the relative importance of MDN increases for areas downstream, where rates of MDN deposition and capture are much higher. Text has been added to clarify this issue.

Appendix D: Traditional Ecological Knowledge and Characterization of the Indigenous Cultures of the Nushagak and Kvichak Watersheds, Alaska

The Pebble Limited Partnership (Doc. #5536)

D.1 *Page*: D3, *Report Section:* Appendix D: Executive Summary

Excerpt: Since the social networks are highly dependent on procuring salmon (fish camps) but also sharing salmon and wild food resources, the current social support system would be appreciably degraded.

Technical Comment from ERM: In this section, "appreciably degraded" is used, not "significantly degraded". This is an important point to consider since "significance" indicates scientific rigor in the analysis was used.

Citations: [none];

General Comment Area: Cultural; *Comment Category:* Information is presented out of context or in a misleading way.

EPA Response: The comment does not explain the contention that information is provided out of context. The excerpt provided is part of a list of ways in which cultural stability would be vulnerable to change if there were significant negative impacts to salmon or streams. The comment does not provide any information to contradict the excerpted statement. No change required.

D.2 Original Draft Location: Page: AD.20, Section: Appendix D, Excerpt: paragraph 1

Original Comment from Environ: A reference to the archeological surveys conducted by BIA archeologists in connection with Native allotment assessments should b included.

Draft Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: On page 21, Appendix D, the original statement has been removed. If it was the commenter's intent to have the BIA study referenced, this comments has not been addressed.

EPA Response: The AHRS database is cited as a reference in the appendix. This database contains verified information and conclusions regarding surveys.

D.3 Original Draft Location: Page: AD.100, Section: Appendix D, Excerpt: paragraph 2

Original Comment from Environ: Link provided for the Census unemployment rate data is inactive. Please replace with current one.

Draft Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Page 85, Link was updated to a current link, but the existing link does not provide unemployment rates. Therefore the original comment still stands.

<u>EPA Response:</u> The link has been corrected. The text now reads: "The unemployment rate in the study area for 2012 ranges from 14% in Igiugig to 37% in Newhalen (computed from Alaska Division of Regional Affairs Community Database of actual number unemployed per village http://www.dced.state.ak.us/cra/DCRAExternal/ community). This compares to the 2012 Alaska unemployment rate of 6.9% (computed from Alaska State Department of Labor and Workforce Development (http://live.laborstats.alaska.gov/labforce/ labdata.cfm?s=2&a=1) and the United States 2012 unemployment rate of 8.1% (United States Bureau of Labor Statistics http://data.bls.gov/timeseries/LNU04000000)."

<u>J. Kari (Doc. #5649)</u>

D.4 §2. Comments on Appendix D, by Boraas and Knott

I have briefly reviewed the 2013 Appendix D, I see that most of the suggestions that I sent directly to authors Boraas and Knott were addressed. This chapter is very well done given the rapid time frame for this work. Appendix D has some original primary data based on traditional elements in the modern cultures of the Yupik and Dena'ina. Synopses on more subtle aspects of modern life are important: nutrition, health, exercise, spirituality, and beliefs about the environment. The array of recently recorded statements by local residents are an important feature of the 2012 Appendix D. The process for conducting the interviews (summarized in their Appendix 1) is quite formal by Alaska ethnographic field work standards. These interview excerpts indicate that Boraas and Knott had active participation in the seven communities with a large group of interviewees. The authors did a fine job in maintaining rapport and clarity. Braund & Assoc. 2008 (Chapters 22, 23, and 50) presented no materials based upon interviews or discussion topics with local residents that would affected by the proposed mine.

As noted in Boraas and Knott Table 2 (p.16), of the fourteen communities that they have surveyed in the region ten are Yupik or part-Yupik and only two (Pedro Bay and Nondalton) are Dena'ina and two are part Dena'ina. However, when we consider the study area closest to the proposed Pebble Mine, and we make note of the sources with high quality cultural resource and ethnographic information, published as well as unpublished, the research materials for the Dena'ina are vastly more extensive than those for the Yupik. I refer to this as the Nushagak-Iliamna Yupik-Dena'ina research disparity situation.

<u>EPA Response:</u> Comment noted; no change required.

D.5 Boraas and Knot cite the array of useful substantive publications for Inland Dena'ina: Ellanna 1986, Ellanna and Balluta 1992, P. Kari 1991, Tenenbaum 1984, P. R. Kari 1987, Balluta 2008, Johnson 2004, Kari 2007, Coray 2007, Russell and West 2003, Stickman et al

2003, Evanoff 2010. These have been produced due to major contributions from Dena’ina speakers from three communities (Nondalton, Pedro Bay and Lime Village).

In 2011-12 Boraas and Knott were able to survey most of the Nushagak/Iliamna Yupik communities (Newhalen, Kokhanok, Igiugig, Levelock, New Stuyahok, Koliganak, and Ekwok) in person. In fact their interviews and summaries from these communities are significant. In addition Boraas and Knott cite the extensive lower Kuskokwim Yupik sources (esp. sources edited by Anne Fienup-Reardon). However, there are very few primary ethnographic sources based upon in-depth research in for the Nushagak/Iliamna Yupik communities (other than sources by James VanStone 1967, 1971).

Comparing indexed audio collections, the audio recordings from the 1970s and 1980s for Nushagak/Iliamna Yupik-Dena’ina interface are extremely uneven. The Dena’ina Audio collection (DAC) that I maintain at ANLC had nearly 500 recordings, and it is has over 225 recordings made with 50 or more Dena’ina speakers from Lime Village, Nondalton and Pedro Bay. As far as I know no Yupik audio materials for the Iliamna/ Nushgagak communities have been consolidated and indexed. (That would indeed be a valuable research objective.).

In 2013 this disparity remains striking, and we accordingly this disparity applies to both the 2013 report by Boraas and Knott and the 2008 report by Braund and Assoc. Since the proposed Pebble Mine site is right at this Yupik-Dena’ina interface, this disparity in the locally reported ethnographic research materials, (published and unpublished) for the two local indigenous cultures and languages must be emphasized.

The Dena’ina ethnogeographic materials are among the best for any Alaska Native language. On pp. 106-07 Boraas and Knott summarize Evanoff 2010. This attractively formatted book has accurate Dena’ina place names lists and maps on a color land-sat base image. These maps were prepared by National Park Service. In Evanoff 2010, the Dena’ina traditional territory is exquisitely and objectively defined by the Dena’ina place name network, which surrounds the Pebble mine site to the north and to the east. There has never been any cumulative compilation of Yupik place names at this Yupik / Dena’ina interface.

The treatment of Dena’ina and Yupik place names in Braund 2008 is of extremely poor quality. (The full citations are Braund and Assoc. Chap. 22, pp. 22-34 to 22-36; with maps in Figs. 22-20, 22-21, 22-23, and a 28-page Appendix 22A with 950 place names entitled “All Documented Place Names in the Bristol Bay and Cook Inlet Drainages.” For Cook Inlet place names Chap. 50, Table 50-2 and Fig. 50-4) The Appendix 22A is riddled with errors and has inaccurate citations of sources for Appendix 22A. Several incorrect statements are made on pp. 22-34 to 22-36. One colleague told me that he was a peer reviewer for the 2008 cultural resources chapters by Braund and Assoc. He had assumed that the place names data in their 2008 report were original research conducted by Braund and Assoc. However, I can show (if need be) that Braund and Assoc. – without my permission – used files with Dena’ina place name data that was being actively edited and revised by me for Lake Clark National Park and for the publication Evanoff 2010. Then they co-mingled with those files Yupik place name data from various uncited sources.

Thus I continue to be concerned that the Yupik ethnogeography at this Yupik/Dena’ina interface and the Pebble Mine area remains so poorly researched. On p. 107 Boraas and

Knott mention the Nushagak Yupik place name coverage by the Nature Conservancy Place Name Project for the Nushagak area. However these materials are very preliminary.

<u>EPA Response:</u> Comment noted; no change required.

D.6 I think that Boraas and Knott have done a very good job with their Appendix D in a short time frame to summarize a wide range of cultural resource topics about the peoples and communities in proximity to the Pebble Mine site. In my opinion the Pebble Mine never should be permitted due to the projected potential effects of this large-scale mine at these major salmon-bearing watersheds as well as the effects of the ancillary infrastructure for the mine.

<u>EPA Response:</u> Comment noted; no change required.

<u>United Tribes of Bristol Bay (Doc. #5275)</u>

D.7 B. The BBWA's chapters on mining impacts effectively demonstrate how the above-described salmon culture will be threatened by large-scale hard rock mining in Bristol Bay.

Of the BBWA's fifteen chapters, four directly address the potential mining impacts to Bristol Bay's salmon-based subsistence culture. As with the above discussion on the Report, it is beyond the scope of this comment to reiterate or summarize the findings in all the chapters, but there is a central theme evident throughout – the development of large-scale hard rock mineral deposits in the Nushagak and Kvichak watersheds will have a devastating impact on salmon – the foundational subsistence species in the region.

<u>EPA Response:</u> Comment noted; no change required.

D.8 Beyond just humans, salmon serve as a primary food source for terrestrial mammals, water and shore birds, freshwater non-salmonid fish, and freshwater invertebrates. Based on data collected from Alaska's Arctic Slope region, the authors describe impact scenarios where a foundational subsistence species is threatened or diminished. The scenarios include: 1) an increased scarcity or contamination resulting in transitions from subsistence diets toward packaged foods; 2) traditional places of cultural exchange, such as hunting grounds and fish camps, are diminished or lost; 3) religious and moral doctrines based on subsistence worldviews are questioned or lost; and 4) individuals and families begin moving from villages to urban centers in search of fulltime wage employment.

Although the above list of scenarios is based on examples from a different region in Alaska, the interviews conducted by Boraas and Knott show many of these scenarios are already causing concern in the region's communities while others are already occurring in the Nushagak and Kvichak watersheds. For example, residents of the upper Mulchatna River and Lake Clark areas have already begun to see changes in the migration of the Mulchatna caribou herd, a traditional subsistence food source. When asked why he thought the caribou no longer followed their traditional route, one elder responded, "[t]he drill wells are making all the noise. We were over there, my wife and I were over there last spring, and when we went over there to check out the Pebble, there [we] saw three other helicopters right in the same area, and that's lots of traffic. We have not had caribou meat around here ever since. Haven't had caribou meat caught here in probably the last six years." Another elder stated, "[s]ince the Pebble Mine started their exploration, I speak for everyone around here that we have not had the big caribou herds that come through here anymore." Changes are not just limited to terrestrial animals. Members of UTBB's own leadership have noticed declines in sockeye salmon in the upper-Mulchatna and Koktuli rivers. This decline places a difficult burden on subsistence users because the spawned-out sockeye salmon in those rivers (referred to as "red fish") play a vital role in filling out the subsistence harvest. [*Footnote: One village elder described versatility of red fish in the subsistence cycle: "[t]hat spring water [at Kijik]. It does not freeze. That is why you can go over there and get a sockeye salmon in March; it might have a green head, and it's red, but it's still a sockeye salmon. You can go over there on New Year's Day and get a fresh sockeye salmon." Id.* [Boraas and Knott] *at 199. See also Id. at 267 (discussing the harvest of late-season sockeye salmon).*] It is no secret to those who live in the area and who have traditional knowledge of the land that mineral exploration and development is already having negative impacts on subsistence.

EPA Response: Comment noted; no change required.

Appendix E: Bristol Bay Wild Salmon Ecosystem: Baseline Levels of Economic Activity and Values

The Pebble Limited Partnership (Doc. #5536)

E.1 *Definitional Clarity*

There are numerous mentions of "sustainable fishing" in the Bristol Bay watershed for commercial, sports and subsistence fishing. For example, Appendix E of the Assessment (p. 10) states that "the existing mainstays of the economy in this region are all wilderness-compatible and sustainable in the long run: subsistence use, commercial fishing, and wilderness sport fishing, hunting, and wildlife viewing and other non-consumptive recreation. Commercial fishing is largely in the salt water outside of the rivers themselves and is closely managed for sustainability. The subsistence, sport fish and other recreation sectors are relatively low impact (primarily personal use and catch and release fishing, respectively)." No explanation is provided as to how "low impact" was determined.

EPA Response: Appendix A includes detailed discussion of the management and quality of the commercial and sport fisheries in the Bristol Bay region. The Alaska Department of Fish and Game manages the commercial fishery under the sustained yield principle. As stated in Appendix A, "Alaska's management of its salmon fishery has proven successful: it was the second fishery in the world to be certified as well managed by the Marine Stewardship Council (Hilborn 2006) and is regarded as a model of sustainability (Hilborn et al 2003a, King 2009)" (Appendix A, p. 16).

The subsistence, sport fish, and other recreation sectors are primarily personal use and catch-and-release fishing. Harvest for subsistence purposes represents less than 1% of the total annual commercial harvest. Therefore, we characterize these activities as low impact in relation to the commercial fishery, which has been clarified in the report.

E.2 *Page:* 20-21, *Section:* Appendix E Section: Summary of Economic Significance, *Excerpt:* [blank]

Technical Comment from ERM: Table 5 Cash Economy Full-time Equivalent Employment Count by Place of Work in the Bristol Bay Region 2009.

Table 6, Cash Economy Estimated Economic Significance of Bristol Bay Ecosystems.

These provide a single snapshot and do not indicate how employment has changed over time.

General Subject Area: Socio-economic.

Comment Category: Information is presented out of context or in a misleading way.

EPA Response: **Appendix D includes a brief description of the population dynamics of communities in Bristol Bay. However, an analysis of current and potential future economic opportunities for Bristol Bay residents is outside the scope of this assessment. This assessment is focused on the salmon fishery and salmon-mediated effects on wildlife and Alaska native cultures. Appendix E is intended to provide a baseline evaluation of current economic activity dependent on a healthy salmon ecosystem.**

E.3 Original Draft Location: Page: AE.102.104, Section: Appendix E, Excerpt: [blank]

Original Comment from Environ: The estimate of costs of fishing is difficult to characterize, as admitted by the authors. The one summary of costs was provided for the year 2008 to show the kinds of cost relative to the same year's earnings. It is important to remember that there is a great amount of uncertainty in fishing costs, which needs to be taken into consideration when attempting to determine impact assessments.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Pages 101-103 indicate there were no changes to the analysis and therefore no attempt to improve the accuracy of the assessment. The comment stands.

EPA Response: **Throughout Appendix E, including in Section 3.7, uncertainties are emphasized. In Section 3.7 there is a detailed discussion of the lack of data and challenges in characterizing fishing costs. Because these uncertainties are described in detail throughout the document, we feel they are adequately covered.**

E.4 Original Draft Location: AE. 191, Section: Appendix E, Excerpt: [blank]

Original Comment from Environ: Another limitation of the ISER Input-Output model is that it is only focused on market values so it is unable to determine the economic significance of subsistence in terms of direct jobs and incomes. These types of limitations should persuade the authors to find a way to incorporate these factors into the analysis.

Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: Text on page 191 is identical to previous draft, therefore no attempt to improve the accuracy of the assessment. The factors have not been incorporated into the analysis, therefore the analysis is incomplete.

EPA Response: In response to this comment we have revised Section 4.2 of Appendix E to include a more detailed explanation of methods. As with all economic analyses that rely on models, the model results are not definitive, but rather provide predicted values. Models are typically designed to capture market activities. Direct jobs and income for subsistence fishers occur outside of traditional markets and thus there is not an input-output model available that can determine the economic value of subsistence activities. The strengths and weaknesses of the ISER Input-Output model are discussed in greater detail in Section 4.2.

Trout Unlimited (Doc. #5527)

E.5 Stable, steady and predictable are important characteristics to build a business on and the Bristol Bay ecosystem, when healthy, provides this foundation through ecosystem service like, abundant salmon and trout, clean water, clean air and wildlife. Therefore, the Bristol Bay recreational fishing industry is strongly tied to a healthy biodiverse Bristol Bay ecosystem. If this system is compromised – particularly the fishery or the wild, remote scenic landscape – over 70 sport fishing business in the region will be directly impacted and ripples will be felt in the local and regional economy. Here is an example from a survey conducted in 2012 on recreation in Bristol Bay.

> *We bring our clients to a number of different rivers throughout the Bristol Bay drainage. It is vital to the success and survival of my business that the health of each of these rivers remains intact. These streams all play a role at some point during our summer season in providing our clients with a high quality experience in which there is a willingness from these clients to pay for. That willingness to pay will quickly evaporate if the productivity and integrity of the system is diminished.*
> *– Brian Kraft, Alaska Sportsman's Lodge (Owner)*

One example of why a diverse healthy system with all the parts and pieces intact is so important to recreation is this:

> On a typical guiding day, the head guide at a fishing lodge has to determine to which rivers he or she will send their clients to that day. They factor in a whole host of factors; what the salmon are doing, the weather, the fitness levels of their clients, what experiences their clients have already had that week, whether or not the fish are biting, the number of float plane seats they have and whatever else happens to come up that day. Then they look at their rover portfolio and determine where to send their groups. Some days, when the weather[']s perfect, the salmon are running and the fishing is easy, they will have 20 rivers that meet the requirements needed to make their clients happy. Other days it will be only a small handful if rivers that can provide the kind of experience their client is seeking. The success of their business depends on the happiness of their clients…and their clients are happy when they are catching fish and getting the true wild Alaska experience they are expecting. And to do that they need many healthy fisheries and rivers.

EPA Response: Comment noted; no change required.

E.6 In appendix E you highlight some ideas we would like to emphasize.

In 2012 we conducted a preliminary survey with Bristol Bay area lodge owners and camp operators. The preliminary results of this study confirm that Bristol Bay's wild, remote and intact landscape and a healthy fishery are the foundation of the Bristol Bay recreation experience.

This study, and others, indicates that the two primary reasons anglers come to the region are: large plentiful fish and the beauty, remote uncrowded undeveloped nature that a true backcountry Bristol Bay experience can offer. Several business owners stated that if the remote, untouched nature of the landscape was changed (for example, if large scale mineral development went forward in the region) that they would be unable to create recreational experience their clients come to Bristol Bay seeking.

Specifically we would like to emphasize if large-scale mining is allowed in Bristol Bay recreation will be harmed in three ways:

1. The remote Alaska experience (large tracts of undeveloped land, uncrowded fishing opportunities, unending scenic beauty, a remote wilderness experience) a majority of Bristol Bay recreational users are seeking would no longer exist.
2. The river portfolio that sport fishing businesses depend on will be less diverse; with fewer rivers available to create a quality recreational fishing experience lodges would not have options and flexibility needed to fully meet their clients expectations.
3. Impacts to the salmon and trout populations likely from large-scale mining even if nothing goes wrong, will impact the quality and quantity of recreational fishing opportunities in the region.

<u>EPA Response:</u> Comment noted; no change suggested or required.

Appendix F: Biological Characterization: Bristol Bay Marine Estuarine Processes, Fish, and Marine Mammal Assemblages

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

F.1 *BBNC's 2012 Comments and Technical Submissions*: "Appendix F could be expanded to include more of the considerable available information about the importance of Bristol Bay as a rearing area for several species of commercially important fishes".

Revised Bristol Bay Watershed Assessment: Appendix F was expanded slightly to consider more discussion of salmon contribution to trophic levels and salmon range and distribution. Moreover, the Revised Assessment itself was also updated to include considerable more attention to the upper Bristol Bay watershed as rearing habitat for several species of commercially important and subsistence fishes. (Revised Assessment, at 3-18 to 3-28)

BBNC's Response to the Revised Bristol Bay Watershed Assessment: BBNC welcomes this expansion of appendix F and the assessment itself, as these now contain more information about the upper reaches of Nushagak and Kvichak River systems as important salmon rearing habitat.

<u>EPA Response:</u> Comment noted; no change required.

Anonymous (Doc. #6267)

F.2 While Appendix F discusses marine environments, little is said about what potential impacts the mine may have. Summary statement just confirm that the salmon are part of the ecosystem. While I realize it will be hard to quantify what potential impacts would occur, there at least needs to be a mention that the effects could occur.

EPA Response: As explained in Chapter 1, the purpose of the appendices is to provide background information on the Bristol Bay region, rather than to evaluate potential effects of mining. Potential effects of mining on marine environments are mentioned in Chapter 2, but were defined as outside the scope of the main assessment.

Appendix G: Foreseeable Environmental Impact of Potential Road and Pipeline Development on Water Quality and Freshwater Fishery Resources of Bristol Bay, Alaska

S. L. O'Neal (Doc. #5528)

G.1 Appendix G. Road corridor:

Figure 1. There is currently no bridge spanning the Newhalen River.

EPA Response: The existing road noted in Figure 1 does not span the Newhalen River. A *proposed* bridge over the Newhalen River would extend from the northernmost portion of the existing road.

G.2 P. 5 (Para 1): Should read 'King Salmon'

EPA Response: Correct; this was an oversight on our part.

Natural Resources Defense Council (Doc. #5436)

G.3 Operation of a Transportation Corridor Would Fragment and Diminish the Quality of Salmonid Habitat

The Bristol Bay watershed is located in "one of the last remaining virtually roadless regions in the United States," and development of a mine there would be impossible without dramatic transportation infrastructure expansion. The 2011 Wardrop report discussed plans to construct an 86-mile access road connecting the mine to a proposed port at Iniskin Bay in Cook Inlet. According to several studies, this road would cross at least 89 streams and require up to 120 stream crossings. Twenty-four of these streams are documented to provide 1,200 acres of spawning habitat for sockeyes and other salmonids. EPA's mine scenario similarly provides for an 86-mile permanent access road connecting the mine site to a new port in Cook Inlet. This road is estimated to cross 34 streams and rivers that support salmonids within the Kvichak River watershed, including 17 streams designated as anadromous waters at the location of the crossing.

EPA Response: Comment noted; no change required.

G.4 Siltation, Sedimentation, and Other Stream Modification Impacts are Likely to Disrupt Anadromous and Resident Salmon Production

Siltation, hydrologic modification, filling of wetlands, and road salts are "likely to diminish" anadromous and resident salmonid production in more than 30 streams. The habitat potentially affected below the road crossings totals 270 km of stream, plus an additional 240 km upstream, if culverts impede fish movement. It is "well-recognized" that management of roads in the type of terrain found in the Pebble prospect area can be "unpredictable and challenging," due to difficulty anticipating the "extent and nature of disruption" to subsurface flow paths, and because "the effects of water table deformation can project hundreds of meters from the road itself." Roads can impact the connectivity between groundwater and surface water systems and, along with pipelines, fundamentally alter the "intricate connections between shallow aquifers and surface channels and ponds," causing further impacts on surface water hydrology, water quality, and fish habitat. Furthermore, the sediment contribution from roads frequently far surpasses that from all other land management activities combined. Road-derived fine sediments have been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, increased predation on fishes, and reduced benthic organism populations and algal production. It could render otherwise suitable spawning gravel useless, and impact the concentrated spawning sockeye salmon populations in the shallow waters of Lake Iliamna.[198] Salts and other materials used to treat roads can also wash off into streams, rivers, and wetlands, causing direct exposure to fish and their invertebrate prey.

<u>EPA Response:</u> Comment noted; no change required.

G.5 Culverts Are Likely to Fragment Habitat and Impede Salmon Movement

Though listed as a "possible" failure by EPA, the Assessment's projections reveal that culvert interference with fish movement is in fact a highly likely result of mining – projected by EPA to eventually impact 50% of culverts. Under any mine scenario, many stream crossings will likely be culverts instead of bridges; EPA anticipates fourteen. Culverts can serve as a barrier to fish, restrict or eliminate fish movement to upstream habitat, and isolate or modify populations. Such habitat fragmentation increases the chance that fish populations will be extirpated due to a lack of genetic diversity or chance events. Culvert interference with fish movement can occur in several ways. The crossings can create excessive water velocities and disorienting turbulence – or the water running through the culvert can be too shallow for fish to traverse. Culverts can further block fish movement as a result of outfall barriers, channel scouring and erosion, lack of resting pools below culverts, or a combination of conditions.

In a healthy watershed, salmon often move into seasonal floodplain wetlands and small valley floor tributaries to escape main-channel flood flow stresses. The existence of culverts reduces flow to these safe havens because flow is instead directed into the main channel. And even if fish can physically swim through a culvert, there may be "behavioral barriers" that prevent fish from attempting passage, as fish will often avoid long culverts, darkness, confined spaces, and shallow depths.

Even assuming compliance with fish passage guidelines at installation, culverts will likely threaten salmon migration in the future. Blockages and erosional failure are common features of culverts, and without prompt repair can cause the loss of a year class if they occur during migrations. Road maintenance during mine operation should generally catch such failures in a timely manner, but without “continual and proper” maintenance, culverts fail and become barriers to fish passage. Because “typical” road inspection and maintenance practice declines post-closure, the likelihood of partial or entire culvert blockage after mining ends jumps to a dramatic 50%. This means that seven of the fourteen potential salmonid-supporting streams with culverts in the risk area would experience post-closure blockage, resulting in the likely loss of the streams’ ability to support long-term populations and resident species such as rainbow trout or Dolly Varden.

EPA Response: Comment noted. Numbers in the final assessment have been updated to reflect that, in roughly 15 of the 32 culverted streams with restricted upstream habitat, salmon spawning may fail or be reduced such that the streams would likely not be able to support long-term populations of resident species.

The Pebble Limited Partnership (Doc. #5536)

G.6 Original Draft Location: Appendix G

Original Comment from Environ: While numerous citations are provided in Appendix G, the appendix does not reflect current construction standards for roads and culverts. In the past couple of decades, great strides have been made in the development of BMPs that substantially reduce runoff from roads and the standards for culverts have changed such the probably of washout has become minimal, culverts are sized to permit both upstream and downstream migration and are also sized to permit movement of debris under the road. Most of the impacts described in this appendix are easily avoided or mitigated using modern construction methods and standards. Documents that address the effects of historical construction techniques are not pertinent. Although the document indicates that literature documenting the effectiveness of BMPs could not be found, there is actually a very large number of documents available that address BMP effectiveness. Suggest removing all citations and discussion that is based on historical construction techniques and focus on current standards

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: The appendix continues to assume that project design and mitigation will not meet current construction standards and mitigation requirements under state and federal regulations. Therefore, the assessment overstates the likely impacts of a project.

EPA Response: See responses to Comments 6.40, 10.46, and 10.53.

Appendix H: Geologic and Environmental Characteristics of Porphyry Copper Deposits with Emphasis on Potential Future Development in the Bristol Bay Watershed, Alaska

K. Zamzow, Ph.D. (Doc. #5054)

H.1 Appendix H, Tables 2 (Global Grade and Tonnage) and Table 3 (Annual Consumption)

These tables showing Pebble's place within the world's copper porphyry mines should separate out the known and indicated resource from the inferred.

<u>EPA Response:</u> The footnotes to Tables 2 and 3 clearly indicate that the values for Pebble are for measured, indicated, and inferred resources. Therefore, readers can decide if a subset of these resource classes better suits their specific purposes.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

H.2 Original Draft Location: Page 19, 20 and 21, Report Section Identification: Appendix H, Excerpt: [blank]

Original Comment from State of Alaska: The following comment is an example of how could significantly alter the conclusions of impact if the mine plan used in the assessment had been vetted through the environmental and permitting review processes. There are actual humidity cell test results for the Pebble tailings, which were started in 2005 and 2008; however, it appears that these tailings are the rougher tails (85% of the total) and not the pyritic tails (14% of the total). Table 7 on page 21 shows pH average of 7.8 for the rougher tails. No specific data is presented for the pyritic tails. It is likely that these tails are extremely acidic due to: a) a fine size of 80% passing 30 meters, and b) the pyrite content will range from 50% to 80% of these tails. This information came from the Northern Dynasty Minerals, Ltd. 2011 Waldrop report. The applicant may state that the acid producing potential of the pyritic tails are irrelevant since they plan to encapsulate them in the TSFs with inert rougher tails and the combination of these tails and a large water height will prevent the pyritic tails from oxidizing. It is still important to know what the potential is of the pyritic tails to produce acid, since the worst case is that these tails may oxidize.

Recommended Change: Get SPLP and/or humidity cell tests on the pyritic tails and evaluate the results. Comment reference: Northern Dynasty Minerals "preliminary Assessment of the Pebble Project Southwest Alaska" issued on February 17, 2011, by Wardrop, a Tetra Tech Company, pages 49, 50 and 409.

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: No additional analytical data for pyritic tails was provided; Appendix H in the second version of the document is identical to the first. Comment stands.

<u>EPA Response:</u> We agree with the suggestion, but the Pebble Limited Partnership did not include any data for their pyritic tails (also known as concentrate). No change required.

Appendix I: Conventional Water Quality Mitigation Practices for Mine Design, Construction, Operation and Closure

<u>Northern Dynasty Minerals Ltd. (Doc. #3650)</u>

I.1 EPA failed to use readily available scientific data and information to develop their ecological characterization for anadromous fishes in the three watersheds surrounding the Pebble deposit area. As a result of this error, EPA then reached a scientifically unsupportable conclusion about the magnitude of the negative impact. EPA concluded that on-site mitigation was not possible, in spite of ample evidence of an abundance of on-site opportunities to implement appropriate mitigation measures and a very large body of scientific literature and monitoring data spanning three-quarters of a century documenting the efficacy of such measures.

<u>EPA Response:</u> Mitigation measures were included in the scenarios, and the best available scientific data were used in the assessment; no change required.

I.2 A second area of improvement claimed by EPA in its fact sheet was the inclusion of new information concerning mitigation measures. Appendices I and J describing potential mitigation methods for impacts to wetlands, streams and fish represents, at best, a limited and qualitative evaluation. The appendices to the Assessment generally do not address mitigation measures in sufficient detail to evaluate their relevance as mitigation measures in the three mining scenarios.

<u>EPA Response:</u> Additional information on mitigation measures was included in the revised assessment. Appendix I is not meant to be specific to any particular location, as it presents a number of options that might be applicable and appropriate depending on a site's specific conditions and regulatory decisions.

I.3 1.2 Zero-Risk Framework – A Misapplication of Engineering Design Principles

To this point, Appendix I, which identifies mitigation practices for mines, contains the following statements relating to failures of tailings dams:

"The failure rate of tailings dams depends directly on the engineering methods used in design and the monitoring and inspection programs in the other mine-life stages."

"Azam and Li (Azam and Li 2010) report that failures in all but Europe and Asia have decreased since 2000; this is attributed to improved engineering practices."

"Data presented indicate that failures peaked to about 50 per decade in the 1960's through the 1980's and has dropped to about 20 per decade over the last 20 years, with the frequency of failure occurrences shifting to developing countries."

These statements challenge the failure probability premise used by the USEPA, but are relegated to an appendix and barely referenced within the main body of the report.

<u>EPA Response:</u> It is quite common for different studies to reach different conclusions due to a number of factors, including whether they relied on identical data to reach said conclusion(s). The Azam and Li (2010) observation has been added to the revised assessment in Section 9.2.2 to demonstrate the contrasting conclusions.

<u>The Nature Conservancy (Doc. #4315)</u>

I.4 The inclusion of a discussion on potential mitigation efforts in response to large-scale hardrock mining in the Bristol Bay watershed is responsive to the request by the peer review process and many public comments for this inclusion while effectively conveying the difficulties and inherent uncertainty associated with these approaches in this region.

<u>EPA Response:</u> Comment noted; no change required.

<u>American Fisheries Society (Doc. #3105)</u>

I.5 Appendix I lists measures that could mitigate mine effects, but provides no assessment regarding the effectiveness of those measures in protecting fish populations or aquatic ecosystems (see Kuipers et al. 2006. Comparison of predicted and actual water quality at hardrock mines: the reliability of predictions in environmental impact statements. Kuipers and Associates, Butte, Montana).

<u>EPA Response:</u> Appendix I is not meant to be specific to any particular location, as it presents a number of options that might be applicable and appropriate depending on a site's specific conditions and regulatory decisions. It is not intended as a document to either evaluate or to present data from other evaluations of existing mitigation practices. No change required.

<u>Center for Science in Public Participation (Doc. #5540)</u>

I.6 The efficacy of water quality mitigation practices for fish conservation outlined in Appendix I are unclear. Recommendation: If available, include citations and statistics of how well such mitigation practices actually work relative to open pit copper porphyry mining.

<u>EPA Response:</u> An evaluation of the effectiveness of mitigation measures is outside the scope of this assessment. It is uncertain if published studies exist that have purposefully examined a specific mitigation measure for its effectiveness related to fish conservation, in the absence of other influencing factors.

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

I.7 *Topic*: Post-Closure Reclamation

BBNC's 2012 Comments and Technical Submissions: BBNC Recommendation: "The draft Assessment leaves unanswered a number of questions about the feasibility of reclamation, including whether there will be adequate cover and topsoil, and whether any mining project in a sub-arctic region has ever successfully achieved reclamation of this nature on so large a scale. We recommend that EPA address these questions in the final assessment."

Revised Bristol Bay Watershed Assessment: These questions remain unaddressed in the Revised Assessment. Appendix I is the only section of the Revised Assessment that substantially discusses post-closure reclamation and it does not address these concerns. Indeed, the Revised Assessment notes that it "assumes that the site would be reclaimed according to statutory requirements, but it is outside the scope of the assessment to evaluate a post-closure plan."(Revised Assessment, at 4-8)

*BBNC's Respon*se: BBNC notes that the Revised Assessment devotes little attention to the feasibility and specifics of post-closure reclamation, which would be extremely difficult for a mine like the proposed Pebble Mine. The assessment thus remains conservative in this regard as well.

<u>EPA Response:</u> The assessment is not a mine plan or a permit application. Thus, whether there would be adequate material for reclamation at this site is outside the scope of the assessment; instead it is necessarily assumed to be true for the purposes of the assessment, otherwise there would be no viable mine on which to base an assessment. It certainly is something that should be assessed for any submitted mine plan. Reclamation for a modern mine on this large a scale in a sub-arctic region does not exist for comparison.

Appendix I is not meant to be specific to any particular location, as it presents a number of options that might be applicable and appropriate depending on a site's specific conditions and regulatory decisions. The revised assessment included specific activities for closure as part of the mine scenarios. Regulatory requirements may change over the long period before closure; therefore, it is not possible to predict what statutory requirements would be at that time to evaluate a plan containing them. Instead, we have presented potential options based upon the current regulatory structure and currently used conventional methods and note that what would be used would be based on requirements (at the future time). No change required.

<u>The Pebble Limited Partnership (Doc. #5536)</u>

I.8 Original Draft Location: Report Section Identification: Appendix I, Volume 3, Excerpt: [blank]

Original Comment from State of Alaska: Appendix I in Volume 3, Conventional Water Quality Mitigation Practices for Mine Design, Construction, Operation, and Closure by Barbara A. Butler, Ph.D. is a primer on mine waste written at a very basic level. It is heavily weighted towards the review of waste rock and tailings storage at hard rock mines (Section 1 and 2), and quickly loses detail and consistency as it discusses other mine features and waste streams such as pits, underground mines, dust, stormwater, chemicals, pipelines, and sanitary wastes. (Sections 3 through 9). In general, the report describes the feature or waste stream, the potential mechanisms or pathways for impacts to the environment, and mitigation measures presented as standard engineering and regulatory practices related to those aspects. For example, waste rock that may be potentially acid generating would be mitigated through a characterization plan, and encapsulated in storage. The body of the report is heavily referenced to a variety of publications including controversial references such as ICOLD, 2001 (Tailings Dams, Risk of Dangerous Occurrences) to potentially stale references such as Piteau Associates Engineering, 1991 (Mined Rock and Overburden Piles – investigation and design manual: Interim guidelines) to recent non-scientific publications such as Chambers and Higman, 2011 (Long term risks of tailings dam failures), as well as some government publications such as the States of Alaska (ADNR, 2005) and Idaho, USEPA, and Commonwealth of Australia. The final section on compensatory mitigation is abbreviated, and introduces the only references to legal issues, related to U.S. Corps of Engineers regulatory jurisdiction for wetlands. The cover page is dated May 2012.

Draft Recommended Change: [blank].

Addressed: No.

Comments Regarding Adequacy of Response in Second Draft: With the exception of Section 10. Compensatory mitigation (which has been deleted in Appendix I of the second review draft), Appendix I has been included in the second draft with no apparent revisions. Failure to address compensatory mitigation and to incorporate mitigation that would likely be required of a project has resulted in over-statement of likely project effects throughout the document.

<u>EPA Response:</u> Some revisions were requested in peer review and public comments and those are reflected in the revised Appendix I. Appendix J was added to the assessment to provide a more detailed discussion of compensatory mitigation. To avoid duplication, the basic discussion presented previously in Appendix I was removed.

<u>M. Bronson (Doc. #5641)</u>

I.9 Make a set of predictions without assuming that modern conventional practices are in place post closure. First, recent studies (e.g., Kuipers et al., 2006) show that such assumptions are incorrect in the majority of metal-mine cases. Secondly, when it comes to post-closure, you'd be hard pressed to find much in the way of industry standards for reliable pollution prevention beyond 30 years for the EPA to even require as permit conditions. Your Appendix I assumes that "if waste rock piles are designed properly with appropriate mitigation measures, monitored and maintained, the release of contaminants is possible, but unlikely." That assertion implies that the waste would indeed release contaminants if monitoring and maintenance disappeared in the decades following closure. Indeed, we can expect that monitoring and maintenance will end at some time when Bristol Bay watershed mine waste still poses risks to fisheries. The mining industry and its regulators, including Pebble and the EPA, have no standard practices for precluding downstream pollution several decades post-closure for most surface, sulfide metal mine situations. Consequently, the probability of significant acid and contaminant releases to the area's streams in the post-closure period, as the acid rock protections disappear, will take on a very high value. The Alaska stakeholders who will inherit the risks of closed mines, such as Pebble, are interested in your predictions of the consequences of that risk extending through the entire future lifetime of the Bristol Bay area fishery.

<u>EPA Response:</u> The failure scenarios evaluated in the assessment (Chapters 8 through 11) consider potential impacts when modern conventional mine design and practices fail.

Appendix J: Compensatory Mitigation and Large-Scale Hardrock Mining in the Bristol Bay Watershed

<u>Alaska Department of Natural Resources (Doc. #5487)</u>

J.1 The revised Assessment has improved the discussion of mitigation and the role of permitting in mitigation. However, the revised Assessment does not adequately describe the measures that the State and federal permitting agencies would require before a mine could be developed in the Bristol Bay area nor the mitigation effect of these measures in the evaluation of environmental risk and impact.

<u>EPA Response:</u> As stated in Appendix J, this appendix provides an overview of Clean Water Act Section 404 compensatory mitigation requirements for unavoidable impacts to aquatic resources. It discusses an array of measures that various entities have proposed as having the potential to compensate for the unavoidable impacts to wetlands, streams, and fish identified in the assessment. The assessment is not a regulatory action, and thus a complete evaluation of compensatory mitigation is considered outside the scope of the assessment.

<u>G. Y. Parker (Doc. #5615)</u>

J.2 Resolving that issue will require EPA to apply the § 404(b)(1) Guidelines 1 to the facts. The executive summary of the assessment summarizes the facts with respect to the context (pp. ES 1- ES 14) and unavoidable and likely impacts (pp. ES 14- ES 26). However, the assessment is not regulatory action. For the most part, it addresses only a portion of the Guidelines, and only in Appendix J with respect to regulations that govern compensatory mitigation. Compensatory mitigation applies to impacts that would occur despite measures to avoid or minimize adverse effects. Impacts that would occur, or are likely to occur, and which are unacceptable to EPA, can be the basis of a § 404(c) determination and any prohibitions or restrictions therein. Appendix J concludes that compensatory mitigation faces challenges in this situation and questions whether sufficient measures exist that could address impacts. Hence, my focus is on suggestions to improve Appendix J and identify the prohibitions and restrictions implied by the assessment.

<u>EPA Response:</u> Comment noted; no response required.

J.3 The first two paragraphs of Appendix J should be revised to state threshold matters that help a reader avoid misimpressions fostered by anyone who neglects to apply the compensatory mitigation regulations to the facts.

Section 1 of Appendix J provides an overview of the regulations that apply to compensatory mitigation under§ 404 of the Clean Water Act. The first two paragraphs of the overview introduce a summary of the regulations. Those paragraphs should focus on what is most important to say at the threshold in this instance. That includes what is necessary to avoid incorrect inferences such as those mentioned above. I believe that something along the lines of the following suggested alternative may help:

Original Opening Paragraphs in Appendix J, p. 1:" Compensatory mitigation refers to the restoration"… "permit "because of the lack of appropriate and practicable compensatory mitigation options" (40 CFR Part 230.91(c)(3))."

My Suggested Alternative: The purpose of the regulations on compensatory mitigation (40 CFR §§ 230.91 - 230.98 and 33 CFR §§ 332.1 - 332.8) is to establish "standards and criteria" for all types of compensatory mitigation of unavoidable impacts to waters of the United States arising from permits granted by the Corps under § 404 of the Clean Water Act (40 CFR § 230.91(a)(l)). The standards and criteria foster reasoned decision-making about mitigation. The regulations are part of the § 404(b)(1) Guidelines. The Corps uses the Guidelines to decide the terms of permits it issues under§ 404(a). The EPA uses the Guidelines to decide the terms of § 404(c) determinations it issues to prohibit, withdraw, restrict or deny such permits due to unavoidable or likely unacceptable adverse effects.

EPA's authority is independent of that of the Corps. A § 404(c) determination does not require that an unacceptable adverse effect be immitigable to be unacceptable. The regulations expressly state that there may be instances when a permit cannot be issued "because of the lack of appropriate and practicable compensatory mitigation options" (40 CFR § 230.9l(c)(3)). Not all unavoidable impacts are susceptible to compensatory mitigation. Moreover, unavoidable and likely adverse effects may be unacceptable under § 404(c) even when compensatory mitigation is available. "Compensatory mitigation" means "the restoration (re-establishment or rehabilitation), establishment (creation), enhancement, and/or in certain circumstances preservation of aquatic resources for the purposes of offsetting unavoidable adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved" (40 CFR § 230.92). These methods of mitigation are discussed below in Section 1.1. A "compensatory mitigation project" is "implemented by the permittee as a requirement of a[§ 404] permit (i.e., permittee responsible mitigation), or by a mitigation bank or an in-lieu fee program" (40 CFR § 230.92). These mechanisms are discussed below in Section 1.2. Compensatory mitigation requirements are based on what is "practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity" (40 CFR § 230.93(a)(l)). In determining what compensatory mitigation will be "environmentally preferable," the Corps "must assess [1] the likelihood for ecological success and sustainability, [2] the location of the compensation site relative to the impact site and their significance within the watershed, and [3] the costs of the compensatory mitigation project" (40 CFR § 230.93(a)(l)). Furthermore, compensatory mitigation requirements must be commensurate with the amount and type of impact associated with a particular Section 404 permit (40 CFR § 230.93(a)(l)).

<u>EPA Response:</u> We appreciate the suggestions to revise the structure and focus of the introduction; however, we believe the introduction is better focused on compensatory mitigation.

J.4 The foregoing alternative paragraphs have several advantages. First, they start, as the regulations do, by stating that the purpose of the regulation is to establish "standards and criteria" for compensatory mitigation. Making that point at the beginning helps everyone to understand that EPA's skepticism that various proposals for compensatory mitigation do not meet the standards and criteria is reasoned, and not arbitrary. That is vital. It is vital because: (1) courts require reasoned, not arbitrary, decisions, (2) legislators should be interested because they enact and should preserve laws, such as the Clean Water Act, requiring as much, and (3) NDM's comments on Appendix J, in contrast, never mention the regulations, and so, NDM and similar critics cannot claim to be consistent with the standards and criteria or to engage in reasoned rather than arbitrary recommendations. Making that point at the beginning helps everyone discard poor proposals for mitigation, and avoid incorrect inferences that any mitigation might be acceptable or might make impacts acceptable.

<u>EPA Response:</u> See response to Comment J.3.

J.5 Second, the foregoing alternative paragraphs help the reader to understand, first, that the standards and criteria are part of the § 404(b)(1) Guidelines used by the Corps and the EPA in their respective capacities under Section 404, and more importantly, that EPA's authority under § 404(c) does not depend on adverse effects being immitigable. This latter point is critical because, unless it is made clearly, EPA's critics are more likely to imply incorrectly that§ 404(c) depends on impacts being immitigable. NDM's comments falsely imply as much.

<u>EPA Response:</u> See response to Comment J.3.

J.6 Third, the principle that not all unavoidable impacts are susceptible to compensatory mitigation then flows naturally from the fact that standards and criteria exist. It flows naturally because any meaningful standard or criterion may be met, or not met, in a given situation. That point bears directly on this situation. In this situation, the proposals for compensatory mitigation do not appear to meet the standards and criteria, as discussed below and in Appendix J.

<u>EPA Response:</u> See response to Comment J.3.

J.7 Fourth, the definitions of "compensatory mitigation" and "compensatory mitigation project" then lay a foundation for subsequent discussion of mitigation methods in Sections 1.1 and mitigation mechanisms in Section 1.2 [of Appendix j]. The first of the general standards and criteria stated in 40 CFR § 230.93(a)(1) then lay a foundation for subsequent discussion of other, more specific, standards later in the overview of the regulations.

<u>EPA Response:</u> See response to Comment J.3.

J.8 Finally, this alternative draft cites four sections of the regulations in the order in which they are codified: i.e., 40 CFR §§ 230.91(a)(l), 230.91(c)(3), § 230.92, and 230.93(a)(1). In contrast, the original paragraphs discuss§ 230.93(a)(l) before§ 230.91(c)(3). This lack of proper sequence can mislead readers to infer, incorrectly, that compensatory mitigation is always available, and then overlook the last sentence of the second paragraph which says otherwise, but almost as an afterthought. The point that compensatory mitigation is not always available is important, so I made it the topic sentence of the third paragraph.

<u>EPA Response:</u> See response to Comment J.3.

J.9 Although proposals for compensatory mitigation of unavoidable impacts of developing the Pebble deposit do not meet the first and/or second criteria stated in 40 CFR § 230. 93(a)(l), above, that problem is compounded by the fact that other metallic sulfide deposits exist in the Kvichak and Nushagak drainages, and that other deposits could be mined if the infrastructure necessary to develop the Pebble deposit leads to developing other deposits. However, Appendix J focuses on mitigation of developing the Pebble deposit which is in advanced exploration. Appendix J says nothing directly about other potential mines even though the assessment takes drainage-wide approach and applies to all these potential mines. Moreover, an advance § 404(c) determination makes sense because multiple deposits exist (see footnote 1, above). Therefore, Appendix J should also address compensatory mitigation in the context of multiple mines. To do so, Appendix J should identify relevant portions of the δ404(b)(1) Guidelines on compensatory mitigation to provide a framework for addressing multiple mines when one is in advanced exploration and others are not. One candidate for that framework is the requirement in the Guidelines that an applicant for a δ404 permit prepare and obtain approval from the Corps of a "Mitigation Plan" prior to issuance of a permit.[40 CFR δ230.94(c)(1)]. The Mitigation Plan must include: (1) a description of the factors considered during the site selection process and this should include consideration of watershed needs, on-site alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site; and (2) and "adaptive Management Plan" [See 40 CFR δ230.04(c)(4) and 40 CFR δ230.94(c)(12).

<u>EPA Response:</u> **Appendix J discusses an array of measures that various entities have proposed as having the potential to compensate for the unavoidable impacts to wetlands, streams, and fish identified in the assessment. Whereas some of these measures are specific to the North Fork Koktuli, South Fork Koktuli, and Upper Talarik Creek watersheds, others are applicable across the entire Nushagak and Kvichak River watersheds. In discussing the array of proposed measures, consideration was given to watershed needs, on-site alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site.**

J.10 "Adaptive Management" means that which "anticipates likely challenges associated with compensatory mitigation projects" and requires consideration of the risk, uncertainty, and dynamic nature of compensatory mitigation projects. [40 CFRδ230.92] An "Adaptive Management Plan" is –

A management strategy to address unforeseen changes in site conditions or other components of the compensatory mitigation project, including the party or parties responsible for implementing adaptive management measures. The adaptive management plan will guide decisions for revising compensatory mitigation plans and implementing measures to address both foreseeable and unforeseen circumstances that adversely affect compensatory mitigation success. [40 CFR δ 230.94 (c)(12)]Thus, when foreseeable and unforeseen circumstances adversely affect mitigation success, the Adaptive Management Plan in theory provides an option, such as an alternative site to replace or supplement the original mitigation project.

However, as a practical matter, metallic sulfide deposits occur in groups. This is the case in the immediate vicinity of the Pebble deposit. Therefore, whenever there are insufficient options for compensatory mitigation for developing one deposit, the theory that Adaptive Management plans will accommodate failure of mitigation breaks down, not only for that one mine. But even more so for multiple mines in the immediate vicinity. That is because each Adaptive Management Plan is likely to compete with the other Adaptive Management Plans for a limited set of adaptive options in the same vicinity.

<u>EPA Response:</u> **We agree that potentially effective compensatory mitigation options for impacts of this type and magnitude in this region are limited. We believe this notion is already adequately captured by Appendix J.**

J.11 Appendix J should address more thoroughly the requirement that options for compensatory mitigation are assessed in part by the "likelihood for ecological success and sustainability." Appendix J focuses mostly on whether suitable sites or opportunities for compensatory mitigation exist either within the North and South Fork Koktuli River and Upper Talarik Creek watersheds, or off-site and/or out-of-kind. The conclusion that adequate sites do not exist would be strengthened by initial and additional focus on whether potential compensatory mitigation projects are likely to be self-sustaining. That is because the regulations, in stating a host of requirements, standards, criteria and considerations throughout 40 CFR § 230.93, begin with the following general requirements and considerations:

The fundamental objective of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the United States authorized by DA permits. The district engineer must determine the compensatory mitigation to be required in a DA permit, based on what is practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity. When evaluating compensatory mitigation options, the district engineer will consider what would be environmentally preferable. In making this determination, the district engineer must assess [three criteria]: [1] the likelihood for ecological success and sustainability, [2] the location of the compensation site relative to the impact site and their significance within the watershed, and [3] the costs of the compensatory mitigation project. … Compensatory mitigation requirements must be commensurate with the amount and type of impact that is associated with a particular DA permit.

<u>EPA Response:</u> Appendix J has been expanded to include new compensatory mitigation measures identified in public comments on the revised assessment. Additional measures within the North Fork Koktuli, South Fork Koktuli, and Upper Talarik Creek watersheds are discussed, as well as additional potential measures across the larger Nushagak and Kvichak River watersheds. Where appropriate, both the efficacy and sustainability of these measures are discussed.

J.12 Appendix J concludes that because so much of the area is undeveloped, there are not sufficient sites to restore or enhance as compensatory mitigation. In other words, the conclusion of Appendix J is based mostly on the second criterion (the location of a compensation site relative to the impact site and their significance within the watershed) and less so on the first criterion (the likelihood for ecological success and sustainability).

<u>EPA Response:</u> We disagree with this assertion. Conclusions in Appendix J are based on both criteria mentioned above. Also see response to Comment J.11.

<u>Bristol Bay Native Corporation (Doc. #5438)</u>

J.13 The discussion of compensatory mitigation in Appendix J of the Revised Assessment represents a significant improvement over the general discussion of mitigation that was included as Appendix I of the Draft Assessment. Appendix J clarifies that CWA regulations prohibit issuance of a 404 permit where appropriate and practicable compensatory mitigation measures are lacking.[95] It is also clear from the discussion in Appendix J and from earlier analyses[96] that existing opportunities to mitigate the impacts of the Pebble Mine as proposed, as well as those of the new smaller 20-year, 0.25 billion ton mine scenario analyzed in the Revised Assessment, are highly unlikely to meet the CWA 404 regulatory requirements.

<u>EPA Response:</u> Comment noted; no response required.

J.14 BBNC's 2012 Comments and Technical Submissions:

Site-Specific Mitigation: "Whereas Appendix I discusses mitigation practices and descriptions of mining industry standard practices, this 24-page report offers no specifics about the Bristol Bay watershed or mitigation practices therein" and "falls short of assessing the likelihood that a mine would be constructed that could adequately offset habitat losses." *BBNC's 2012 Comments and Technical Submissions:*

Revised Bristol Bay Watershed Assessment: In the Revised Assessment, EPA added Appendix J to assess compensatory damages.

*BBNC's Response to the Revised Bristol Bay Watershed Asses*sment: The discussion of compensatory mitigation in Appendix j of the Revised Assessment represents a significant improvement over the general discussion of mitigation that was included as Appendix I of the initial draft BBWA.

<u>EPA Response:</u> Comment noted; no response required.

J.15 BBNC's 2012 Comments and Technical Submissions:

BBNC's Recommendation: "We recommend that EPA address in the Final Assessment the risks/probabilities that such losses could be adequately offset through compensatory mitigation measures. This discussion should include examples of large hardrock mining operations that have excavated and/or filled large areas of fisheries habitat and wetlands where those direct impacts have been either benign or offset by compensatory mitigation measures.

Revised Bristol Bay Watershed Assessment: In the Revised Assessment, EPA added Appendix J to assess compensatory damages.

*BBNC's Response to the Revised Bristol Bay Watershed Asses*sment: The discussion of compensatory mitigation in Appendix j of the Revised Assessment represents a significant improvement over the general discussion of mitigation that was included as Appendix I of the initial Draft Assessment. The analysis in appendix j provides ample support for the conclusion that there are no appropriate and practicable compensatory mitigation measures that would adequately offset the specific aquatic resource losses that would result from development of either the Pebble Mine or the BBWA mine scenarios.

<u>EPA Response:</u> Comment noted; no response required.

J.16 Ecological Functions of Lost Aquatic Resources. The discussion of the ecological functions of the streams and wetlands that would be lost under each of the Revised Assessment mine scenarios is important and on-the-mark. EPA recognizes the enormity of the number of acres and miles of wetlands and streams that would be lost, as well as the important and unique ecological functions that these waters perform. EPA acknowledges that it is these functions—indeed, the whole suite of functions—that would have to be replaced through compensatory mitigation. Particularly important is EPA's acknowledgment that the losses of streams and wetlands would affect genetically unique populations of salmon, undermining the stability of the overall Bristol Bay fishery that depends on the genetic diversity of individual populations (the "portfolio effect").

<u>EPA Response:</u> Comment noted; no response required.

J.17 Lack of Appropriate and Practicable Compensatory Mitigation Measures. EPA acknowledges that all three compensatory mitigation mechanisms—mitigation banks, in-lieu fee programs, and permittee-responsible mitigation—share the fundamental problem that there simply are not opportunities for mitigation that could effectively replace the suite of aquatic functions that would be lost under the Revised Assessment mine scenarios. As EPA states: In the context of the mine scenario, the primary challenge to both a watershed approach and on-site compensatory mitigation is the absence of existing degraded resources and watershed needs within the NFK, SFK and UTC watersheds. Specifically, these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios.

EPA Response: Comment noted; no response required.

J.18 Beaver Dam Removal. EPA's assessment reviews the scientific evidence concerning the impact of beaver dams on salmonid species and concludes that the impacts are more positive than negative.[105] EPA may also want to cite the findings of Pebble Partnership studies (as cited at footnote 117 in Yocom & Bernard 2013) that beaver ponds provide important habitat for salmonids.

EPA Response: Comment noted; no response required.

J.19 Flow Management. EPA properly concludes that, even if a flow management system were shown to successfully control water temperature in water discharges, this system would be required as a measure to minimize impacts rather than as a compensatory mitigation measure.[106] In addition, such measures would require difficult, unprecedented, and perhaps even impossible, perpetual management and maintenance.

EPA Response: Comment noted; no response required.

J.20 Spawning Channels. There is inadequate scientific evidence of success with such measures. The constant maintenance such channels require would be inconsistent with the requirement that compensatory mitigation projects be self-sustaining.

EPA Response: Where appropriate, both the efficacy and sustainability of compensation measures are discussed.

J.21 Preservation. EPA states that a preservation approach to compensatory mitigation "would require a site that is very large, performs similarly important aquatic functions, and is under threat of destruction or adverse modification."[108] EPA should go further and acknowledge that, under the Section 404 regulations, the mitigation site would be required to perform not just "similarly important aquatic functions," but the same suite of aquatic functions as the resources lost to mining.[109] As EPA points out, no one has identified any such site and, perhaps even more importantly, there is no precedent for such a preservation-dominated mitigation approach in the context of this type and magnitude of ecological loss.

EPA Response: The recommended change is outside the scope of this assessment.

J.22 Old Mine Site Remediation, Road Removal, and Road Stream Crossing Retrofits. EPA correctly notes that, although there are degraded sites that could benefit from restoration or enhancement, these are few and scattered, located in more distant portions of the broader Nushagak and Kvichak watersheds, and simply not adequate in size or type to offset aquatic resource losses associated with the mine scenario.[110] Additionally, the use of such distant sites as compensatory mitigation would not be consistent with the Section 404 regulations:

Defining the watershed scale this broadly …would likely fail to effectively compensate for the adverse environmental impacts of the permitted discharge-the fundamental requirement of the Mitigation Rule. The genetic differences between individual salmon stocks in various drainages, and the importance of this genetic diversity to the overall stability of the Bristol Bay salmon fishery, undermine the value of mitigation measures designed to protect aquatic resources in a drainage far from the site of impact.

EPA Response: **Comment noted; no response required.**

J.23 Hatchery Construction. Hatcheries would pose more ecological risks than benefits.[112] To put it simply, it would be inconsistent with the Section 404 regulations' emphasis on replacing lost aquatic functions to mitigate for impacts to wild—and genetically unique—salmon populations by introducing hatchery fish with all their attendant ecological problems.

EPA Response: **Comment noted; no response required.**

J.24 Fish Stocking. For the same reasons, fish stocking poses more ecological risks than benefits.

EPA Response: **Comment noted; no response required.**

J.25 Commercial Fishery Harvest Reductions. Not only would this measure not be effective in mitigating impacts, as EPA states,[114] but there would be a fundamental inequity in forcing an existing and sustainable user group to reduce its impacts to compensate for the impacts of a new and non-sustainable user.

EPA Response: **Comment noted; no response required.**

J.26 Other Suggested Compensation Measures. BBNC agrees with EPA's conclusion that payments to organizations for education, outreach, and research may be beneficial but do not constitute compensatory mitigation under the regulations.

EPA Response: **Comment noted; no response required.**

J.27 Notably EPA's compensatory mitigation conclusion is weaker than the analysis that precedes it. EPA concludes that "[t]here are significant challenges regarding the potential efficacy of compensation measures proposed by commenters for use in the Bristol Bay region, raising questions as to whether sufficient compensation measures exist that could address impacts of this type and magnitude."[97] Yet the analysis in Appendix J supports the stronger conclusion that the mine scenarios (and the Pebble Mine as proposed) would not qualify for a Section 404 permit because of the lack of sufficient appropriate and practicable compensatory mitigation measures to offset the type and magnitude of aquatic resource losses. As EPA points out, any large mine at the Pebble deposit would directly destroy hundreds to thousands of acres of high-functioning wetlands and tens of miles of salmon streams.[98] These streams and wetlands are not replaceable or fungible. Not only do they provide important ecological functions, they also support genetically unique salmon populations that are part of the overall population diversity that is key to the stability of the Bristol Bay salmon fishery.[99] Appendix J, and the earlier analysis in Yocom & Bernard 2013, thoroughly support the conclusion that there are no reasonable or practicable compensatory mitigation measures that could adequately offset the impacts of mining the Pebble deposit within the affected or nearby watersheds.

<u>EPA Response:</u> See response to Comment J.21.

J.28 The Revised Assessment is founded on a thorough review of existing literature on the fishery and water resources of Bristol Bay, takes local knowledge of those resources into account, and includes a solid assessment of the risks posed to those resources by potential large-scale mining in the region. EPA has greatly strengthened and clarified the science and estimation of risks throughout the Revised Assessment, and EPA's robust peer review and public comment process support these strong scientific findings. BBNC respectfully urges EPA to finalize the assessment without delay so that it can be relied on by agency decisionmakers, stakeholders, and the general public as a valuable information resource and as a guide in future federal, State, and local decision-making processes affecting the waters, fishery resources, and Alaska Native cultures of Bristol Bay.

<u>EPA Response:</u> Comment noted; no response required.

J.29 Appropriate Watershed Scale. The discussion correctly acknowledges that the most appropriate watershed scale is the affected drainages themselves—North Fork Koktuli ("NFK"), South Fork Koktuli ("SFK"), and Upper Talarik Creek ("UTC"). EPA correctly recognizes that this scale is most appropriate because compensatory mitigation in these drainages would have the greatest likelihood of replacing the suite of functions lost to mining, in particular impacts to salmon populations that are unique to these drainages. In addition, it is important to note that watersheds (as delineated by the U.S. Geological Survey) are much larger on average in Alaska, due to mapping-scale differences, and that additional caution is therefore warranted in considering mitigation measures outside of the immediate drainages where the impacts occur.

<u>EPA Response:</u> Comment noted; no response required.

J.30 *Appendix J should discuss more thoroughly why preservation of other resources is not an option.* Preservation of other resources as an option for compensatory mitigation requires that all of the following conditions be met: (i) The resources to be preserved provide important physical, chemical, or biological functions for the watershed; (ii) The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available; (iii) Preservation is determined by the district engineer to be appropriate and practicable; (iv) The resources are under threat of destruction or adverse modifications; and (v) The preserved site will be permanently protected through an appropriate real estate or other legal instrument (e.g., easement, title transfer to state resource agency or land trust)

<u>EPA Response:</u> The regulatory provisions regarding preservation at 40 C.F.R. §230.93(h) are summarized and cited in Section 1.1 of Appendix J.

J.31 EPA can strengthen the conclusion of Appendix J that inadequate compensatory mitigation sites exist by revising Appendix J to state clearly how it assesses the first criterion. Doing so is important for two reasons. First, the regulations require a mitigation plan for any § 404 permit, 14 and the mitigation plan must consider the practicability of accomplishing ecologically "self-sustaining" compensation. 15 Second, in this instance, many of the suggestions that have been made for compensatory mitigation projects in the North and South

Forks of the Koktuli River and Upper Talarik Creek would not be self-sustaining. These include proposals to: remove beaver dams; construct or improve spawning channels; re-connect old stream channels and isolated ponds to the present channel; create habitat by placing boulders, logs and root wads in waters; and improve the water chemistry for biological productivity by managing the effluent of the waste water treatment plant. 16 Such projects would require perpetual maintenance and would not meet the criterion that projects be self-sustaining. Instead, they would require perpetual care to assure that natural processes such beavers and floods that naturally rearrange stream systems, constantly destroying and creating habitat at any given location, would not alter these human constructions, rendering them ineffective as mitigation for lost habitat. Perpetual care and maintenance is required to ensure that these mitigated ecosystems do not continue to operate naturally. As is discussed elsewhere in the assessment, perpetual care is unlikely.

<u>EPA Response:</u> See response to Comment J.11.

J.32 Resolving that issue will require EPA to apply the § 404(b)(1) Guidelines 1 to the facts. The executive summary of the assessment summarizes the facts with respect to the context (pp. ES 1- ES 14) and unavoidable and likely impacts (pp. ES 14–ES 26). However, the assessment is not regulatory action. For the most part, it addresses only a portion of the Guidelines, and only in Appendix J with respect to regulations that govern compensatory mitigation. Compensatory mitigation applies to impacts that would occur despite measures to avoid or minimize adverse effects. Impacts that would occur, or are likely to occur, and which are unacceptable to EPA, can be the basis of a § 404(c) determination and any prohibitions or restrictions therein. Appendix J concludes that compensatory mitigation faces challenges in this situation and questions whether sufficient measures exist that could address impacts. Hence, my focus is on suggestions to improve Appendix J and identify the prohibitions and restrictions implied by the assessment.

<u>EPA Response:</u> Comment noted; no response required.

J.33 After an overview of the regulations, Appendix J discusses potential actions that have been offered, conceptually, to address the impacted fish stocks in the North and South Forks Koktuli River and Upper Talarik Creek, including mitigation bank credits, in-lieu fee program credits, beaver dam removal, management of stream flows, construction of spawning channels, and preservation of otherwise threatened areas.[22].

<u>EPA Response:</u> Comment noted; no response required.

J.34 The immediate and surrounding watersheds are in near pristine condition and face no threats other than from mining. Artificial stream and wetland enhancement efforts in these watersheds require perpetual maintenance to be effective, which is unlikely to occur. The relative absence of sites needing restoration or enhancement, and of sites or areas otherwise threatened and needing preservation other than from mining, make compensatory mitigation impracticable and incapable of meeting the requirements, conditions, and criteria stated in the regulations.

<u>EPA Response:</u> Comment noted; no change required.

Region 10 Tribal Operations Committee (Doc. #5658)

J.35 The Tribal Caucus strongly supports the findings of the Assessment. The revision to the Assessment addressed many of the shortcomings in the previous draft that the Tribal Caucus supports. Particularly, the Tribal Caucus supports the revisions that include:… Addition of an appendix describing methods to compensate for impacts to wetlands, streams and fish.

EPA Response: **Comment noted; no change required.**

Resource Development Council (Doc. #5489)

J.36 The BBA includes discussion on potential mitigation efforts in response to large-scale hardrock mining in the Bristol Bay watershed that is based on hypothetical measures, which do not consider new industry standards or innovative practices. Additionally, the section on compensatory mitigation was cursory and dismissive; the importance of this issue is belittled through the EPA's wholly inadequate 16-page treatment of the topic.

EPA Response: **Appendix J has been expanded to include new compensatory mitigation measures identified in comments on the revised assessment.**

The Pebble Limited Partnership (Doc. #5536, #5535, and #5752)

J.37 Although USEPA has included a new appendix on compensatory mitigation, no mitigation measures are incorporated into the assessment. EPA provides a general overview of Compensatory Mitigation concepts (Appendix J) and basically concludes that sufficient compensation measures that could address impacts defined in the report do not exist. Several of the unsupported key assumptions within this appendix are clearly erroneous. For example, the Assessment assumes that mitigation options located within the other watersheds throughout the Bristol Bay region would be excluded. This assumption about mitigation location, however, is contrary to standard practice in Alaska which addresses wetlands mitigation on a regional watershed basis and assumes that large-scale compensatory mitigation is unachievable for mining projects in the Bristol Bay region because there are few degraded wetlands to enhance or restore. In fact, preservation is the most common form of compensatory mitigation in Alaska and there are case studies that document the feasibility of large-scale preservation projects. The Assessment's evaluation of compensatory mitigation has been conducted before PLP has submitted a formal Compensatory Mitigation Plan, a requirement of the permitting process. Other mitigation options not included within the seven options evaluated by the Assessment would show that mitigation is possible. The Assessment's premature dismissal of effective mitigation is based on false assumptions and is indicative of the superficial nature of the study. It appears to be an ill-informed attempt to supersede an essential step of the permitting process.

EPA Response: **Mitigation measures are discussed throughout the assessment. Scenarios assume that modern conventional mining technologies and practices are utilized and the assessment considers risks from routine operation of a mine designed using modern conventional mitigation technologies and practices. Also see response to Comment J.11.**

J.38 Mitigation: The BBA includes a new appendix, J, to discuss compensatory mitigation. The BBA states "a complete evaluation…is considered outside the scope of the assessment." The BBA acknowledges that this evaluation is incomplete, yet uses this evaluation to infer conclusions about the efficacy of mitigation.

EPA Response: Appendix J clearly states that any formal determinations regarding compensatory mitigation can only take place in the context of a regulatory action. The assessment is not a regulatory action, and thus a complete evaluation of compensatory mitigation is considered outside the scope of the assessment.

J.39 Excerpt from BBA, Appendix J, preface:

Comments from the public and peer review members on the May 2012 draft Bristol Bay Assessment raised concerns that the topic of compensatory mitigation was not adequately addressed, in particular that the discussion of compensatory mitigation included in Appendix I of the May 2012 draft assessment did not discuss the efficacy of potential compensatory mitigation measures. In response to these comments, this appendix, which focuses exclusively on compensatory mitigation, has been added to the Bristol Bay Assessment. This appendix provides an Overview of Clean Water Act Section 404 compensatory mitigation requirements for unavoidable impacts to aquatic resources and discusses an array of measures that various entities have proposed as having the potential to compensate for the unavoidable impacts to wetlands, streams, and fish identified in the Bristol Bay Assessment. Please note that any formal determinations regarding compensatory mitigation can only take place in the context of a regulatory action. The Bristol Bay Assessment is not a regulatory action, and thus a complete evaluation of compensatory mitigation is considered outside the scope of the assessment.

HDR comment:

The introduction to this new appendix specifically addresses the need for a response to compensatory mitigation with regard to the efficacy of potential compensatory mitigation measures. There has been no public mitigation plan proposed by Pebble. The EPA not only moves too quickly to judge mitigation of any mining project in the Bristol Bay region without a mitigation plan, but they also fail to mention successful mitigation of other large projects in Alaska. Speculating Pebble's mitigation plan, the EPA responds to whether EPA-driven potential mitigation measures will work to compensate for the impacts of mining scenarios. Seven measures are discussed in Appendix J. This appendix sticks close to the federal compensatory mitigation regulations and does not make any recommendations or mention of opportunities that work within the inherent flexibility described in the regulations. There is no discussion or recognition of innovative EPA and ACOE approved compensatory mitigation projects from other large scale Alaska projects. The assessment acknowledges that this evaluation is incomplete, yet uses the information to make predictive conclusions about the efficacy of mitigation. It is equally possible that complete evaluation could find that compensatory mitigation is effective.

EPA Response: See response to Comment J.11.

J.40 Compensatory mitigation is an essential element of any valid mine scenario risk analysis. Compensatory mitigation is required by federal law and would be imposed on any mining project in the region. But rather than prepare a realistic ecological risk assessment, EPA chose to cut out essential parts the permitting process – the requirements for minimization of risks and compensation for any remaining harms. Omitting those requirements produced risk scenarios that are vastly overstated.

<u>EPA Response:</u> **The potential for compensatory mitigation is addressed in Box 7-2 and Appendix J. The assessment considers the risks at the sites in question. Even if compensatory mitigation were to occur elsewhere in the watershed, the risks in this particular area would remain the same. Also see response to Comment J.11.**

J.41 Preservation is the most common form of compensatory mitigation in Alaska and there are case studies to support large-scale preservation projects. For example, the Port of Anchorage Expansion (Anchorage, Alaska) purchased credits from a mitigation bank and from an in-lieu fee sponsor (who in turn partnered with a Tribal corporation) to preserve 5,000 acres of floodplain habitat. The expansion also involved two permittee-responsible mitigation projects. The permittee-responsible mitigation projects are notable because they were both off-site and out-of-kind mitigation projects located miles away from the impact areas. The justification for off-site and out-of-kind mitigation was to direct benefits for anadromous fish migrating from near the impact area in Cook Inlet to spawning and rearing areas in the Knik and Matanuska Rivers. Also the in-lieu fee was used to purchase the estuary property at the mouth Campbell Creek in Anchorage. While the Port project is located along Knik Arm, the estuary is about 10 miles distant and it does not drain into Knik Arm. The estuary was considered appropriate for use as mitigation because it benefitted beluga whales and salmon; two potentially impacted species targeted by a multi-agency mitigation planning process.

<u>EPA Response:</u> **Appendix J recognizes that preservation is an acceptable form of compensatory mitigation in certain circumstances and is fairly common in Alaska. Decisions regarding the appropriate type, amount, and location of compensatory mitigation are made on a case-by-case basis and depend on a number of factors including the type, amount and location of aquatic resources being impacted. The example project cited in the comment, the permit for the expansion of the Port of Anchorage (#POA-2003-502), involved impacts to aquatic resources that differ significantly in type, amount, and location when compared to the impacts considered in the assessment. Thus, comparisons of the compensation required for the impacts associated with the port expansion are neither appropriate nor illustrative with regard to potentially appropriate compensation for the impacts described in the assessment. For example, the permit for the Port of Anchorage expansion authorized, overall, a total of 159 acres of fill, with 138 acres being intertidal mudflats/subtidal waters and the other 21 acres being freshwater wetlands. Although the Port of Anchorage expansion was a comparatively large impact for the State of Alaska, the project site was along an already impacted urbanized/industrialized area. In contrast, the impacts associated with the assessment mine scenarios involve the loss of tens of miles of salmon-supporting streams and hundreds to thousands of acres of associated, high-functioning wetlands, in a virtually unaltered region of Alaska that supports a world-class fishery.**

J.42 Excerpt from BBA, Appendix J, p. 5:

A 2011 supplement to the Alaska District's 2009 guidance further recommends that projects in "difficult to replace" wetlands, fish-bearing waters, or wetlands within 500 feet of such waters will also likely require compensatory mitigation, as will "large scale projects with significant aquatic resource impacts," such as "mining development" (ACOE 2011).

HDR comment:

The actual quote is "Compensatory mitigation will likely be required when: fill placed in fish bearing waters and jurisdictional wetlands within 500' of such waters when impacts are determined more than minimal." The "difficult to replace" wetlands are mentioned separate from fish bearing waters as is the "large scale projects" comment. Stating "mining development" is one example of a "large scale project" is true, but other examples include highway, airport, pipeline, and railroad construction projects. These quotes were pulled to support the argument of the Appendix and may lead the reader to assume they are all in this particular order in the referenced document.

Citation:

ACOE (U.S. Army Corps of Engineers). 2011. Memorandum for Regulatory Division, Alaska District, 3 March 2011.

EPA Response: We do not agree that the identified sentence misconstrues the meaning or intent of the March 2011 supplement to the Alaska District's 2009 compensatory mitigation guidance. It simply summarizes relevant information from that supplement. A citation for the guidance document is included so that interested readers can access and read the guidance document in its entirety if more information is desired.

J.43 Excerpt from BBA, Appendix J, p. 5

The ACOE's 2009 Alaska guidance also provides sample compensatory mitigation ratios based on the type of mitigation and the ecological value of the impacted resource (high, moderate, or low). These guidelines include streams in the high quality category, indicating compensation ratios of 2:1 for restoration and/or enhancement and 3:1 for preservation (ACOE 2009).

HDR comment: There is only mention of compensatory mitigation ratios for streams. There is mention of ecological values of high, medium, and low, but there is no discussion of the functional assessment of the watershed assessment area and the amount of acreage for each of the assessed functional groups of wetlands or streams. This argument also fails to mention the compensatory mitigation process is limited only to fill placed in streams. Conclusions about mitigation ratios based on this paragraph may lead the reader to understand that all impacts to streams need compensatory mitigation when actually only fill requires compensatory mitigation. The reader doesn't have the opportunity to read about the complexity in developing mitigation ratios. Also, this section fails to mention

> *"The ratios provided below are guidance and represent what a permit applicant should expect as a compensation requirement, thereby providing some predictability. However, a Corps regulator may deviate from this guidance. Corps regulators must make an*

individual determination on the compensatory mitigation ratios required for specific aquatic resource impacts to ensure that the compensation is proportionate to the proposed loss or degradation of an aquatic resource area and/or its functions."

Citation:

ACOE (U.S. Army Corps of Engineers). 2011. Memorandum for Regulatory Division, Alaska District, 3 March 2011.

<u>EPA Response:</u> The sentences identified in the comment do not attempt to draw any conclusions regarding potential ratios that might apply in an actual permitting context for any specific project. These sentences simply summarize and highlight relevant points from the guidance document. A citation for the guidance document is included so that interested readers can access and read the guidance document in its entirety if more information is desired.

J.44 Excerpt from BBA, Appendix J, p. 6:

In the northeastern United States, headwaters contribute approximately 70% of the water volume and 65% of the nitrogen flux to second-order streams and 55% of the volume and 40% of the nitrogen flux to fourth-and higher-order rivers (Alexander et al. 2007) …Headwater streams also have high rates of instream nutrient processing and storage due to extensive hyporheic zone interactions resulting from a large bed surface area compared to the volume of the overlying water (Alexander et al. 2007).

HDR comment:

Poor references. There is no reference to headwater contribution in northwestern streams. Irrelevant and unnecessary citations assuming the research in the northeastern US is ubiquitous for all headwaters everywhere. There is no data or research-supported discussion of the Bristol Bay watershed nutrient processing or extensive hyporheic zones. Relevant references are needed to support this argument. Concluding headwaters in the Bristol Bay watershed have similar biogeochemical processing to northeastern US waters without any relevant data or research is unnecessary.

<u>EPA Response:</u> This section of Appendix J has been revised to include additional citations that underscore the important ecological functions and services provided by affected streams and wetlands.

J.45 Excerpt from BBA, Appendix J, p. 6:

The losses of headwater streams and wetlands due to the mine footprint would reduce inputs of organic material, nutrients, water, and macroinvertebrates to reaches downstream of the mine footprints.

HDR comment:

This conclusion assumes there are large biochemical inputs into downstream waters by headwater wetlands and streams. The assumption is that there will be less inputs that will affect fish populations. There is no data to support this assumption in the BBA area and the citations referenced supporting this statement are based on inputs from grass-dominated headlands (Dekar, et. al. 2012), bluejoint grass litter in headwater streams of the Kenai Peninsula (Shaftel, et. al. 2011), macroinvertebrate community structure and salmonid distributions driven by catchment topography and wetland geomorphology in southcentral Alaska (King, et.al. 2012), and landscape and wetland influences on headwater stream chemistry in Kenai Lowlands (Walker, et. al. 2012). This conclusion is unsupported as there is no data from the BBA area and the conclusions drawn need data to support the detailed claims.

<u>EPA Response:</u> See response to Comment J.44.

J.46 EPA creates a series of assumptions based on a limited watershed scale where they assume mitigation must occur. That is, EPA assumes a watershed scale with only the UT, SFK, and NFK watersheds. There is precedent for larger watershed scales in Alaska, which EPA fails to acknowledge.

<u>EPA Response:</u> See response to Comment J.11.

J.47 Several assumptions within this appendix are not supported by case studies in Alaska or by the literature referenced within the document. The BBA assumes that compensatory mitigation must occur within a small watershed scale that would include the three local drainages near the deposit. The BBA also assumes that mitigation options located within the other watersheds throughout the Bristol Bay region would be excluded. These assumptions about the location of compensatory mitigation are contrary to standard practice in Alaska which addresses wetlands compensatory mitigation on a regional watershed scale. For example, The Point Thomson Project's permit allows for compensatory mitigation to occur through The Conservation Fund's in-lieu fee permit. The geographic range for this project's compensatory mitigation is the Arctic coastal plain of the North Slope Borough, an area that extends west of Barrow, which is located over 200 miles from the Canning River where Point Thomson Project is generally located. As another example, the Usibelli Coal Mine near Healy, recently received an approved permit that included mitigating impacts to wetlands through permittee-responsible preservation at a site that is located more than 80 miles away near Fairbanks. The mitigation site was approved by the resource agencies due to several factors, one of which was that the site was located in the same regional watershed as the mine; this regional watershed being Interior Alaska.

The BBA makes an argument against compensatory mitigation projects outside the drainages containing the Pebble deposit (the North Fork Koktuli, South Fork Koktuli, and Upper Talarik) based on a concept termed the portfolio effect. This concept of an ecological portfolio effect for Bristol Bay sockeye salmon is described in a 2010 paper by Schindler et al. Schindler et al. propose that a diversified genetic population of sockeye salmon in the Bristol Bay region is essential for supporting a sustainable commercial fishery. The scale of Schindler's analysis includes nine major rivers (Alagnak River, Egegik River, Igushik River, Kvichak River, Naknek River, Nushagak River, Togiak River, Ugashik River, and Wood River) and, as reported, hundreds to thousands of discreet populations of sockeye salmon. From this analysis, the BBA asserts that impacts to streams within the mine footprint will eliminate one or more sockeye populations and therefore, will degrade genetic diversity and weaken the stability of Bristol Bay sockeye salmon. The BBA does not include data on the genetics or life history of the sockeye salmon within the footprint or fish located downstream to indicate that these fish make up a genetically distinct population component. Without such data, these hypothetical impacts to the stability of Bristol Bay sockeye salmon from reduction of the sockeye salmon located in the mine are unknown and unfounded. The BBA proposes to constrain compensatory mitigation to a small watershed scale without having the necessary genetic data to support this concept.

EPA Response: See response to Comment J.11. Appendix J does not constrain compensation options to exclusively within the North Fork Koktuli, South Fork Koktuli, and Upper Talarik Creek watersheds. Rather, it points out a compelling reason why compensation options within these three watersheds should be carefully considered. Also, as clarified in the revisions to Appendix J, in the Bristol Bay region, hydrologically-diverse riverine and wetland landscapes provide a variety of salmon spawning and rearing habitats. Environmental conditions can be very different among habitats in close proximity, and recent research has highlighted the potential for local adaptations and fine-scale population structuring in Bristol Bay and neighboring watersheds (Quinn et al. 2001, Olsen et al. 2003, Ramstad et al. 2010, Quinn et al. 2012). No comments provided any information to suggest that fish within the footprint of the mine or located downstream are not part of genetically distinct populations.

J.48 Excerpt from BBA, Appendix J, p. 6

For the mine scenarios evaluated in the Bristol Bay Assessment, the lost functions and services occur in the watersheds that drain to the North Fork Koktuli (NFK) and South Fork Koktuli (SFK) Rivers and Upper Talarik Creek (UTC). Accordingly, the most appropriate geographic scale at which to compensate for any unavoidable impacts resulting from such a project would be within these same watersheds, as this location would offer the greatest likelihood that compensation measures would replace the “suite of functions typically provided by the affected aquatic resource” (40 CFR 230.93(c)(2)). An important consideration is that compensation projects within these watersheds appear to offer the only opportunity to address impacts to salmon populations that are unique to these drainages (Yocom and Bernard 2013) and thus sustain the population diversity that is key to the stability of the overall Bristol Bay salmon fishery (i.e., the portfolio effect) (Schindler et al. 2010). If there are no practicable or appropriate opportunities to provide compensation in these watersheds, it may be appropriate to explore options in adjoining watersheds. However, defining the watershed scale too broadly would likely fail to ensure that wetland, stream and associated fish losses from the mine scenario are effectively offset, because compensation in a different watershed(s) would not address impacts to the portfolio effect from losses in the impacted watersheds.

HDR comment:

This conclusion is not supported by one of the references it cites. According to a conclusion in the Schindler et al. 2010 paper, “Thus, the Bristol Bay sockeye fishery integrates across substantial population diversity both within and among watersheds.” Given this statement, the narrow scope of compensatory mitigation only within NFK, SFK, and UTC watersheds is neglecting the contributions of all watersheds within the Bristol Bay sockeye fishery. This referenced paper considered the entire Bristol Bay watershed including nine major rivers and only studied the diversity and portfolio effect of the sockeye salmon population. The BBA concludes a broadly defined watershed scale would "fail to ensure that wetland, stream and associated fish losses from the mine scenario are effectively offset" which is against the conclusions of the cited Schindler et al. 2010 paper.

Citation:

Schindler, D.E., R. Hilborn, B. Chasco, C.P. Boatright, T.P.Quinn, L.A. Rogers, and M.S. Webster. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465: 609-612.

<u>EPA Response:</u> The comment argues that our conclusion is not supported by Schindler et al. (2010). We sought and received the opinion of the lead author of Schindler et al. (2010), Dr. Daniel Schindler. Schindler disagrees with the points made in the comment. He acknowledges that the Bristol Bay commercial fishery benefits from the portfolio of salmon and habitat across the entire system. According to Schindler, his work also demonstrated that portfolio effects propagate across a hierarchy of scales. At the scale of the Bristol Bay watershed, the overall fishery benefits from portfolio effects that derive from the nine major rivers (including the Kvichak and Nushagak Rivers). However, his work also showed that portfolio effects play out at smaller spatial scales as well. According to Schindler, "[T]the returns to an individual river are dependent on the contributions by individual tributary streams. If you eroded the diversity within an individual river by snipping away at its tributaries, you would reduce the reliability of returns to that river, and at the larger scale, returns to B[ristol] B[ay]…." Schindler concludes that "by eroding the portfolio within small pieces of the overall system, you run the risk of reducing the reliability of the entire system. Whether compensation can make up for losses within a specific watershed are unclear, but probably not likely." (Schindler, D. Professor, University of Washington, College of the Environment, School of Aquatic and Fishery Sciences. September 2013 – Email to Palmer Hough)

J.49 *HDR comment*:

Schindler et al. (2010) also state, "However, at present there are neither quantitative estimates of the strength of portfolio effects produced by population and life history diversity in exploited species, nor an objective assessment of the benefits of population diversity to human economies and ecosystem services in general." Portfolio effects cannot be supported solely based on this paper. The supporting document used (Schindler et. al. 2010) did not support the arguments used in the BBA discussion about keeping the watershed scale very small.

Citation:

Schindler, D.E., R. Hilborn, B. Chasco, C.P. Boatright, T.P.Quinn, L.A. Rogers, and M.S. Webster. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465: 609-612.

<u>EPA Response:</u> The comment argues that our conclusion is not supported by Schindler et al. (2010). We sought and received the opinion of the lead author of Schindler et al. (2010), Dr. Daniel Schindler. He disagrees with the points made in the comment. According to Schindler, the comment has taken the sentence in question out of context. Schindler points out that "the sentence in question was from our Introduction and was

intended to motivate the study we then performed." (Schindler, Daniel. Professor, University of Washington, College of the Environment, School of Aquatic and Fishery Sciences. September 2013 – Email to Palmer Hough)

J.50 Excerpt from BBA, Appendix J, p. 6-7

An important consideration is that compensation projects within these watersheds appear to offer the only opportunity to address impacts to salmon populations that are unique to these drainages (Yocom and Bernard 2013)

HDR comment: This reference "acknowledges the support of BBNC for, and the contributions of Dr. Carol Ann Woody and Sarah L. O'Neal to, the preparation of this article." This reference is not a neutral reference as it acknowledges Bristol Bay Native Association (BBNA) for their support in preparation of this article. BBNA has come out against the Pebble mine.

Citation:

Yocom, T.G. and R.L. Bernard. 2013. Mitigation of Wetland Impacts from Large-Scale Hardrock Mining in Bristol Bay Watersheds. Seattle Journal of Environmental Law, Vol. 3(available at http://www.sjel.org/vol3/mitigation-ofwetland-impacts-from-large-scale-hardrock-mining-in-bristolbay-watersheds (last visited April 5, 2013).

<u>EPA Response:</u> The comment does not identify any technical or scientific deficiency in the reference cited.

J.51 In Appendix J, EPA claims that compensatory mitigation for the Pebble Mine must be conducted within the watersheds that drain the north and south forks of Koktuli River and Upper Talarik Creek. Id. at App. J, 6. According to EPA, these watersheds would offer the "greatest likelihood" that compensatory mitigation would replace the ecological functions lost or affected by the mining activity. Id. Not surprisingly, EPA offers no support for this critical assumption, aside from claiming that "these watersheds appear to offer the only opportunity to address impacts to salmon populations that are unique to these drainages …" Id. at 6-7.

<u>EPA Response:</u> See response to Comment J.11. Appendix J does not constrain compensation options to exclusively within the North Fork Koktuli, South Fork Koktuli, and Upper Talarik Creek watersheds. Rather, it points out a compelling reason why compensation options within those three watersheds should be carefully considered.

J.52 In reality, the compensatory mitigation regulations provide ample flexibility to the permitting authority – in this case the Alaska District of the Corps of Engineers – to select the appropriate scale and location of compensatory mitigation. The regulations require the district engineer to "use a watershed approach to establish compensatory mitigation requirements …to the extent appropriate and practicable." 40 C.F.R. § 230.93(c). The regulations do not mandate the size of the watershed that must be considered in establishing a compensatory mitigation strategy, they simply require that the watershed "should not be larger than is appropriate to ensure that the aquatic resources provided through compensation activities will effectively compensate for adverse environmental impacts resulting from [the permitted] activities … " Id. § 230.93(c)(4). "The district engineer should consider relevant environmental factors and appropriate locally-developed standards and criteria when determining the appropriate watershed scale in guiding compensation activities." Id. Thus, the appropriate watershed scale might include any "land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean." Id. § 230.92 (definition of watershed). The key is to use a "landscape perspective" that will identify the "types and locations of compensatory mitigation projects that will benefit the watershed and offset losses of aquatic resource functions … caused" by the authorized activities, id. (definition of watershed approach), taking into consideration "the likelihood for ecological success and sustainability" and "the location of the compensation site [in relation] to the impact site and their significance within the watershed …" Id. § 230.93(a).

In Alaska, with large tracts of relatively undisturbed areas and an abundance of wetlands and stream resources, the appropriate landscape and watershed scale requires a far different calculus than is used for the more urbanized environments typical of the lower 48 states. That is why the Alaska District of the Corps has adopted special policies for developing compensatory mitigation strategies for projects within its jurisdiction. See, e.g., Alaska District Regulatory Guidance Letter, RGL Id. No. 09-01 (Feb. 25, 2009). Those policies note that the compensatory mitigation regulations "provide flexibility for district engineers to use innovative approaches or strategies for determining more effective compensatory mitigation requirements that provide greater benefits for the aquatic environment." Id. at Tbl. 1. As HDR points out in its June 28, 2013 comments on the draft Assessment, there are several examples of the Alaska District devising suitable compensatory mitigation requirements for large-scale developments in Alaska, including using a large, regional watershed scale approach to mitigation. See HDR Comments at 2-4.

Thus EPA's contention that the Corps must look only to a narrow mine scenario watershed for mitigation opportunities ignores the Corps' policies for compensatory mitigation in Alaska. Below we will briefly describe the ample mitigation opportunities that would be available to the Pebble project – not only regionally, but in the vicinity of the mine.

<u>EPA Response:</u> Appendix J includes a discussion of both the federal compensatory mitigation regulations discussed in the comment as well as the Alaska District Regulatory Guidance Letter. Also see responses to Comments J.11 and J.51.

J.53 Excerpt from BBA, Appendix J, p.7:

The mine scenarios evaluated in the Bristol Bay Assessment identify that the mine footprints alone will result in the loss of (i.e., filling, blocking or otherwise eliminating) hundreds to thousands of acres of high-functioning wetlands and tens of miles of salmon-supporting streams. Such extensive habitat losses could also result in the loss of unique salmon populations, potentially eroding the genetic diversity that is essential to the stability of the overall Bristol Bay salmon fishery (i.e., reduction in the "portfolio effect").

HDR comment:

This paragraph is based on the portfolio effect that Schindler et al. (2010) state, "However, at present there are neither quantitative estimates of the strength of portfolio effects produced by population and life history diversity in exploited species, nor an objective assessment of the benefits of population diversity to human economies and ecosystem services in general." Portfolio effects cannot be supported solely based on this paper. Also, there is no functional assessment of wetlands quantified in the BBA therefore concluding there are "hundreds to thousands of acres of high-functioning wetlands" cannot be supported. Lastly, the Bristol Bay fishery referenced in the Schindler et al. 2010 paper includes nine river systems, two of which are represented in the BBA. The conclusions drawn in this paragraph are not supported by the documents referenced. Also, Pebble has publicly claimed that they will not significantly reduce the population of fish within these drainages. Pebble will be required to submit a fish mitigation plan to the Alaska Department of Fish and Game as a part of the Title 16 permitting process. This state permit can not be issued if Pebble can not prove to avoid meaningful impacts to salmon. If one assumes that Pebble can mitigate salmon in the local watersheds, then the portfolio effect is maintained.

Citation:

Schindler, D.E., R. Hilborn, B. Chasco, C.P. Boatright, T.P.Quinn, L.A. Rogers, and M.S. Webster. 2010. Population diversity and the portfolio effect in an exploited species. Nature 465: 609-612.

EPA Response: This comment raises a number of points. See responses to Comments J.48 and J.49 regarding whether the referenced statements in Appendix J are supported by Schindler et al. (2010). The comment that potentially affected wetlands cannot be described as high functioning because a functional assessment has not been completed ignores the fact that the potentially affected wetlands are largely or completely unaltered, which would by definition make them reference standard wetlands, the highest functioning wetland for that wetland type. Although the Pebble Limited Partnership has made claims that a mine will not significantly reduce the population of fish within affected drainages, there is widespread disagreement regarding whether this is indeed possible.

J.54 Excerpt from BBA, Appendix J, p.7:

Yocom and Bernard (2013) recently reviewed the likely efficacy of a subset of these potential measures at offsetting potential adverse effects.

HDR Comment:

This reference "acknowledges the support of BBNC for, and the contributions of Dr. Carol Ann Woody and Sarah L. O'Neal to, the preparation of this article." This reference is not a neutral reference as it acknowledges Bristol Bay Native Corporation (BBNC) for their support in preparation of this article. BBNC has come out against the Pebble mine.

Citation:

Yocom, T.G. and R.L. Bernard. 2013. Mitigation of Wetland Impacts from Large-Scale Hardrock Mining in Bristol Bay Watersheds. Seattle Journal of Environmental Law, Vol.3, available at http://www.sjel.org/vol3/mitigation-ofwetland-impacts-from-large-scale-hardrock-mining-in-bristolbay-watersheds (last visited April 5, 2013).

<u>EPA Response:</u> The comment does not identify any technical or scientific deficiency in the reference cited.

J.55 Further, the BBA questions the ability of an in-lieu fee provider to perform large-scale compensatory mitigation in Alaska. However, the Conservation Fund has managed more than 320,000 acres of projects in Alaska, and more than 7,000,000 acres across the U.S. (The Conservation Fund 2013a). Within the Bristol Bay region, this effort has included more than 20,000 acres to preserve the "entire length of the 4-mile-long Agulowak River and more than 40 miles of shoreline along lakes Aleknagik and Nerka" (The Conservation Fund 2013b). (http://www.conservationfund.org/projects/wood-tikchik-state-park/).

<u>EPA Response:</u> Appendix J does not question The Conservation Fund's (TCF's) ability to manage land, it highlights the fact that to date the largest single impact for which the program has provided compensation is the loss of 267 acres of wetlands associated with development of the Point Thomson natural gas production/processing facilities on Alaska's Beaufort Sea coast. Thus, as noted in Appendix J, TCF does not have any experience in providing the magnitude of compensation necessary to address the loss of hundreds to thousands of acres of high-functioning wetlands and tens of miles of salmon-supporting streams associated with the assessment's mine scenarios.

J.56 Excerpt from BBA, Appendix J, p.8:

To date, TCF has completed four wetland preservation projects in the Bristol Bay watershed, financed in part with in-lieu fee funds. The majority of in-lieu fees collected by the TCF program have been for relatively small impacts to aquatic resources. Statewide, TCF has accepted in-lieu fees to compensate for a few projects with over 50 acres of impacts; to date, the largest impact represented in the TCF program is the loss of 267 acres of wetlands associated with the development of the Point Thomson natural gas production/processing facilities on Alaska's Beaufort Sea coast. Thus, it is not clear if this program could effectively provide the magnitude of compensation necessary to address the loss of hundreds to thousands of acres of high functioning wetlands and tens of miles of salmon-supporting streams associated with the mine scenario.

HDR comment:

Questioning the effectiveness of The Conservation Fund (TCF) as a viable in-lieu fee program sponsor based on the size of their past projects is not a component of the permitting process. If TCF has not served well as an in-lieu fee program sponsor, that would be considered during the permitting process, but not on sizes of projects past. The logic for this argument is not linear and shows causality where there is no connection.

<u>EPA Response:</u> We disagree with this comment. The fact that the TCF program has never been asked to provide the magnitude of compensation necessary to address the loss of hundreds to thousands of acres of high functioning wetlands and tens of miles of salmon-supporting streams associated with the mine scenario is relevant to the discussion of whether such compensation can be effectively provided, and thus is important to highlight.

J.57 EPA provides a general overview of Compensatory Mitigation concepts (Appendix J) and basically concludes that sufficient compensation measures that could address impacts defined in the report do not exist. Several of the unsupported key assumptions within this appendix are clearly erroneous. For example, the Assessment assumes that large-scale compensatory mitigation is unachievable for mining projects in the Bristol Bay region because there are few degraded wetlands to enhance or restore. In fact, preservation is the most common form of compensatory mitigation in Alaska and there are case studies that document the feasibility of large-scale preservation projects.

<u>EPA Response:</u> See response to Comment J.11. Appendix J recognizes that preservation is an acceptable form of compensatory mitigation in certain circumstances.

J.58 The Assessment quantifies direct and indirect impacts to stream habitat as an absolute expressed in kilometers. The EPA neglects to account for on-site and off-site mitigation and enhancement measures the mine applicant would implement to offset direct impacts and minimize indirect effects. Reasonable mitigation measures that could comfortably be assumed as part of modern mine design might include a mitigation flow distribution plan including groundwater infiltration galleries, spawning channel and off-channel habitat construction, removal of fish barriers, and potential nutrient supplementation. In Box 7-2 of the Assessment, Compensatory Mitigation (p. 7-32), the EPA labels all mitigation as compensatory and challenges the efficacy of mitigation. Developing protection, mitigation, and enhancement measures is a fundamental step in the review process of any large project such as the mine scenarios considered in the Assessment. Failing to acknowledge protection, mitigation, and enhancement measures will be part of any mine application allows the EPA to assume a worst case scenario.

<u>EPA Response:</u> See response to Comment J.11. Appendix J recognizes that some measures, such as flow management plans (if proven to be feasible and ecologically beneficial), would likely be required to minimize the impacts of flow reduction (e.g., aquatic habitat loss) resulting from water use at the mine, rather than compensating for unavoidable impacts.

J.59 Excerpt from BBA, Appendix J, p.9

Specifically, these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could

Restore or enhance to offset the magnitude of impacts expected from the mine scenarios.

HDR comment:

This argument is based on the unsubstantiated use of the term “appear.” There is no supporting data given to allow the use of that term. Preservation should be recognized here as a viable option in Alaska that has been used by numerous and recently permitted projects such as the Point Thomson project.

<u>EPA Response:</u> See response to Comment J.11. Appendix J recognizes that preservation is an acceptable form of compensatory mitigation in certain circumstances. Appendix J includes a lengthy list of citations from the scientific literature to support its findings and conclusions (see References section of Appendix J).

J.60 Excerpt from BBA, Appendix J,p.11:

However, if specific flow management plans prove to be feasible and ecologically beneficial, such measures would likely be required to minimize the impacts of flow reduction (e.g., aquatic habitat loss) resulting from water use at the mine, rather than compensating for unavoidable impacts.

HDR comment:

No explanation as to why measures would "likely" be required to minimize impacts of flow reduction rather than compensating for unavoidable impacts.

EPA Response: As other comments have correctly noted, measures such as flow management, if proven to be feasible and ecologically beneficial, would likely be required to "minimize indirect effects" (e.g., aquatic habitat loss) resulting from water use at the mine, rather than compensating for unavoidable impacts.

J.61 The Assessment Ignores Evidence That Compensatory Mitigation Could Eliminate Any Net Loss of Salmon Habitat. EPA fails to account for compensatory mitigation measures in assessing mine scenario impacts to streams and wetlands. Rather than assess the effectiveness of those measures, EPA claims that it must wait for a "formal regulatory action" (i.e., permitting) before it can analyze this issue and simply notes that there may be "significant challenges regarding the potential efficacy of compensation measures …" Assessment at 7-32. In fact, EPA notes that "there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios." Id. at App. J, 8-9. In reaching this conclusion, EPA committed at least two fundamental errors: (1) the Agency incorrectly narrowed the regional extent of compensatory mitigation opportunities, and (2) it ignored evidence that there are many suitable local mitigation sites. These omissions make EPA's risk scenarios grossly overstated.

EPA Response: See response to Comment J.11. Appendix J includes a lengthy list of citations from the scientific literature to support its findings and conclusions (see References section).

J.62 EPA also claims that there are no mitigation options within these three watersheds that could offset impacts associated with the Pebble project. In support for these sweeping biological conclusions, EPA relies heavily on a recent article written by Thomas Yocum and Rebecca Barnard. Ms. Barnard is a lawyer representing the Bristol Bay Native Corporation in their opposition to the Pebble Mine.[4] Mr. Yocum likewise is an active opponent of the Pebble Mine, recently authoring anti-Pebble reports for the Bristol Bay Native Corporation and Trout Unlimited.

EPA Response: See response to Comment J.61.

J.63 Habitat improvement techniques have a long and successful track record of improving salmon productivity, particularly in the Pacific Northwest and Alaska. There are a variety of proven methods that can be used to promote fish production and habitat productivity, including several within the very same watersheds that EPA has concluded cannot support compensatory mitigation projects. As explained by Buell & Associates:

Physical habitat manipulation within existing stream channels can create new spawning areas and juvenile rearing habitats. Strategic placement of boulders, wood, and other structures can modify water velocity and flow patterns, cause localized scour, and create deposition zones for suitable spawning habitat. Stream channels can be elongated, stream banks can be stabilized, and pools and habitat cover can be created. Seasonal or temporary barriers to water flow can be modified or removed, while permanent means of fish passage over other physical impediments can be provided. As explained by Buell & Associates, these techniques have been used successfully in Alaska, western Canada and the Pacific Northwest to increase the productive capacity of salmonid and other fish habitats with growing sophistication over the past several decades. See id. at 22-41. More importantly, these kinds of techniques can be evaluated to offset impacts in the Pebble deposit watersheds. See id. at 70-73.

<u>EPA Response:</u> See response to Comment J.61.

J.64 Secondary channel and off-channel habitat improvement projects can also successfully increase fish production through the development of new spawning, rearing and overwintering habitat. For example, abandoned channels and cut-off oxbows can be reconnected to main stream channels through targeted reconfiguration projects. New secondary channels and offchannel pond-stream complexes can also be created, making use of surface or groundwater connections to develop the targeted habitat. Deep pools with cover elements, for example, can be incorporated into groundwater-based secondary channel designs to provide overwintering habitats, while lower-velocity secondary channels can be created adjacent to high-velocity stream segments to provide rearing habitat for juveniles. Buell & Associates extensively explain these concepts and successful project examples in their May 22, 2013 paper. See id. at 41-58.

<u>EPA Response:</u> See response to Comment J.61.

J.65 EPA also ignored potential water quantity and water quality-based mitigation techniques that have been successful in promoting fish productivity. The timing and location of water discharges from treatment facilities associated with the Pebble project could be engineered and operated to overcome natural limitations in salmon spawning habitat. See id. at 18. Those discharges can also be controlled to address the biological needs of the three primary watersheds near the deposit by regulating for temperature and water chemistry. See id. at 58-66. Rather than consider these possibilities, EPA assumed that any treatment facility discharge from the Pebble project would have significant negative consequences for the local watersheds encompassing the deposit. As explained by Buell & Associates, "EPA's lack of familiarity with the three principal watersheds, the water flow characteristics within those watersheds, and [the] apparent[] lack of knowledge regarding salmon egg incubation ecology resulted in [its] inappropriate and deleterious water management scenario." Id. at 18. Beneficial water management options can be evaluated as part of the Pebble permitting process. See id. at 70-73.

<u>EPA Response:</u> See response to Comment J.61.

J.66 EPA's failure to consider well-known mitigation techniques and management measures is puzzling. To conclude that "there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios" (Assessment at App. J, 8-9) ignores the published literature and available scientific evidence.

Buell & Associates provide numerous examples of fish habitat mitigation projects that have been successful in this region and context. These options would be evaluated during any normal mine permitting process.

<u>EPA Response:</u> See response to Comment J.61.

J.67 The Appendix provides a general overview of mitigation concepts and basically concludes that sufficient compensation measures do not exist that could address assumed impacts of the hypothetical scenarios. The permitting process would address all mitigation measures, including avoidance, minimization and mitigation, to address direct and indirect impacts.

<u>EPA Response:</u> See response to Comment J.61.

J.68 A second area of improvement claimed by EPA in its fact sheet was the inclusion of new information concerning mitigation measures. Appendices I and J describing potential mitigation methods for impacts to wetlands, streams and fish represents, at best, a limited and qualitative evaluation. The appendices to the Assessment generally do not address mitigation measures in sufficient detail to evaluate their relevance as mitigation measures in the three mining scenarios. Further, the discussion of mitigation options is incomplete and covers only a subset of potential compensatory mitigation approaches. The Assessment improperly continues to assume that few, if any, compensatory mitigation measures will be adopted for a project in the Bristol Bay watershed.

Additionally, Appendices I and J and the text boxes inserted throughout the document intended to address mitigation are incomplete, and fail to identify numerous approaches that are commonly used to avoid such impacts.

<u>EPA Response:</u> See response to Comment J.11. Appendix J addresses the complete list of compensation measures identified in comments on both the original draft and revised assessments. Appendix J includes a lengthy list of citations from the scientific literature to support its findings and conclusions (see References section of Appendix J). The assertion that "the assessment continues to assume that undersized culverts will be used" is incorrect (e.g., see response to Comment 10.28).

J.69 The BBA's evaluation of compensatory mitigation has been conducted before PLP has submitted a formal Compensatory Mitigation Plan, a requirement during the permitting process. Other mitigation options would show that effective mitigation is possible. Case studies of recent large development projects support the concept that current regulations provide a means for achieving effective compensatory mitigation: Point Thomson, Port MacKenzie Rail Extension, Port of Anchorage Expansion, and Usibelli Coal Mine.

<u>EPA Response:</u> See response to Comment J.11. Appendix J addresses the complete list of compensation measures identified in comments on both the original draft and revised assessments. Appendix J includes a lengthy list of citations from the scientific literature to support its findings and conclusions (see References section of Appendix J). Decisions regarding the appropriate type, amount, and location of compensatory mitigation are made on a case-by-case basis and depend on a number of factors including the type, amount and location of aquatic resources being impacted. The example projects cited in the comment involved impacts to aquatic resources that differ significantly in type, amount, and location when compared to the impacts described in the assessment. Thus,

comparisons of the compensation required for the impacts associated with these permitted impacts are neither appropriate nor illustrative with regard to potentially appropriate compensation for the impacts described in the assessment. For example, the permit for 1) the Port of Anchorage expansion authorized, overall, a total of 159 acres of fill, with 138 acres being intertidal mudflats/subtidal waters and the other 21 acres being freshwater wetlands; 2) Point Thompson authorized the fill of 6 acres of intertidal wetlands and 261 acres of freshwater wetlands/waterbodies/streams; 3) Port MacKenzie Rail Extension authorized the fill of 96 acres of freshwater wetlands/waterbodies and 1 stream crossing (anadromous); and 4) Usibelli Coal Mine authorized fill in 3 acres of freshwater wetlands and six stream crossings (streams have resident, not anadromous, fish) for the construction of the mine access road and fill in 28.2 acres of freshwater wetlands and one intermittent stream for construction of the first phase of the mine. Although the first three projects involved comparatively large impacts for the State of Alaska, the impacts described in the assessment involve the loss of tens of miles of salmon-supporting streams and hundreds to thousands of acres of associated, high-functioning wetlands and in a virtually unaltered region of Alaska that supports a world class fishery.

J.70 Excerpt from BBA, Appendix J, p. 16:

The mine scenarios evaluated in the Bristol Bay Assessment identify that the mine footprints alone will result in the loss of (i.e., filling, blocking or otherwise eliminating) hundreds to thousands of acres of high-functioning wetlands and tens of miles of salmon-supporting streams.

HDR comment:

There is no functional assessment of wetlands quantified in the BBA therefore concluding there are "hundreds to thousands of acres of high-functioning wetlands" cannot be supported.

EPA Response: The comment that potentially affected wetlands cannot be described as high functioning because a functional assessment has not been completed ignores the fact that the potentially affected wetlands are largely or completely unaltered, which would by definition make them reference standard wetlands, the highest functioning wetland for that wetland type.

J.71 Excerpt from BBA, Appendix J, p.16:

Such extensive habitat losses and degradation could also result in the loss of unique salmon populations, potentially eroding the genetic diversity essential to the stability of the overall Bristol Bay salmon fishery. There are significant challenges regarding the potential efficacy of compensation measures proposed by commenters for use in the Bristol Bay region, raising questions as to whether sufficient compensation measures exist that could address impacts of this type and magnitude.

HDR comment:

Vague, undefined terms are used to conclude this appendix. Seven compensation measures recommended by commenters were discussed in this appendix. This paper assumes these are the only compensatory mitigation measures available for use on this project. Questioning the efficacy and sufficiency of only the seven compensatory mitigation measures that were supplied by the commenters to the 2012 EPA assessment and not waiting to discuss the outlined measures in the future-released Pebble mitigation plan allows no room for additional measures or discussion of new options for compensatory mitigation. Conclusions that the seven compensation measures within the three watersheds are the only permittee-responsible compensatory mitigation opportunities available to the project is incorrect. There is no recognition of other opportunities or of expansion of the watershed scale. This conclusion prematurely gives little support for successful compensatory mitigation measures, even though mitigation has indeed been successfully permitted on other large development projects in Alaska. Case studies of successful compensatory mitigation include Point Thomson, Port Mackenzie Rail Extension, The Port of Anchorage Expansion, and Usibelli Coal Mine (Jumbo Dome).

EPA Response: See responses to Comments J.68 and J.69.

J.72 EPA fails to account for compensatory mitigation measures in assessing mine scenario impacts to streams and wetlands. Rather than assess the effectiveness of those measures, EPA claims that it must wait for a "formal regulatory action" (i.e., permitting) before it can analyze this issue and simply notes that there may be "significant challenges regarding the potential efficacy of compensation measures …" Assessment at 7-32. In fact, EPA notes that "there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios." Id. at App. J, 8-9. In reaching this conclusion, EPA committed at least two fundamental errors: (1) the Agency incorrectly narrowed the regional extent of compensatory mitigation opportunities, and (2) it ignored evidence that there are many suitable local mitigation sites. These omissions make EPA's risk scenarios grossly overstated.

EPA Response: See responses to Comments J.68 and J.69.

J.73 EPA's failure to use the best available information concerning mitigation is a fatal flaw in the Assessment. Ecological risk assessments should always incorporate the best available information and data. This standard is essential to ensuring any measure of reliability and to avoid bias. It is especially critical given that the information in the Assessment may be used to support policy decisions respecting potential future mining, and policymakers are instructed to "weigh the best available science, along with additional factors such as practicality, economics, and societal impact, when making policy decisions." Scientific Integrity Policy at 3-4 (emphasis added).

EPA Response: We disagree with this comment. We used the best available information to inform development of Appendix J. See also response to Comment J.68.

National Mining Association (Doc. #5557)

J.74 Furthermore, the revised assessment continues to unfairly overstate the potential impacts of any proposed mine by failing to adequately address the types of mitigation and impact avoidance activities that would inevitably be included in any mine plan as required by law. While EPA, presumably in response to criticisms over the lack of reference to mitigation, added two appendices purporting to discuss potential mitigation measures, EPA is quick to dismiss the effectiveness of such measures. Notably, in the compensatory mitigation appendix, EPA uses a scant 16 pages to reach the conclusion that there are significant "questions as to whether sufficient compensation measures exist that could address impacts of this type and magnitude." However, mitigation measures to minimize and compensate for potential adverse impacts are required by law and are a substantial aspect of modern mining plans. Mining companies often work for years with agencies to develop appropriate mitigation plans for proposed mines. To ignore this reality by excluding an appropriate assessment of such measures in the text of a document studying the potential impacts of modern day mining on a watershed is simply inexcusable.

EPA Response: Impact avoidance/minimization and why it is unrealistic to assume that avoidance and minimization measures will eliminate all impacts to wetlands, streams, and fish are discussed in Chapters 6 and 7 of the assessment. Compensatory mitigation is also discussed in Chapter 7 of the assessment, and Appendix J is devoted to the discussion of compensatory mitigation (see response to Comment J.11). Appendix J contains a lengthy discussion regarding compensation mitigation, but any formal determinations regarding compensatory mitigation can only take place in the context of a regulatory action. The assessment is not a regulatory action, and thus a complete evaluation of compensatory mitigation is considered outside the scope of the assessment.

Kachemak Bay Conservation Society (Doc. #1118 and #4284)

J.75 I steadfastly disagree with the EPA that compensatory mitigation measures could offset some of the stream and wetland losses as a result of spill contamination. Some things are priceless.

EPA Response: We agree that offsetting the impacts to wetlands, streams and fish associated with spill contamination would be extremely difficult.

J.76 KBCS steadfastly disagrees with the EPA that compensatory mitigation measures could offset some of the stream and wetland losses as a result of spill contamination. The historical record clearly demonstrates that the loss of salmon runs in northern Europe, the northeastern US and the Pacific Northwest was the cumulative result of "death by a thousand cuts". The loss of any stream stretch, wetland, lake etc. or any small portion of the Bristol Bay watershed will have negative ecosystem functionality affects that ripple through the system. One cut or disturbance will not collapse the entire system, but all potential impacts must be considered collectively, as that is how the natural systems function. All things are connected and you cannot do "one" thing. These are the great lessons ecology informs. The rivers and wetlands systems of the Bristol Bay watershed are priceless, complex and beyond our ability to safely develop. KBCS would like to see examples of any large scale mining operation, in a similar landscape that has had minimal negative environmental impact.

EPA Response: We agree that potential impacts must be considered collectively, which is why the assessment includes a chapter that evaluates the cumulative impacts of multiple mines in the watersheds.

Natural Resources Defense Council (Doc. #5436 and #5378)

J.77 Unavoidable Habitat and Flow Losses Cannot be Mitigated. Where impacts from a dredge and fill project are unavoidable, such as the habitat and flow losses resulting directly from the mine footprint and transportation corridor described in the Assessment, the Clean Water Act requires compensatory mitigation to replace the loss of wetland and aquatic resource functions in the watershed. Compensatory mitigation refers to the "restoration, establishment, enhancement, or in certain circumstances preservation of wetlands, streams or other aquatic resources for the purpose of offsetting unavoidable adverse impacts,"[EPA, Wetlands Comp. Mitigation (2010), *available at* http://www.epa.gov/owow/wetlands/pdf/CMitigation.pdf.] and is an option once all opportunities for aquatic resource impact avoidance and minimization have been exhausted.

<u>EPA Response:</u> Comment noted; no change required.

J.78 To fulfill this requirement, mitigation must be commensurate with the amount and type of impact. Compensatory mitigation should generally occur within the same watershed as the impact site and in a location where it is most likely successfully to replace lost functions and services.[940 C.F.R. § 230.93(b)(1) (2012).] It must be, to the extent practicable, "sufficient to replace lost aquatic resource functions."[*Id.* at § 230.93(f)(1)]. Where there is a "lack of appropriate and practicable compensatory mitigation options" – as is the case here – discharge of dredge or fill is not permissible.

<u>EPA Response:</u> Comment noted; no change required.

J.79 In its comments, NDM also asserts that impacts on fish habitats can be offset by opening up new habitat areas and creating improved habitat conditions, presumably by constructing fish habitat in otherwise pristine areas that currently support other ecosystems and biota but which do not contain fish. In our judgment, altering—and for at least some biological resources, negatively impacting—one habitat to replace loss of another is neither a sound nor effective approach for compensatory mitigation.

<u>EPA Response:</u> Comment noted; no change required.

J.80 Because the Bristol Bay region is currently in a "pristine condition,"[95] compensation within the watershed is unachievable – there is currently no development to mitigate. Further, serious questions exist as to whether compensation measures could address the impacts of the type and magnitude likely to result from mining.96 As explained in detail in the Assessment, each method for compensatory mitigation, including mitigation bank credits, in-lieu fee program credits, and opportunities within the North Fork Koktuli, South Fork Koktuli, and Upper Talarik Creek Watersheds (e.g., beaver dam removal, flow management, spawning channel construction, preservation, off-site and out-of-kind opportunities, old mine site remediation, road removal, road stream crossing retrofits, hatchery construction, fish stocking, and commercial fishery harvest reductions), would face "significant challenges" in the Bristol Bay environment.[97] Northern Dynasty's recent claims that it would be possible to counterbalance large-scale mining impacts by improving the quality and complexity of off-channel habitat and increasing connectivity within the watershed are scientifically unfounded.

<u>EPA Response:</u> Comment noted; no change required.

J.81 An important addition to the 2013 Assessment is Appendix J, which discusses various approaches for compensatory mitigation to restore, establish, enhance, and/or preserve wetlands, streams, or other aquatic resources for the purpose of offsetting authorized impacts to these resources by a permitted activity. This section also responds directly to several of the earlier public comments that suggested specific compensatory mitigation strategies, including beaver dam removal, stream flow management using water stored during higher flow events, and establishment of hatcheries to replace lost salmon production. As the appendix acknowledges, there are significant challenges regarding both the feasibility and efficacy of all of the potential compensation measures described. We already have decades of research and practical experience in the United States and elsewhere that document our inability to replace fish and ecosystem losses with either artificial propagation or engineered habitats. Therefore we agree with the 2013 Assessment's conclusion that there is a high level of uncertainty that sufficient compensation measures exist that could address impacts of the types and magnitudes of those that will result from large-scale mine development in the Bristol Bay watershed.

<u>EPA Response:</u> Comment noted; no change required

J.82 The Bristol Bay watershed is a sensitive, globally significant and ecologically irreplaceable resource for fish, people and native cultures. Based on the results of the 2013 Assessment and its conservative estimates for unavoidable and persistent negative impacts to stream habitats and water quality, it meets each of the criteria identified by AFS for prohibition of mining activities. The near certain ineffectiveness of any form of compensatory mitigation reinforces this conclusion. Based on this, we believe that the EPA has sufficient information and justification to use its authority and issue a denial of use of the area because of unacceptable adverse effects on fishery areas under Section 404c of the Clean Water Act.

<u>EPA Response:</u> Comment noted; no change required.

J.83 Many of the comments responding to the first draft Assessment – ours included – highlighted EPA's conservative underestimation of potential harm. We commend EPA for strengthening its assessment by addressing these critical risk factors, while nevertheless remaining consistently conservative in its projections of environmental impact. Notably, over half of the peer reviewers' twelve "key" recommendations for revisions called on EPA to add or supplement sources of harm that it deemed insufficiently addressed in the first draft, or to explain the rationale for excluding potential impacts. Recommendations aimed at tempering risk projections – such as calling for analysis of a smaller mine scenario and of mitigation measures – have now been added to EPA's second draft Assessment, and, in fact, they strengthen the case for 404(c) action.

<u>EPA Response:</u> Comment noted; no change required.

J.84 In response to comments from both the peer-review panel and the mining companies,[85] EPA's second draft Assessment includes detailed discussion of potential mitigation measures, including modern conventional mitigation practices as reflected in NDM's published plan for the Pebble deposit, plus practices suggested in the mining literature and consultations with experts. Examination of the mitigation methods outlined by NDM dispels any illusion that large-scale mining could ever coexist with Bristol Bay salmon ecosystems. Mitigation options fail to adequately address flow reductions and stream habitat losses, impacts from tailings storage and the transportation pipeline and corridor, or losses to Alaska Native subsistence use of the salmon.

<u>EPA Response:</u> Comment noted; no change required.

J. M. Robbins (Doc. #4200)

J.85 FOURTH, the report speaks to Compensatory Mitigation (Box 7.2). Nothing is said about mitigating the loss of an important and irreplaceable part of the groundwater system dewatered as a result of this mining project. Although streams and wetlands are mentioned, the report omits discussion about the impact on other aquifers to which this area of the groundwater system flows.[6] The affects will likely be both long-term and long-reaching on existing and future generations. The National Environmental Policy Act, 42 USC 4321, et seq., declares the continuing policy of the government is to fulfill the social, economic and other requirements of present and future generations of Americans. It recognizes its public trust responsibility to succeeding generations to attain among other things the widest range of beneficial uses without degradation, risk to health or safety, or other undesirable and unintended consequences, and enhance the quality of renewable resources. Again the policy states clearly that future generations must be considered in any decision requiring an EIS. Nothing is said in the assessment about such future generations therefore making the report inadequate in this important way as well.

EPA Response: We agree that the mine scenarios evaluated in the assessment involve impacts to groundwater resources. Appendix J has been expanded to include discussion of additional measures which comments proposed as having potential to offset some of these impacts to groundwater resources.

Northern Dynasty Minerals Ltd. (Doc. #3650)

J.86 Fish habitat enhancement projects and other fisheries mitigation approaches are well-established and proven to be effective over a documented history of 80+ years. Moreover, compensatory mitigation for projects that affect salmon habitat is the law in Alaska and the United States. The fact that EPA's 'hypothetical' mine provides no compensatory mitigation for footprint effects is another example of why such a mine could not be permitted in Alaska in the 21st century.

EPA Response: See response to Comment J.11.

J.87 The 2012 Assessment has not considered the role of mine reclamation to mitigate habitat loss during the post-closure period. The report does not appear to recognize that there is an opportunity to mitigate habitat lost in the mining process through reclamation design and implementation. When addressed early in planning and design, there are elements of mine reclamation that can be engineered to reduce the short and long-term impacts of mining operations. Working within operational constraints, standard reclamation activities such as the containment, placement, and stabilization of fill can be modified in consideration of final re-vegetation, habitat and land use considerations.

EPA Response: Mine site reclamation would take place decades or centuries after impacts take place, long after affected fish populations have been exterminated. Further, we are not aware of examples of reclamation technologies used to successfully recreate wetlands or streams at a reclaimed porphyry copper mine that are capable of effectively replacing lost ecosystem services, particularly at the scale required by impacts described in the assessment.

J.88 In 2013, EPA released a second external review draft of the Assessment (BBWA2). In response to public comments pointing out that the hypothetical project could not obtain permits to operate, especially without implementation of mitigation measures, EPA tried to remedy this defect by developing the information presented in Appendix J of the document. In Appendix J, EPA outlined the appropriate rules and regulations regarding mitigation requirements for large mine development, summarized their hypothetical assessment of the kilometers of fish habitat that would be lost as a result of their development scenarios and flow reductions downstream of their mine and tailings storage facilities, provided a list of suggested mitigation actions identified from the public comments, and finally concluded that: "…these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios.". In other words, EPA concluded that there were no mitigation opportunities available within the three primary mine infrastructure area watersheds or the broader drainage areas which could offset the fish habitat impacts of their hypothetical mine development scenarios.

<u>EPA Response:</u> See response to Comment J.11.

J.89 Based on the information developed in the BBWA2 in Chapter 7 and the discussion of compensatory mitigation in Appendix J, EPA concludes that: "Specifically, these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios." In addition, EPA generally dismisses the potential mitigation measures identified in comments from the public and EPA's peer-reviewers on the 2012 external draft of the Bristol Bay Watershed Assessment. EPA failed to identify any measures that could mitigate for the impacts estimated using their analyses and dismissed the list of measures identified by commenter's and peer-reviewers because of concerns about the efficacy of such measures and general ecological considerations.

In summary, EPA provides no credible scientific basis for their inferred fish habitat/population impacts or for their wholesale rejection of widely recognized fish habitat mitigation methods.

<u>EPA Response:</u> See response to Comment J.61.

J.90 2.2.2 EPA Wrongly Concluded that No Mitigation Opportunities exist within the SFK,

NFK, and UT Watersheds The BBWA2, in Appendix J concludes: "Specifically, these three watersheds are largely unaltered by human activities, and there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios." [Emphasis added]. This statement by EPA is demonstrably and patently false. There are a number of factors, within EPA's control, that could have caused EPA to reach this fatally flawed conclusion. For example:

EPA failed to accurately assess the magnitude of potential impacts from their hypothetical mine development, which resulted in an impression that the magnitude of impacts would be much greater than the empirical data indicates. This is discussed in detail above.

EPA failed to conduct an effective site visit of the three principal watersheds surrounding the Pebble deposit and thus have no firsthand knowledge of the site about which they are drawing conclusions.

EPA failed to conduct an effective over flight of the three principal watersheds to view the topography and stream geomorphology of the site, which would have shown numerous mitigation opportunities in the plethora of existing off-channel aquatic habitats.

EPA failed to review publically available satellite imagery on Google Earth which shows, to an experienced biologist, numerous locations where multiple off-channel habitats exist and could be enhanced.

EPA failed to review photographs in Chapters 4, 7, 9, and 15 of the EBD, which show close up images of portions of the various stream channels. An experienced biologist would have immediately identified mitigation and enhancement opportunities from these photographs alone.

EPA failed to conduct a detailed review of the available water quality data contained in Chapter 9 of the EBD, which shows numerous opportunities to increase the primary productivity and fish productive capacity of many existing habitats through a combination of water chemistry enhancements and management of the water chemistry parameters for water discharged from the Wastewater Treatment Plant.

EPA and the authors of the BBWA2 appear to lack even a rudimentary knowledge of the fish habitat improvement scientific literature and the efficacy of such improvements and are thus unable to render technically and professionally credible conclusions regarding the potential mitigation measures that are available in the three principal watersheds.

EPA's conclusion that no mitigation opportunities existed is tantamount to reaching an a priori conclusion regarding the impacts of their development scenarios and selectively misleads the reader into reaching the same conclusion. In other words, the mitigation suitability conclusions were justified to reach a pre-conceived ecological conclusion of major impacts without regard to the available site specific data and information and the application of sound scientific principles during their analyses.

Singly and in combination, the factors listed above have contributed to EPA's scientifically indefensible conclusions to reject the potential for a substantial suite of mitigation measures 16 to be implemented within the three principal watersheds (SFK, NFK, and UT) and other locations within the Kvichak River watershed. The remainder of this document will outline the scientific literature supporting and describing applicable mitigation techniques, a brief discussion of the efficacy of such techniques, an overview of on-site and off-site mitigation techniques that could be used to provide a successful mitigation program for EPA's hypothetical mine development scenario in compliance with the various regulations and policies outlined in Appendix J.

<u>EPA Response:</u> See response to Comment J.68. Discussion regarding the magnitude of potential impacts is in Chapter 7 of the assessment, and this discussion has been further expanded (see Chapter 7 of the final assessment and responses to Chapter 7 comments in this document).

J.91 3. Review of the Scientific Literature with Respect to Fish Habitat Mitigation Techniques

EPA failed to describe any potential fish habitat mitigation techniques that they believed were applicable to the three mine area watersheds. Instead, they relied on input from the public and peer reviewers for suggestions on possible mitigation measures. EPA's failure to acknowledge or consider the considerable body of scientific literature on fish habitat improvement techniques is puzzling to us. This section provides a comprehensive review of fish habitat improvement techniques which we believe are not only applicable to the Pebble deposit area, but are backed by well documented rates of success and efficacy in increasing fish production. These are the techniques that a review of the literature would have revealed to EPA.

3.1 Overview

EPA concluded in the BBWA2 that no on-site mitigation measures were available to offset the impacts from their development scenarios within the three primary watersheds. This assertion is refuted by a large body of scientific literature combined with the ecological conditions within these watersheds. On the contrary, for more than 75 years fish habitat managers have successfully applied in-stream habitat mitigation measures in numerous salmon supporting watersheds. This section describes actions and techniques that could be used to implement a fish habitat mitigation program in order to mitigate impacts to aquatic habitats resulting from implementing EPA's mine development scenarios. Section 3.2 describes water management techniques which deal with changes in water flow and water temperature resulting from reducing the area of a watershed that contributes surface and groundwater flow to downstream areas. Section 3.3 outlines measures that have been used by others to improve/create access to existing, suitable habitat areas and the creation or improvement of physical habitats that will increase the total habitat area available or improve the production potential of existing, undisturbed habitats. Section 3.4 evaluates the potential for enhancing certain water chemistry parameters (e.g., alkalinity, hardness, and total dissolved solids) or nutrient levels (nitrogen and phosphorus) in order to improve the primary productivity of area waters at selected locations with a resulting increase in fish production. All of these strategies and associated techniques are discussed below. We have chosen to only review those techniques or approaches that have been used by others to address similar mitigation or habitat improvement issues and which we believe are appropriate for the species and ecological conditions associated with the Pebble deposit area.

3.2 Water Management

3.2.1 Background

In Section 7.3 of the BBWA2, EPA describes their assumptions and analyses of changes in stream flows as a result of the elimination of flow contributing portions of the three watersheds in their development scenarios. EPA's operations assumptions result in water surplus being passed through the wastewater treatment plant (WWTP) for treatment and subsequent release into stream channels downstream of project infrastructure. The BBWA2 assumes that WWTP releases are divided equally between the NFK and SFK, with the SFK providing water to the UT via a subsurface connection and UT tributary 1.190 and that discharges are surface water additions to existing channels. This appears to be the only technique EPA used to distribute surplus WWTP water to the environment. EPA only dealt with flow volume and did not deal with WWTP discharge water chemistry or water temperature. As a result of this flaw in EPA's analyses, they failed to recognize the consequences of their "realistic development scenarios", which include violations of Alaska's Water Quality Standards and disrupting the normal egg incubation water temperature regime for anadromous and resident fish species. EPA's lack of familiarity with the three principal watersheds, the water flow characteristics within those watersheds, and apparently lack of knowledge regarding salmon egg incubation ecology resulted in this inappropriate and deleterious water management scenario.

3.2.2 Water Management Techniques Applicable to the Three Principal Watersheds

3.2.2.1 Management of Water Discharged from the WWTP

There are a number of water management techniques and strategies that could be implemented within the principal watersheds which would provide a much greater level of protection to fish populations and their habitat needs than that outlined in Section 7.3 of the BBWA2. The following list briefly describes some of the more obvious techniques and strategies that EPA did not discuss:

1. Manage water discharged from the WWTP according to a hydrologic program of releases rigorously defined by advanced flow and habitat modeling techniques, and thereby ensuring that the availability of downstream fish habitat is ensured.
2. Manage water discharged from the WWTP to comply with Alaska's Water Quality Standards and meet the ecological needs of the fish species downstream of the discharge locations.
3. Manage water discharged from the WWTP in a manner that considers the "ecological importance" of certain key habitat and fish population areas (e.g., South Fork Koktuli "Springs" area and UT immediately downstream of the cut off wall for EPA's waste rock piles).
4. Manage the chemical constituents of water discharged from the WWTP to increase the primary productivity and fish productive capacity in areas downstream from discharge locations.
5. Manage water discharged from the WWTP to the environment in order to meet the ecological water temperature requirements of fish downstream of the discharge locations.
6. Manage the volume of water discharged from the WWTP into each watershed considering whether or not salmon spawning habitat is limiting the population and to offset naturally imposed bottlenecks to fish production (e.g., critically low winter flow periods).

3.2.2.2 Techniques to Increase the Total Volume of Water Available to Offset Downstream Flow Reductions

Three techniques are also available to increase the total volume of water available to offset downstream flow reductions; none of these were considered by EPA in the BBWA2. The first two are really self-explanatory, while the third requires some more detailed explanation for someone not familiar with the technique.

- Develop impoundments to increase the total volume of water available to offset flow reductions downstream of EPA's infrastructure components in each of the three development scenarios.
- Increase the volume of water available to recharge groundwater aquifers and provide additional stream flow by creating ice fields during the fall and winter time periods (Clark and Lauriol 1997; Alamaro 1999; Yoshikawa et al. 2007).
- Use a water pump-back technique to supply water to upstream areas that would otherwise be flow-depleted.

3.2.2.2.1 Water Pump-Back (i.e., Re-circulating Water from Downstream Back to Upstream Areas)

General Description

The water pump-back concept involves establishing a well field or screened intake and associated pumping plant in a watershed down-gradient of the reach or reaches where supplemental water is desired. Water from this downstream source is pumped to a storage location, release point, or area upgradient of the reach or reaches to receive water supplementation. Water is then released from the upstream site(s) to maintain or improve aquatic habitats and ultimately the productive capacity of the stream. This water eventually flows downstream and is effectively recycled, through the pumping system, back to the upstream site(s). Once the system is charged (a one-time draw on local surface or groundwater), the water is recycled non-consumptively keeping the desired flow in the reaches between the release area (e.g., wetlands and/or up-gradient aquifer recharge area) and the down-gradient screened intake or well field aquifer recharge area.

Selected Examples

Several examples of a pump-back technique being used to improve fish and/or aquatic habitat purposes are briefly outlined below. Examples vary considerably in scope and detail, but each uses the water pump-back concept for maintenance or enhancement of fish habitat and other environmental amenities. Most incorporate upstream storage, but some do not.

A. *Colorado Water Congress – Upper Colorado River Endangered Fish Recovery Program*

   This program has developed a complex array of elements to restore and enhance aquatic habitats providing for irrigation and municipal water supply obligations. Several elements involve pump[20] back approaches. Objectives include re-creation of more natural hydrographs for both fish resources and recreational purposes (GrandRiver Consulting 2005; GEI Consulting 2008). Some project elements include:

   - The Wolford Mountain Reservoir element involves pumping 75 cfs from the Colorado River at the mouth of Muddy Creek to a reservoir about 7 mi upstream where it is released down the creek as part of a multi-purpose storage/release program.
   - The Fraser River (Colorado) Pump-Back element recycles 5 cfs via several components for fisheries, recreation, scenic and other environmental purposes.

- The "15-mile Reach Pumpback" element recycles 350 to 400 cfs (150 ft. lift) to an upstream release location at the top of a 15 mi long segment of the Colorado River between Grand Junction and Palisade, Colorado, providing flow enhancement during late summer. No storage is involved.

B. *Los Angeles Water and Power / Inyo County Lower Owens River Plan, (Los Angeles Water and Power 2005).*

This project involves pumping 35-50 cfs from the Owens River to an aqueduct for release to lakes and ponds from which it is returned to the river via surface flow. The primary goal of the project is to establish a "… healthy, functioning Lower Owens River ecosystem… for the benefit of biodiversity and Threatened and Endangered Species, while providing for the continuation of sustainable uses including recreation, livestock grazing, agriculture and other activities."

C. *Umatilla Basin Project, (Bronson and Duke 2005; USBR 2007)*

An upgrade to this century-old U.S. Department of the Interior, Bureau of Reclamation project involves pumping up to 140 cfs from the Columbia River near the mouth of the Umatilla River upstream in the Umatilla drainage to the off-channel Cold Springs Reservoir (321 ft. rise) (Bronson and Duke 2005). This "conjunctive use" water passes from the reservoir and enters the Umatilla Basin Project irrigation and water supply complex (USBR 2007). This scheme increases flow in the Umatilla River directly through a 1-for-1 exchange for Umatilla River diversions and indirectly through recharge of basin aquifers. Increased Umatilla River discharge provides fish passage flows and fish habitat maintenance in the lower river.

D. *Columbia River Basin Storage Options – Yakima Basin Water Storage, (USBR 2007)*

The Wymer Alternative of this project involves pumping water from the Yakima River to Wymer Reservoir on Lmuma Creek and release of water from the reservoir to return to the Yakima River (USBR 2007). Objectives include fish and aquatic habitat maintenance in Lmuma Creek.

E. *Oregon Governor's Watershed Enhancement Board Pump-Back Projects, (Ken Bierly, Watershed Enhancement Board, pers. comm.)*

Several pump-back projects have been approved for funding by the Oregon Governor's Watershed Enhancement Board (Ken Bierly, Watershed Enhancement Board, pers. comm.). Most of these projects are in the arid eastern part of the state. Examples incorporating fish and aquatic habitat enhancement include: (1) Willow Creek Pump-back Project, (2) Rudio Creek Replumbing Project and (3) Little Butte Creek Pump-back Project.

Hypothetical Application of a "Pump-Back" Project in the Pebble Project Area

Using the South Fork Koktuli River as a hypothetical example, water could be pumped at a rate of 50 cfs, either from a groundwater well field on the flats near the North Fork – South Fork Koktuli confluence (el. ~700 ft msl) or from a screened intake in the same vicinity, to a storage reservoir or up-gradient aquifer recharge area (e.g., South Fork Koktuli "flats") about

20-25 mi away (el. ~1,000 ft msl). Releases from the storage reservoir or to the recharge area could be programmed to meet channel maintenance and fish production goals as appropriate. Operation would not necessarily have to occur continuously. During periods of elevated natural runoff, it may be that water supplementation using this method would not be needed. A diagrammatic depiction of this concept is illustrated in Figure 3.1(See comment).

Establishment of the pumping plant in this application would include providing power at the site and provision of access to maintain project infrastructure. Feasibility of the well field supply approach would depend on an analysis of the recharge capability of the donor aquifer. Environmental risks include the potential for turning some gaining reaches in the vicinity of the North Fork – South Fork Koktuli confluence into losing reaches, thereby influencing aquatic habitat quality. The appropriate regulatory requirements associated with obtaining the applicable permits to build a project like this would need to be addressed.

Water recycled in this way would not represent an inter-basin transfer. As long as this flow supplementation water stayed in its own watershed, there would be no associated risks of introduction of fish pathogens or parasites and it is anticipated that no special studies related to fish pathogens would be required.

EPA Response: See response to Comment J.68.

J.92 *3.3 Creation and/or Improvement of Physical Habitat Components or Areas*

3.3.1 Overview

This subsection describes physical habitat-based techniques for mitigating fish and aquatic habitat impacts that might result from EPA's mine development scenarios. The techniques described are based on over three-quarters of a century of experience with habitat manipulation, rehabilitation, enhancement, and creation in the fresh water environment in the Pacific Northwest, western Canada and Alaska (Davis et al. 1935, Silcox 1936, Tarzwell 1938, Gee 1952, Ehlers 1956, Summers and Neubauer 1956).

This subsection incorporates selected techniques and examples from Alaska. Other than the Habitat Division of the Alaska Department of Fish and Game (ADFG), there exists no detailed documentation of habitat restoration or improvement work since Parry and Seaman's 1994 compendium. This conclusion is supported by phone conversations with one state and four federal agency employees familiar with the habitat restoration/improvement actions occurring in the State. The literature documentation and intensive monitoring results are dominated by examples from the Pacific Northwest and Intermountain West of the United States and British Columbia, Canada. It is important for the reader to understand that it was not until the early 1980s that large sums of money became available to "improve salmonid habitats" because of the collapse of salmon runs in the Eastern Pacific Ocean. As a result of the stampede to improve fish habitats, many design mistakes and a general misunderstanding of how streams functioned resulted in failure or disappointing results. Also, other critical factors involved inadequate project planning and misidentification of the factor(s) limiting fish production. However, habitat enhancement and rehabilitation practitioners learned rapidly from their mistakes. In the past three decades, the science and engineering of "habitat improvement" has advanced greatly and it is rare to see projects implemented now that have the same flaws that led to questionable success in the past.

Early efforts and programs targeting enhancement of salmonid habitats in small rivers and streams met with mixed results (Ehlers 1956, Buell 1982, Beschta et al. 1994), but the evolution of knowledge regarding the relationships among fluvial processes, aquatic habitats and the fish they support has brought the art and science of habitat enhancement and rehabilitation to an advanced state (Hall and Baker 1982; Reeves and Roelofs 1982; National Research Council 1992; Sear 1994; Reeves et al. 1995; Slaney and Zaldokas 1997; Benda et al. 1998; Saldi- Caromile et al. 2004).

Successes in increasing productive capacity (the ability of habitats to produce fish) and actual fish production have been documented extensively in the technical literature. Solazzi et al. (1999) reported on an 8-year program specifically designed to evaluate the effectiveness of instream habitat restoration and enhancement projects on many streams in the Oregon Coast Range. They examined the types of rearing habitat created by various habitat improvement techniques, compared the densities of juvenile coho salmon in summer and winter and compared the productivity of constructed versus natural habitats. They also undertook an intensive investigation of several streams before and after habitat restoration work to determine the effects of this work on smolt production. Their data showed that constructed habitats performed as well as natural habitats, and that alcoves (off-channel) and other low-velocity habitats supported larger numbers of overwintering coho than main channel habitats. The intensive before-and after studies showed that overwinter survival rates for juvenile coho ranged from 35-52% in constructed habitats, triple the rates from control streams over the 8-year study period. The number of large (>90mm) downstream steelhead and coastal cutthroat trout migrants also increased in the treated versus non-treated streams.

Many monitoring studies are chronicled in British Columbia's Watershed Restoration Technical Circular entitled "Fish Habitat Restoration Procedures" (Slaney and Zaldokas 1997). This compendium contains large chapters on a number of stream restoration and enhancement approaches, including spawning habitat enhancement, secondary channel and off-channel development, use of large woody debris, boulders and combinations of these elements and fish production enhancement using low-level nutrients. Each chapter summarizes successful (and unsuccessful) applications of these approaches. For example, Table 3.1 summarizes data on stream-rearing fish species from Keeley et al. (1996) for 15 paired studies of treated and untreated areas in streams. These data show significant increases in fish life stage density, up to an order of magnitude, resulting from habitat-based treatments for all species studied.

Citing data from Keeley et al. (1996), Slaney and Zoldakas (1997) report fish production benefits of a 1.8- to 9.3-fold increase adult salmon and steelhead returns resulting from increasing main channel habitat complexity (i.e., introduction of large woody debris, boulders and other complexing elements). Fish production benefits associated with developed secondary channels and off-channel habitats, especially as compared to associated natural habitats, are also documented. More thorough documentation of higher egg-to-fry survival (e.g., Bustard 1986; Marshall 1984; WDFW 1986) and coho salmon overwintering survival and smolt output (Bachen 1984; Bustard 1986; Cederholm and Scarlett 1991; Guillermo and Hinch 2003; Morley et al. 2005) resulting from habitat improvement measures.

The Washington Department of Fish and Wildlife has developed Stream Habitat Restoration Guidelines (Saldi-Caromile et al. 2004), which provide very comprehensive and detailed guidance on habitat-based rehabilitation and enhancement of streams targeted specifically at the production of fish, especially salmonids. Besides chronicling strategies and implementation techniques and instructions, this document stresses the benefits that can be expected from implementation of the approaches and techniques described.

EPA Response: See response to Comment J.68.

J.93 The purpose of the remainder of this subsection is to provide the reader with a brief synopsis of the scientific literature and compendiums which clearly demonstrate the potential benefits to fish populations resulting from properly planned and executed habitat improvement projects or programs. More specific improvement actions or techniques are discussed in more detail below, with additional literature-based documentation of the results of implementing specific techniques or combination of techniques also presented. Review of the scientific literature and the authors' extensive personal experiences in planning and implementing habitat improvement projects and managing agency-based regional habitat improvement programs for Pacific salmon form the foundation for the selection of techniques detailed below. It should also be noted, that the authors have several decades of experience in dealing with Alaska ecosystems and their associated fish species.

The techniques reviewed in this document reflect a distillation of those specific techniques that the authors believe are most applicable to the Pebble Deposit area and its setting in Southwest Alaska. Many millions of dollars have been spent and continue to be spent on habitat-based enhancement of production of salmon and other fish species in the Pacific Northwest, western Canada and Alaska, and monitoring results from a wide variety of these efforts over the last quarter century or more, some of which are reviewed here, attest to their effectiveness. This money is being spent by the private sector for mitigation and by the public sector for mitigation and enhancement because the approaches being funded work. The authors believe that the benefits of habitat improvement are settled science.

3.3.2 Improved Access to Existing Spawning or Rearing Habitats

3.3.2.1 Removal or Modification of Seasonal Barriers (beaver dams)

A major concern to fish managers in their efforts to manage existing natural or newly created aquatic habitats is the potential for beaver to either change the character of the habitat, existing or created, or to prevent access to these habitats by both adult and/or juvenile fish. Beaver dams blocking access to upstream areas for migrating salmon have been documented in the general project area. Coho salmon spawning within a beaver pond in spring areas visible from the air have also been documented in the proposed project area.

Pools created by beaver dams provide some of the most productive aquatic habitat found in and near the Pebble Project area. These pool areas provide relatively productive rearing areas, especially multiple age classes of juvenile coho salmon. They provide significant quantities of overwintering habitat area for a variety of fish species.

Clearly, the negative and positive characteristics of beaver activity in salmon producing watersheds require close management, but more importantly, present substantial opportunities for fish habitat mitigation. Finnigan and Marshall (1997) provide an excellent overview of managing beaver to maintain ecosystem values for fish, such as providing complex and highly productive rearing habitat for juvenile fish. They also describe a variety of techniques to keep beaver construction actions from damaging project infrastructure, such as damming road culverts and causing road prism failure.

3.3.2.2 Creation of Permanent Access over Existing Waterfalls

The only fish migration impediment currently affecting access to useable fish habitat is a bedrock cataract on UT 1.190 near the confluence of this stream with the UT main stem. Fish sampling efforts have yielded no anadromous fish (juveniles or adults) upstream of this cataract in spite of a base stream flow of about 25 cfs. This level of flow is sustained year around via an underground transfer from the SFK watershed. This stream remains generally ice free during the winter and could provide valuable winter rearing habitat.

<u>EPA Response:</u> See response to Comment J.68.

J.94 The use of large boulders (typically 2-6+ ft. in diameter) to create desired habitat conditions or channel complexity has been used in western North America by a variety of agencies to improve salmonid fish habitat. Boulder placements generally occur in riffles or side channels to create habitat diversity or complexity. The fundamental principle behind boulder placement is creation of desirable conditions within the stream channel by causing localized scour and deposition to create spawning areas due to the sorting and accumulation of suitable bed materials downstream of the rock(s) location (Figure 3.2) (Lisle 1981). Juvenile rearing habitat is also created by changing the water velocity and flow patterns within the channel and creating low or zero velocity areas downstream of the boulder. Enhanced feeding opportunities for juveniles and adult salmonids are created in the shear zones at each downstream corner of the boulder. Drift food organisms are delivered to the quiet, zero velocity area immediately downstream of the rock, thus minimizing energy expenditures for individual fish. Groups of boulders placed in a triangular pattern adjacent to the channel bank can create the same types of habitats as described for a single boulder. In addition, these multiple rock structures can reduce/stop bank erosion, particularly on the outside bends in certain types of channels.

<u>EPA Response:</u> See response to Comment J.68.

J.95 Habitat improvement projects using large wood in some form can accomplish a number of the recommended mitigation goals outlined in this document. Whether it is restoration of habitats damaged during construction or creation of new habitats, large wood can be used to create a variety of different habitat conditions. Wood can be used to change the water velocity patterns within the channel, creating a variety of microhabitats suitable for multiple age classes of fish. Wood can be used to create complexity within a channel, providing more structure within the water column, which in turn provides cover and additional feeding opportunities for juvenile fish. Wood can be used to create a substrate for algal and aquatic invertebrates, which enhances the food supply for juvenile fish. Large wood can also be used to create scour pools, lateral scour pools, and create stream bed erosion which allows deposition of spawning sized gravels. All of these conditions can be created in both small and large channels. Use of wood in pools or low velocity channels is generally associated with increased cover or feeding opportunities. EPA's exclusion of these types of habitat mitigation measures seriously undermines the credibility of the BBWA2 conclusions.

<u>EPA Response:</u> See response to Comment J.68.

J.96 Reconnecting abandoned secondary channels and oxbows and development of connected secondary channels in flood plains constitutes a direct supplementation of existing physical aquatic habitat. As illustrated by the selected examples summarized above, these developed habitat areas can be and usually are designed to incorporate features that complement and often significantly enhance productive capacities of natural habitats associated with the parent stream. Monitoring results frequently indicate higher production of standing fish stock and smolt output per unit habitat area or stream corridor length than associated natural stream channels. For example, overwintering habitat elements (*e.g.*, deep pools with incorporated cover elements) can be incorporated into groundwater-fed secondary channel design to supplement existing natural habitats or supply such habitats in areas where they are rare. Likewise, low velocity rearing areas for young-of-the-year life stages can be provided in developed secondary channels alongside stream reaches dominated by high-velocity riffles and runs with little or no coarse boulders or large woody debris to provide velocity refugia. The large secondary off-channel habitat complexes described above provide ample evidence of the feasibility of designing and constructing very high quality off-channel habitats in systems like those in the Pebble Deposit area. Developed secondary channels are typically designed to provide specific habitat needs for target species and life stages, usually anadromous salmonids, according to analyses of factors limiting or potentially limiting those species. Over a quarter century of experience with a wide variety of habitat needs spanning north-temperate to Arctic climate conditions has resulted in a high rate of success for modern designs. Developed secondary channels have been shown through monitoring to complement natural habitats both in areas previously degraded by human activities or natural events (*e.g.*, floods) and in non-degraded settings. Contemporary developed secondary channels and connected off-channel pond-stream complexes are typically designed with trophic considerations, particularly natural aquatic invertebrate food production, in mind. Monitoring data often demonstrate superior growth and overwintering survival in developed secondary channels compared to adjacent natural stream channels. These data also demonstrate high rates of use of off-channel habitats by target and non-target species, reflecting robust aquatic biological communities. Extensive wildlife use of developed secondary channels has been documented (WDFW 2012), sometimes leading to maintenance issues to manage beaver activities.

Developed secondary channels and channel/pond complexes can and should be integrated with nutrient supplementation, if that measure is used to increase carrying capacities for salmon, trout, grayling and other fish species in the Pebble Deposit area or along the road corridor. The quantities of nutrient supplementation to bring main stem streams such as the North Fork Koktuli, the South Fork Koktuli and Upper Talarik Creek up to optimum levels may prove to be prohibitive because of stream flows, especially in middle and lower reaches of these streams. Applying nutrient supplements to developed secondary channels, however, would likely significantly lower the quantity requirements and enable these measures to focus directly on areas with the highest fish production potential. EPA's exclusion of these types of habitat mitigation measures seriously undermines the credibility of the BBWA2 conclusions.

<u>EPA Response:</u> See response to Comment J.68.

J.97 In general terms this technique would increase the nitrogen and/or phosphorus levels at selected locations and times to increase the primary productivity of streams in the project area. Nutrient additions would occur in the three primary watersheds near the mine deposit. However, other locations or tributaries in these watersheds could supply other suitable sites and additional opportunities along the transportation corridor for any streams or lakes that could benefit. Three factors are critical when nutrient additions are contemplated. First is determining the spatial and temporal distribution of the limiting nutrient(s). Both nitrogen and phosphorus can be co-limiting. Second is determining the timing and duration of nutrient application(s). Depending on the source of nutrients, multiple applications may be necessary to achieve the desired concentrations in the receiving waters. Third is determining the desired concentrations of each nutrient and the ratio between N and P for each application location. For mitigation of the hypothetical EPA mine development, the primary focus of nutrient enhancement could be in either existing or newly created side channels, sloughs, beaver ponds, or alcoves. Providing nutrient rich outflow from these areas may be sufficient to meet the nutrient objectives for the main channels of the major streams. If this approach proves insufficient for the main channels (emphasis on rainbow trout and Chinook salmon, with some secondary benefits to sockeye and other resident species),then applications could be made at approximately 10 km downstream intervals in the main channels. These additions could be made during the growing season (i.e., after breakup through August initially). However, it might be beneficial to add nutrients earlier or potentially all winter in open water locations where the water temperatures are a few degrees Celsius and suitable for biological production to continue\year around. Calculating the current nutrient concentrations from existing water quality data and then determining where nutrient enhancement could occur would be critical. The type of nutrient delivery varies from liquid fertilizer to slow-release fertilizer to nutrient analogs which are essentially slow release pellets. All of these methods have been used successfully. The key consideration is access cost and maintenance requirements. Sterling and Ashley (2003), provide a good general overview of the various formulations tried and delivery mechanisms. Slaney et al. (2003) provide insight into some of the problems associated with direct fertilization techniques used in the Keogh and Salmon Rivers on Vancouver Island.

3.4.3.3 Selected Examples: The literature reviewed above demonstrates a broad base of countries that are using nutrient enhancement in a variety of lakes and streams to increase fish production. Alaska had a lake fertilization program aimed at sockeye salmon production. Stream and lake nutrient enhancement projects are still routine programs in Sweden and Norway. Canada has programs centered in British Columbia on a variety of lakes and streams. Finally, the Northwest Power and Conservation Council and Bonneville Power Administration announced in January 2010 funding for a 10-year nutrient enhancement program in the Snake River Basin. The program, to be managed by the Shoshone-Bannock Tribe, will use nutrient analogs of C, N, and P in high elevation streams to increase fish productivity with a target of increasing anadromous fish populations. The benefits of fertilization of oligotrophic waters for the stimulation of fish production have been demonstrated in several venues. For example, whole-stream fertilization of the Keogh and Salmon rivers in British Columbia resulted in up to 2 to 3-fold increases in the average weight of juvenile steelhead trout just 3 months after fertilizer application in the Keogh River (Slaney et al. 1986, Johnston et al. 1990, Slaney and Ward 1993). These studies also documented striking increases in fry densities, growth rates (mass and length) and a doubling of survival to the smolt stage from 25% to 50%. This translated into a 65% increase in adult returns. Similar results were found in the Salmon River. Stream fertilization in the Kuparuk

River (AK) resulted in a 1.4 to 1.9-fold increase in age 0+ Arctic grayling size and a 1.5 to 2.4- fold increase in growth rate for adults (Deegan and Peterson 1992).

<u>EPA Response:</u> See response to Comment J.68.

J.98 4. Review of the Documented Efficacy of Selected Fish Habitat Mitigation Techniques

The previous sections of this report have chronicled a wide variety of measures that can be applied appropriately to mitigate unavoidable impacts of the development and operation of a mine at the Pebble deposit location. The efficacy track record of these measures has also been documented for over three quarters of a century of application. There is no question about the effectiveness of an appropriate application of these measures to enhance production of aquatic biological resources, especially salmon. Large amounts of money continue to be dedicated towards the implementation of these kinds of measures because they work; this is settled science.

On the other hand, not all mitigation measures implemented to compensate for unavoidable impacts of human activities work all the time. Many individual mitigation exercises have failed to meet stated objectives, and these failures have occurred for many reasons. One of the most comprehensive and detailed investigations of the most detailed and comprehensive reviews of the efficacy of fish habitat mitigation measures (as opposed to jurisdictional wetland mitigation banks, which are usually the subject of CWA Sec. 404 mitigation success) was conducted as a formal evaluation program by Jason Quigley and David Harper of the Department of Fisheries and Oceans, Environment Canada, in the mid-2000s (Harper and Quigley 2005a, Quigley and Harper 2006a, Quigley and Harper 2006b). A summary version of their early findings was published in Fisheries (Harper and Quigley 2005b). The evaluation program had four parts:

- Literature Review – Detailed file reviews were conducted of all studies in the peer-reviewed and grey literature that could be found relating to assessment of habitat compensation/mitigation projects to determine success in achieving the national No-Net-Loss policy for fish habitat;
- Detailed File Review – Permits and associated conditions for 124 projects and developments issued between 1994 and 1997 were collected and analyzed to provide an indication of the types of projects permitted, mitigation approaches used and associated monitoring/evaluation programs;
- Compliance Audit – A subset of 52 of the 124 permitted projects and developments were subjected to field inspections to assess compliance with biological, physical and chemical parameters identified in permits and associated regulatory documents;
- Effectiveness Audit – A subset of 16 of the 52 field-audited projects and developments in the compliance audit were quantitatively evaluated for achievement of No-Net-Loss by comparing habitat productivity at treatment and control (reference) sites.

This detailed evaluation concluded that the national Habitat Policy requiring No-Net-Loss for fish habitat, particularly that part requiring compensatory habitat development or enhancement to offset losses "is an excellent conservation strategy, potentially serving as a model for other jurisdictions" (Quigley and Harper 2006a). [Emphasis added]. They also found that, in the aggregate, success in meeting the No-Net- Loss objective was not always met, and that significant improvement was called for. In all, only 64% of the 124 projects and developments subjected to a detailed file review were successful in meeting or exceeding the No-Net-Loss fish habitat goal.

The Evaluation Program, as reported in the references cited above, identified the reasons for compliance failure. These reasons cover a broad spectrum, and are informative when it comes to development of a mitigation program for any large project if such a program is to succeed. These reasons can be grouped as follows:

Non-Achievement of No-Net-Loss

Permits / Authorizations

- Required mitigation/compensation ratios are often too small
- Temporal losses in fish habitat productive capacity result from avoidable time lags
- Technical regulatory reviews of mitigation/compensation proposals are inadequate
- Limiting factors influencing productive capacities are overlooked or wrongly analyzed during the mitigation/compensation design process

Compliance

- Non-compliance with permit specifications is undetected and/or not enforced
- Monitoring is inadequate
- Project/development design changes are not reflected in new or modified mitigation requirements
- Field audits are rarely conducted to assure compliance with mitigation and monitoring requirements
- Insufficient financial security (performance bonding) is required to assure continued compliance through time

Mitigation / Compensation Science

- Ecosystem function is inadequately incorporated into mitigation plans
- Knowledge from fish habitat enhancement/restoration is not adequately incorporated into mitigation/compensation programs

Measuring No-Net-Loss

Permits / Authorizations

- Permits and permit conditions often lack specific goals and objectives

Monitoring Programs

- Monitoring programs are often not designed to measure No-Net-Loss
- Frequency and duration of monitoring is often insufficient to measure No-Net-Loss

- Inappropriate variables are often incorporated into monitoring programs ☐ Statistical power is seldom considered in monitoring programs ☐ Delineation of mitigation/compensation sites is often unclear

Organizational Memory, Learning, Transparency

Transparency in Decision-Making

- Links between monitoring results and regulatory action are often missing
- Communication of regulatory and administrative goals to project/development owners is muddled or lacking
- Rationales governing financial securities (performance bonds) are not clear
- Magnitudes of performance bonds are often not proportional to actual needs

  Improvements in learning and organizational memory are needed

  Improvements in program effectiveness and adaptive management are needed, especially for long-term mitigation/compensation programs.

To address the specific shortcomings of many mitigation/compensation projects, Quigley, Harper and Galbraith (2006) developed a suite of 39 specific recommendations. All of these recommendations are consistent with good biological and regulatory sense and are grounded in good science. All are reasonable, practical and achievable in a modern regulatory setting.

It is very important to note that most of the reasons for failure of a significant proportion of mitigation/compensation measures to achieve the No-Net-Loss goal for fish habitat, and the Quigley- Harper-Galbraith recommendations to rectify these shortcomings, reflect a failure of regulatory and administrative functions, not the measures themselves. The next-most-important reason for failure to achieve mitigation goals is the failure to incorporate what is already known about habitat enhancement and rehabilitation, as reflected in the track record of achievement documented in earlier sections of this document.

It is also important to note that most of Quigley-Harper-Galbraith recommendations are effectively embodied in the large project regulatory framework that currently exists in Alaska. This can be demonstrated by three hard rock mining examples: Red Dog Mine near Kotzebue, Greens Creek Mine near Juneau and Fort Knox Mine near Fairbanks. All three of these large mines have clear mitigation program requirements with associated goals and objectives. All three have detailed, hierarchical, multi-parameter monitoring programs with compliance thresholds and action plans. All three have very close regulatory authority involvement (ADFG), with annual technical monitoring reports incorporating quantitative multiparameter biological benchmarks. All three monitoring programs have detected occasional deviations from parameter limits specified in permit compliance documents, and in all three examples measures have been undertaken to correct or compensate for these deviations in a timely manner. In other words, the program works as designed.

In summary, the discussion regarding the efficacy of mitigation compensation projects reviewed above point to inadequate regulatory implementation. Throughout Section 3 of this report there are embedded numerous examples and documentation of the proven efficacy of the fish habitat improvement techniques reviewed there. While there were some early failures resulting from a lack of knowledge about stream hydraulics and geomorphology, resulting in faulty designs. A lack of maintenance funding in many agencies also contributed to the poor performance. Those types of problems are now decades behind us as the knowledge base and sophistication of designs have demonstrated successes. As a result, agencies are now committing billions of dollars to restore anadromous and resident fish populations in Western North America. EPA's failure to demonstrate their knowledge of the large body of scientific literature describing the efficacy of fish habitat improvement techniques in BBWA2 only undermines the scientific credibility of the conclusions reached in their document.

EPA Response: A new section discussing the efficacy of selected fish habitat mitigation techniques has been added to Appendix J.

J.99 5. Identification of Fish Habitat Mitigation Techniques and their Applicability to Pebble Deposit Area Watersheds

The authors of this report have extensive professional experience and training in aquatic habitat mitigation techniques. They are familiar with the scientific literature and have participated in numerous evaluations of the applicability and efficacy of fish habitat improvement programs, including a $500 million program funded by the Cal/Fed Bay Delta Program. One of the authors has designed and installed fish habitat improvements for anadromous fish and served as a regional technical expert for the U.S. Forest Service on their fish habitat improvement program and as a national oversight committee member of the Forest Service's fish habitat research program. Both authors have extensive experience in Alaska and both have intimate knowledge of the Pebble Deposit area. Author Bailey served as Chief, Fisheries Resources Division for the U.S. Fish and Wildlife Service in Anchorage for nine years and has been working as a senior fish biologist on the Pebble Project since 2007 specifically. Author Buell conducted the original fish distribution and relative abundance reconnaissance surveys of the Pebble deposit area beginning in 1991 and has spent a great deal of time in the three watersheds used by EPA in their hypothetical example since then. He has been active in other mining projects in Alaska throughout his career and has been a senior fish biologist on the Pebble Project since 2004.

Given these technical and professional credentials, the authors have identified the following types and techniques that could be used as part of a mitigation program at on-site locations to mitigate the fish habitat impacts associated with EPA's mine development scenarios.

1. *Water Management:* Water from EPA's WWTP could be distributed in a manner that reflects the relative importance of certain locations and reaches of streams. For example, instead of arbitrarily distributing water from the WWTP equally to the NFK and SFK, water discharge could be appropriately distributed to the upper portion of UT where the greatest potential magnitude of benefit would accrue to coho salmon. Surprisingly, EPA chose to distribute no water into this watershed. Also, EPA could have ensured that sufficient water was distributed to the South Fork "Springs" area which is the major salmon spawning area in the SFK.

2. *Water Management:* EPA chose to distribute water from their WWTP via surface discharge, which would result in violations of Alaska's Water Quality Standards and change the emergence timing of juvenile salmon, resulting in potentially catastrophic juvenile mortality. EPA should have realized that using the water available to recharge and surcharge

groundwater aquifers, with aquifer residence time of generally a year or more, that provide critical stream flow would have eliminated the problems identified. In addition, the default release of WWTP water to recharge and surcharge aquifers would assure that WWTP upset or shutdown would not interfere with the continuing release of water to streams from groundwater storage for extended periods.

3. *Water Management:* EPA should have recognized that the WWTP discharge could be designed to provide water chemistry concentrations that would improve the buffering capacity, primary productivity, secondary productivity, and also reduce the potential toxicity of metals at area downstream of locations where discharge water reenters the stream channels.

4. *Increase Habitat Connectivity:* EPA failed to recognize numerous opportunities in all three principal watersheds to provide fish access to existing, suitable habitats that are not currently connected to a main stem channel. Figures 5.1, 5.2, and 5.3 show representative sites in the NFK, SFK, and UT, respectively. These figures are representative of photographs displayed in the EBD in Chapters 4, 7, and 15, which EPA apparently did not review. These figures are for illustrative purposes only and are not intended to identify any specific potential mitigation site. EPA did not consider providing fish passage over a cataract currently blocking anadromous fish access to suitable habitats in tributary stream UT 1.190.

5. *Increase the Quality of Existing Off-Channel Habitats:* EPA failed to recognize the potential to improve the quality of existing off-channel habitats by increasing the complexity these areas through the use of boulders, large wood, and deepening or altering the shoreline development ratio in order to create better over wintering habitat and more alcoves, and thus contributing to increased survival.

6. *Create New Habitats through the Development of Semi-Natural Channels:* EPA failed to recognize the potential for development of new off-channel habitats within the three watersheds. These new channels could provide additional spawning and rearing habitats by locating them in locations where subsurface flow will provide the water to the new channel. The authors have personally reviewed and/or visited dozens of potential sites.

7. *Increase the Primary Productivity and Productive Capacity for Fish:* EPA failed to recognize the potential to increase primary productivity and overall productive capacity for fish by developing an appropriate design for their WWTP so that discharges would increase key water chemistry constituents. They also failed to recognize that the entire area has very soft water and thus low productive potential. This situation could be improved through a carefully designed water chemistry enhancement program.

<u>EPA Response:</u> See response to J.68.

J.100 6. Identification of Fish Habitat Mitigation Opportunities at Off-Site Locations

6.1 Overview

The purpose of this section is to identify the types of mitigation techniques, of which the authors are aware that would be suitable for off-site mitigation actions for EPA's hypothetical large mine development in the Bristol Bay Watershed. The techniques listed are examples are those of which the authors are personally aware. This list is not comprehensive; the list of actions presented should be considered potential opportunities.

6.2 Degraded Habitat Rehabilitation, Reconnection, and/or Development of New Habitat

Projects identified are examples of areas where aquatic habitats have been degraded or eliminated by various mining-related activities. Opportunities are known to exist. Mitigation at these sites would involve the rehabilitation, reconnection, and/or development of new habitat in areas previously disturbed by mining activities.

6.3 Repair or Replacement of Culverts Impairing or Preventing Fish Passage

There opportunities to assist agencies in fixing problem culverts and other types of structures at road crossings. ADFG has established a Fish Passage Program within the Sport Fish Division. This program has begun an inventory of fish passage barriers or impediments which include a large number of improperly sized and/or installed culverts that result in fish passage impairment. At the present time, this inventory is limited to major road networks in Central and South-Central Alaska and Kodiak Island. Although it is acknowledged that many problem culverts exist in other regions, including Southwest Alaska, these have not yet been added to the ADFG inventory. According to program documents, approximately 44% of 130 culverts in the Matanuska-Susitna Valley, 78% of 97 culverts on the Kenai Peninsula and 83% of 29 culverts near Tyonek are known or assumed to be inadequate for passage of juvenile salmonids, according to criteria for water depth, culvert size and installation (Albert and Weiss, in review; Rich, in review a; Rich, in review b).

6.4 Access to New Habitats (Fish Passage around Natural Barriers)

Both the Nushagak River watershed and the Kvichak River watershed are very large. The Nushagak Watershed is about 8 million acres in size (excluding the Wood River watershed); the Kvichak watershed is about 5 million acres in size (excluding the Alagnak River watershed). Within these large areas there are numerous opportunities to provide access to habitats not currently accessible to anadromous fish. Within the Kvichak River watershed alone, for example, several reconnaissance efforts by one of the authors have identified several large river systems and some smaller but significant streams with barrier falls low in their watersheds. Evaluation has confirmed preliminary feasibility for providing new anadromous access as mitigation for EPA's hypothetical mine development scenario. If passage at barrier falls were provided, these systems could, in the aggregate, provide several tens of miles of river/stream access and many thousands of acres of lake habitat available to anadromous fish that are 75 presently inaccessible. The consequence of this would be significant new runs of salmon for exploitation by subsistence, recreational and commercial fisheries alike, and would, in time, add to the genetic diversity of salmon runs in the Kvichak watershed, adding significantly to the important genetic portfolio effect in that watershed.

EPA Response: See response to Comment J.68.

J.101 EPA's claim in, Appendix J, that: "… there appear to be no sites that a mitigation project could restore or enhance to offset the magnitude of impacts expected from the mine scenarios." [Emphasis added], is so patently false as to be absurd. Any competent, experienced fish biologist, who was familiar with the area in and around the hypothetical mine site and tailings storage facilities, had over-flown the area and observed it, examined satellite imagery, looked with an experienced eye at the photos and data in the EBD, or was familiar with the very large body of published scientific literature could not have concluded that no on-site opportunities for mitigation existed. They are everywhere.

In addition, anyone familiar with Alaska's Water Quality Standards and the water quality data contained in Chapter 9 of the EBD would have realized that EPA's water management scenario was not "realistic" and that multiple opportunities existed to mitigate fish habitat losses through the manipulation of water chemistry parameters in the WWTP discharge and at other locations in the watersheds to improve primary production and the productive capacity for fish populations.

Two possible conclusions can be reached, regarding EPA's assertion that no on-site opportunities for mitigation existed:

1. The EPA staff that authored the BBWA2 are ignorant of the scientific literature regarding the techniques and efficacy of salmonid fish habitat improvement and/or totally unfamiliar with the stream geomorphology and/or fish habitats existing within the three watersheds.
2. The EPA deliberately understated the availability of fish habitat mitigation opportunities in order to influence the impact conclusions presented to the general public.

Whatever the reason, the BBWA2 clearly demonstrates that EPA critically failed to present a "scientifically defensible" discussion of potential mitigation measures. In fact, most of the potential measures outlined in Appendix J, came from the public and/or peer reviewers, not EPA staff. This fact alone should raise serious questions regarding the technical competence of EPA's staff to address this issue.

The bottom line conclusion for this report is that:

- EPA failed to use the best readily available science (Section 2 of this report),
- EPA failed to understand the applicable published literature on fish habitat improvement (Section 3),
- EPA failed to understand the applicability and efficacy of the habitat improvement techniques to their mine development scenarios (Sections 3 and 4), 80
- EPA failed to follow routine scientific methods related to an assessment of this nature, thus exaggerating the magnitude of potential effects on fish habitat/populations and under-estimating the benefit of well-established, successful mitigation measures, and
- EPA failed to demonstrate the required technical and professional expertise to develop a mitigation program applicable to their development scenarios (Sections 5 and 6).

Accordingly, the BBWA2 report is not a scientifically credible document, and its conclusions are unsupportable. It is a document that provides a biased, non-objective assessment of the risks/benefits of a mine development at the Pebble location, or elsewhere within the Bristol Bay watershed. It should not be used during future agency/public deliberations on the effects of and mitigation measures for a specific modern mine proposal.

<u>EPA Response:</u> See response to Comment J.68.

The Wilderness Society (Doc. #5486)

J.102 The EPA's assessment of Bristol Bay salmon habitat and the potential impacts of mining presents a reasonable analysis of the detrimental impacts that large-scale mining will have on fish populations, their habitat and overall habitat quality for many associated species in the region. There are no examples of mining operations that have achieved mitigation of impacts, and the risk assessment in Chapter 14 seems to understate the potential for destruction of habitat. Need we look further than at salmon habitat destruction from development in the Pacific Northwest to understand how costly it will be to sustain and reclaim Bristol Bay should large-scale mining be permitted? We know that we are incapable of reproducing what occurs in a natural, undeveloped ecosystem, given the fine balance between so many variables. Maintaining and restoring channels and flow is such a small part of a watershed ecosystem.

EPA Response: **Comment noted; no change required.**

Center for Science in Public Participation (Doc. #5540 and #5657)

J.103 *Northern Dynasty (NDM): Water Management* **–** Water from EPA's WWTP could be distributed in a manner that reflects the relative importance of certain locations and reaches of streams. For example, instead of arbitrarily distributing water from the WWTP equally to the NFK and SFK, water discharge could be appropriately distributed to the upper portion of UT where the greatest potential magnitude of benefit would accrue to coho salmon. Surprisingly, EPA chose to distribute no water into this watershed. Also, EPA could have ensured that sufficient water was distributed to the South Fork "Springs" area, which is the major salmon spawning area in the SFK.

> *RESPONSE CSP2 Woody:* Northern Dynasty Mine (NDM) fish consultants claim to know where the highest densities of spawning salmon are located in each river by species; based on this knowledge they suggest 3 water management mitigation scenarios not considered by EPA. Their proposal to add water to Upper Talarik to provide the greatest "potential magnitude of benefit" to coho salmon is untenable based on data presented in the PLP EBD. Baseline studies are inadequate to estimate total number of spawning or rearing salmon because bias and precision of aerial counts or fry density by study section was never determined. Further potentially hundreds of kilometers of headwaters used by salmon were never surveyed. Thus their claim of knowing where to derive the greatest magnitude of benefit to coho salmon over time via water redistribution is unsupported. Further, they will be impacting all freshwater life stages of five species of salmon, which have different habitat needs in space and time. How will each species be proportionally affected and compensated for via water management?

EPA Response: **Comment noted; no change required.**

J.104 The three water management scenarios suggested below are all untested under harsh Alaska environments to mitigate for lost fish habitat. NDM consultants suggest on page 19 Appendix D to:

1. *NDM: Develop further impoundments to increase total water volume available to offset downstream flow reductions. RESPONSE CSP2 Woody*: This option would likely

increase impacts to salmon habitat through further damming of streams and impoundment creation in the region; no supporting documentation regarding efficacy of such a program for salmon mitigation is provided.

2. *NDM: Creation of ice fields to recharge aquifers and increase available stream flows.* RESPONSE CSP2 Woody: Authors cite three papers implying that this technique has been successfully implemented elsewhere in regards to mitigation for salmon habitat loss. However, review of citations does not support such mitigation for salmon. Clark and Lauriol (1997) is a study of natural groundwater recharge rates in a karst permafrost system of the Yukon and is not comparable to the alluvial, non-karst, non-permafrost Pebble region where such ice fields would have to be created, managed, and maintained – basically an unproven experiment with unknown outcome. Alamaro 1999 is an unpublished Masters thesis on the feasibility of generating and storing winter ice to meet summer water demands but was never published in the primary literature and is unavailable for review. Yoshikawa et al. (2007) is a study of natural ice fields and hydrology in the Brooks Range of Alaska, and provides no support regarding potential application or efficacy of ice field creation for manipulating stream flows in a mine-impacted environment.

3. *NDM: Water pump-back systems or recirculation of downstream water upstream for re-release.* RESPONSE CSP2 Woody: The non-mine influenced examples given for where this method "works" are from the Lower 48 (LA, Colorado, etc.) in highly altered systems with endangered and threatened fish populations. How this hypothetical system would work in a unique mine-impacted hydrologic unit is unknown and untested. A potentially expensive experiment with unproven utility for mitigating mine impacts under Alaska conditions. Such systems would need power, and potentially, maintenance into perpetuity. Further, no peer-reviewed before-after studies showing statistically defensible increases in salmon production as a result of these pump back projects exist.

<u>EPA Response:</u> Comment noted; no change required.

J.105 *NDM: Water Management:* EPA chose to distribute water from the WWTP via surface discharge, which would result in violations of Alaska's Water Quality Standards and change the emergence timing of juvenile salmon, resulting in potentially catastrophic juvenile mortality. EPA should have realized that using the water available to recharge and surcharge groundwater aquifers, with aquifer residence time of generally a year or more, that provide critical stream flow would have eliminated the problems identified. In addition, the default release of WWTP water to recharge and surcharge aquifers would assure that WWTP upset or shutdown would not interfere with the continuing release of water to streams from groundwater storage for extended periods.

RESPONSE CSP2 Woody:

1. Manipulation of the complex groundwater hydrology documented by PLP consultants (Smith & McCredie 2008, Groundwater Hydrology-Mine; PLP Agency presentations 2008, Anchorage) to augment stream flows would be a large-scale experiment and could fail to achieve critical stream flows for salmon mitigation, particularly during Alaskan winters.

2. Developing water impoundments, ice fields, and pump back systems to mitigate for decreased natural river flows in Alaska are unproven. No scientific documentation on the success of such projects to increase salmon production is provided.
3. If impacts are perpetual then perpetual maintenance of proposed mitigation may be required.

<u>EPA Response:</u> Comment noted; no response required.

J.106 *NDM: Water Management:* EPA should have recognized that the WWTP discharge could be designed to provide water chemistry concentrations that would improve the buffering capacity, primary productivity, secondary productivity, and also reduce the potential toxicity of metals at area downstream of locations where discharge water reenters the stream channels.

RESPONSE CSP2 Woody:

1. Changing the water chemistry of area streams fails to recognize basic salmon life history in that salmon imprint on natal stream chemistry (Dittman and Quinn 1996), which enables them to return to and spawn in the streams to which they are adapted. Calcium ions are considered an important odorant that allow sockeye salmon to discriminate their natal stream (Bodznik 1978). Changing stream chemistry could result in salmon not recognizing their natal stream and dying without spawning or they could stray to a stream to which they are not adapted and potentially suffer higher mortality thus lowered productivity.
2. Accurate and precise manipulation and control of stream chemistry for the large rivers that would be impacted would be a challenging difficult experiment with unknown outcome particularly during spring and fall flood seasons. And would there be water management into perpetuity?

<u>EPA Response:</u> Comment noted; no response required.

J.107 *NDM: Increase Habitat Connectivity***:** EPA failed to recognize numerous opportunities in all three principal watersheds to provide fish access to existing, suitable habitats that are not currently connected to a main stem channel. Figures 5.1, 5.2 and 5.3 show representative sites in the NFK, SFK, and UT, respectively. These figures are representative of photographs displayed in the EBD in Chapters 4, 7, and 15, which EPA apparently did not review. These figures are for illustrative purposes only and are not intended to identify any specific potential mitigation site. EPA did not consider providing fish passage over a cataract currently blocking anadromous fish access to suitable habitats in tributary stream UT 1.190. Authors propose to increase fish habitat connectivity to increase salmon production potential in a number of ways. (see pg. 22-57 Appendix D, NDM response to EPA revised watershed assessment.)

NDM: Removal or Modification for Seasonal Barriers (beaver dams and fish passes). Beaver Dams – RESPONSE CSP2 Woody:

1. Authors purport to have documented beaver dams blocking salmon access to upstream habitats in the Pebble project area. However, review of the PLP EBD shows no empirical studies buy a list of purported beaver dam “barriers” in the project area ranging from 0.2

meters to 2 meters high. Bryant (1984) showed that dams of 2 meters in height did not block salmon passage upstream and surveys in the Pebble region have documented salmon above dams higher than 2 meters (Figure 1) [***figure deleted here; see original public comment for figure***]. Further, authors failed to review the most recent literature by Devries et al. (2012), employed by one of PLP's primary consulting firms on the Pebble Project. They advocate emulating ecosystem engineering by beaver as a less expensive and disruptive fish enhancement technique relative to large-scale in-stream engineering projects. It seems reasonable based on the most recent scientific literature to not manipulate or change current beaver created habitat unless studies how unequivocally that they block fish passage or somehow impair the number of smolts produced per spawner.

Northern Dynasty consultants neglected to review the most recent scientific literature on the impacts of beaver dams on fishes and fish habitat. For example, Kemp et al. (2012) conducted a systematic meta-analysis of the literature and expert opinion primarily for North America. The most frequently cited benefits of beaver dams were increased habitat heterogeneity, rearing and overwintering habitat and flow refuge for fish, and invertebrate production. Benefits (184) were cited more frequently than costs (119). The majority of 49 North American and European experts considered beaver to have an overall positive impact on fish populations, through their influence on abundance and productivity. The most cited negative effect of beaver activity was that dams impeded fish passage but little research quantifying the existence or magnitude of this impact exists.

The single citation provided by NDM relative to beaver management as a mitigation tool is Finnegan and Marshall (1997) who advocate a variety of engineered structures to prevent beaver from damming culverts, which do not currently exist in the project area, as well as engineered structures to help fish pass upstream of beaver dams. Managing beaver to mitigate for lost fish habitat has questionable efficacy as beaver activity in the Pebble Project area has not been shown to reduce fish production, salmon obviously pass above beaver dams, and recent studies indicate the benefits of beaver dams outweigh the costs. The long-term efficacy of proposed structures are not proven and not documented in the primary literature.

2. Fish passes or Fishways: RESPONSE CSP2 Woody:

Authors propose to install a fishway on a tributary to Upper Talarik Creek where groundwater from the South Fork Koktuli emerges (pg. 25, Appendix D). As a Biologist on the Tongass for 4 years one of my jobs was to maintain fish passes. Fish passes require constant maintenance, especially after floods and in areas with beaver (who will continually dam the fishway entrance); their effectiveness at passing fish is inconsistent, their effectiveness is rarely monitored and only recently studied and fishways can actually prevent or delay fish passage (Meixler 2009, Lauritzen et al. 2010, Roscoe and Hinch 2010, Hatry et al. 2011, Noonan et al. 2011, Bunt et al. 2012, Williams et al. 2012). Performance of fishways varies greatly with their type, design and operating regime, and with the species involved. Of the 50 fish passes installed on the Tongass in Southeast Alaska, none are monitored to determine whether estimated fish production from installation was ever realized. Instead, managing agencies report estimated increases in fish production based on available habitat, which is very different than actually measuring increased fish production.

<u>EPA Response:</u> Comment noted; no response required.

J.108 *NDM: Increase the Quality of Existing Off-Channel Habitats:* EPA failed to recognize the potential to improve the quality of existing off-channel habitats by increasing the complexity these areas through the use of boulders, large wood, and deepening or altering the shoreline development ratio in order to create better over wintering habitat and more alcoves, and thus contributing to increased survival.

RESPONSE CSP2 Woody:

NDM consultants propose to add boulders and large wood, as well as bulldoze new and deeper habitats to increase fish production in watersheds that would be impacted by mining. They also claim that the success of such projects is “settled science”. Such a proposal is flawed for a number of reasons. First NDM assumes that habitat is limiting salmon production and that they can somehow improve it. But these rivers already produce the world’s largest sockeye and Chinook salmon runs and there is no data to indicate habitat is limiting. But since NDM would eliminate significant amounts of salmon habitat if mining is permitted, they would have to compensate or mitigate for lost habitat. Authors overlook the fact these rivers are wild and although habitats may be disconnected at certain times of the year they are connected at other times. The photographs in attachment D on pages 72 and 73 clearly show how the rivers have moved across the landscape over time. These rivers will continue to move and any mitigation projects to “reconnect” or “improve” habitats will only affect salmon habitat temporarily. Recent science also shows such projects would have to restore 100% of eliminated floodplain and in-channel habitat to detect a fish production increase of 25% with 95% certainty (Roni 2011). The lack of statistically valid pre-mining fish abundance and aquatic biota data in the PLP EBD underscores the fact that they would be unable to show any scientifically valid increases in fish abundance in a before after study of mitigation which is one of the primary problems cited in achieving and evaluating mitigation goals (Quigley and Harper 2006a). A review in SCIENCE (Bernhardt et al. 2005) of US river restoration efforts found that although river restoration has become a highly profitable business with an average of 1 billion spent annually fewer than 10% of 37,099 projects were ever monitored post-construction to determine if objectives were realized. The outcomes of tens of thousands of projects have never been tracked over the long term thus the efficacy of such projects is equivocal. Stewart et al. (2009) found only equivocal evidence of their effectiveness at increasing salmonid abundance and significant variability in success among projects.

<u>EPA Response:</u> Comment noted; no change required.

J.109 *NDM: Create New Habitats through the Development of Semi-Natural Channels:* EPA failed to recognize the potential for development of new off-channel habitats within the three watersheds. These new channels could provide additional spawning and rearing habitats by locating them in locations where subsurface flow will provide the water to the new channel. The authors have personally reviewed and/or visited dozens of potential sites.

RESPONSE CSP2 Woody:

1. Effectiveness of engineered off-channel habitats, primarily for coho salmon, was recently evaluated in British Columbia (Cooperman et al. 2006). Authors indicated that assessment of channel functionality is very limited. A rapid assessment of ten channels showed eight of ten were “functional” but five of the eight had issues that likely

compromised their utility to salmon. Although authors assessed three topics 1) physical connectivity, 2) thermal stability and, 3) coho use and growth, they did not show statistically defensible augmentation of coho salmon populations in sites that were purportedly successful. Effectiveness monitoring was listed as needed to determine if off-channels actually augment salmon production.

2. Morley et al. (2005) compared coho salmon use of constructed versus natural side channels in Washington. Total salmonid densities were not significantly different between channel types, but coho salmon densities were higher in constructed channels and trout densities were higher in natural channels in winter.
3. Creation of spawning channels for sockeye salmon can result in disease outbreaks and reduced salmon production (Mulcahy et al. 1982)
4. Price (2012) examined potential effects of spawning channels on Babine Lake sockeye salmon. His review indicated that increasing sockeye salmon stocks artificially using spawning channels can alter prey communities and reduce average weight of juveniles leaving the nursery lake. Marine survival rates declined with increasing numbers of emigrating salmon.

EPA Response: Comment noted; no change required.

J.110 *NDM: Increase the Primary Productivity and Produce Capacity for Fish:* EPA failed to recognize the potential to increase primary productivity and overall productive capacity for fish by developing an appropriate design for their WWTP so that discharges would increase key water chemistry constituents. They also failed to recognize that the entire area has very soft water and thus low productive potential. This situation could be improved through a carefully designed water chemistry enhancement program.

RESPONSE CSP2 Woody:

1. Changing the water chemistry of area streams fails to recognize basic salmon life history in that salmon imprint on natal stream chemistry (Dittman and Quinn 1996), which enables them to return to and spawn in the streams to which they are adapted. Calcium ions are considered an important odorant that allow sockeye salmon to discriminate their natal stream (Bodznik 1978) a water quality characteristic that NDM proposes to change. Changing stream chemistry could result in salmon not recognizing their natal stream and dying without spawning or they could stray to a stream to which they are not adapted and potentially suffer higher mortality thus lowered productivity.
2. There is no data on area streams and rivers showing that salmon productivity is currently nutrient limited or that nutrients affect the stock recruitment relationship (Adkison 2010).
3. Lake and stream fertilization experiments to increase primary productivity and theoretically salmon populations, assume that nutrients limit salmon production, but this is not always the case:
   - Wipfli and Baxter (2010) showed that most fish food comes from external or very distant sources, including: from marine systems borne by adult salmon, from fishless headwaters that transport prey to downstream fish, and from riparian vegetation and associated habitats.

- Paeliolimnologic studies in Alaska indicate nutrient inputs are not always tied to higher primary productivity or salmon productivity (Chen et al. 2011).
- Added nutrients can result in no increased fish growth (Cram et al. 2011).
- Nutrient additions can result in nuisance algae blooms or undesirable diatoms (Hyatt et al. 2004)
- Nutrient additions can result in declines in primary production due to changes in ecosystem metabolism (Holtgrieve and Schindler 2011).
- Nutrient additions did not increase salmonid biomass, growth or retention in 6 California streams (Harvey and Wilzbach 2010).
- In some systems the highest yields can be obtained from small nutrient depleted populations (Adkison 2010)

1. Accurate and precise manipulation and control of stream chemistry for the large rivers that would be impacted would be a challenging difficult experiment with unknown outcome.

<u>EPA Response:</u> Comment noted; no change required.

J.111 NDM claims: "There is no question about the effectiveness of an appropriate application of these measures to enhance production of aquatic biological resources, especially salmon. Large amounts of money continue to be dedicated towards the implementation of these kinds of measures because they work; this is settled science." Pg. 67 Appendix D. They also rely heavily on papers by Quigley and Harper (2005, 2006a, 2006b) on Canadian mitigation to support their claims but in actuality these papers actually refute their claims.

1. Quigley and Harper (2006a) showed that 67% of compensation projects resulted in net losses to fish habitat and only 2% resulted in no net loss.
2. Quigley and Harper (2006a) showed that 86% of permitted "harmful alteration, disruption of destruction to fish habitat" (HADD) in Canada had larger HADDs and/or smaller compensation areas than authorized.
3. Quigley and Harper (2006a) indicated that habitat compensation in Canada was at best only slowing the rate of fish habitat loss.
4. NDM claims that Quigley and Harper (2006a) conclude compensatory habitat development or enhancements to offset losses "is an excellent conservation strategy, potentially serving as a model for other jurisdictions", but in fact
5. Quigley and Harper (2006b) showed that 63% of projects resulted in net losses to aquatic habitat productivity and only 25% achieved no net loss.
6. Quigley and Harper (2006b) concluded "the ability to replicate ecosystem function is clearly limited".

<u>EPA Response:</u> Comment noted; no change required.

J.112 General Comments from Northern Dynasty Minerals (NDM)

5. Throughout the 400 square mile area surrounding Pebble, there are tremendous opportunities to undertake fish mitigation projects that would substantially increase the productive capacity of the area for both salmon and resident fish species. (NDM 2013a)

Northern Dynasty proposes to compensate and mitigate for lost salmon and fish production from Pebble Mine by "improving" upon Bristol Bay's already productive natural rivers by bulldozing "new" habitat, adding boulders and logs to rivers, and altering water quality to "improve productivity". Such techniques rarely show scientifically defensible increases in salmon production over the long term, require long-term maintenance and monitoring, and if done improperly can adversely affect salmon habitat and salmon production.

EPA Response: Comment noted; no change required.

J.113 Compensatory Mitigation is now considered in Chapter 7 as well as Appendix J. Compensatory mitigation measures considered a wide range of measures ranging from beaver dam removal to hatcheries. Current status of U.S. salmon is a testament to the efficacy of billions of dollars of mitigation efforts, although well intentioned, mitigation and compensation have failed to reverse the decline of salmon and effects of mitigation at the watershed scale are not known (Bernhardt et al. 2005).

EPA Response: Comment noted; no change required.

Earthworks (Doc. #5556)

J.114 Although mine proponents claim they can offset salmon losses via mitigation, recent studies[30] clearly question the efficacy of mitigation to offset salmon losses. Although a billion dollars are spent annually in the US on salmon restoration[31] effectiveness and cumulative impact of various mitigation and restoration techniques on salmon production remain debatable at the watershed scale and can sometimes be harmful.

EPA Response: Comment noted; no change required.

American Fisheries Society, Western Division (Doc. #5377)

J.115 Appendix J acknowledges the substantial challenges to mitigating the unavoidable salmon losses that will result from routine mine operations or those that will occur as a result of catastrophic spills. We are not only concerned that mitigation and remediation options are not adequate but that the report gives the impression that mitigation is seamless. We have decades of research and practical experience in the lower 48 that demonstrate our inability to replace fish and ecosystem losses with either human-engineered habitats or human-produced hatchery product. Other specific concerns, many of which were addressed, are identified in our July 21, 2012 letter and accompanying document.

EPA Response: Comment noted; no change required.

J. L. Hallock Jr. (Doc. #2889)

J.116 EPA is slightly reserved in their statements in the draft assessment, but they appear to acknowledge what I just stated. Given the one of a kind setting and productivity of the area, and scale of impacts even from the 0.25 mine scenario – compensatory mitigation that can replace these lost functions and values does not seem remotely possible.

EPA Response: Comment noted; no change required.

APPENDIX 1. MASS-MAILERS AND EPA RESPONSES.

The majority of comments submitted to the docket during the public comment period were from mass-mailing and petition letter campaigns. This appendix contains the text of each mass-mailing and petition letter campaign and EPA's response. The number of duplicates of each mailer received and the sponsor (where known) are noted. Mass-mailers with minor modifications to the title or content were included in the number count.

EPA-HQ-ORD-2013-0189-0186 [5 on-time duplicates]

I am writing today to ask you to protect Bristol Bay, Alaska from the Pebble mine. Please use your influence to ensure that the EPA uses its authority under the Clean Water Act to stop this ill-conceived project immediately. Pebble will damage the world-class fishery in Bristol Bay and that is why the commercial fishermen and Alaska Natives who depend on it, and the local businesses that make their living off of this wild landscape in Southwestern Alaska oppose it.

At first glance, Pebble Mine might appear to be a classic jobs vs. the environment issue. The reality is that the Pebble Mine would create between 1000-2000 jobs while endangering 12,000 commercial and recreational fishery-related jobs in the $600 million annual salmon fishery. And the mining jobs would disappear once the minerals are extracted. In contrast, the jobs supported by salmon will continue long past the closure of the mine, as long as we take care of the habitat. In Bristol Bay, protecting the environment protects jobs.

I urge you to initiate a Clean Water Act 404(c) process in Bristol Bay immediately. Alaska Natives, sportsmen, commercial fishermen, churches, and conservation organizations deserve a public and science-based process to determine if the Pebble Partnership's plans to build the biggest open pit mine in North America will harm one of our nation's greatest fisheries.

This is the wrong mine in the wrong place, and this Administration should work to stop it before more time and resources are wasted. Bristol Bay demonstrates that some places should be left free of industrial development because their natural resource values, and the benefits they provide to people, outstrip short-term development values.

> **EPA Response: Comment noted. Economic values and activities were summarized in Appendix E of the assessment. As a scientific assessment, this study does not recommend policy or regulatory decisions. It is a technical resource for the public, tribes, and governments as EPA considers how best to address the challenges of mining and ecological protection in the Bristol Bay watershed.**

EPA-HQ-ORD-2013-0189-0187 [17,691 on-time duplicates]

I fished for years in Bristol Bay and have many friends and family that continue that tradition. Economically speaking a pebble mine clearly does not provide the same benefits that one of the worlds largest fisheries in the world does. Bristol bay is the last unique and mostly intact fishery left on earth, lets not negatively impact this legacy just so that a large multinational corporation can continue to fill its coffers. Thank you to the EPA for the diligent work, transparent process and extensive scientific review in evaluating the destructive impacts of large-scale mining in the Bristol Bay, Alaska region through its Bristol Bay Watershed Assessment.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega mining. Bristol Bay and its healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon.

It is time for the Pebble Partnership to stop playing games and Politics with what are clearly unacceptable impacts. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

Please bear in mind that Pebble CEO John Shively told a crowd in March 2013: "At closure, we will have to have a system for closure and we will have to have a very substantial amount of money set aside so if we're not available to work on closure, the government or somebody else can do it." I'm certain no American taxpayers are interested in having the "government" handle closure and cleanup issues for the Pebble Mine. In addition, because employees in the State of Alaska's Department of Natural Resources have already said (in a nationally televised episode of "Frontline") that if the Pebble Partnership brings a mine application it would likely be approved, Bristol Bay is clearly a case in which the help of the federal government is required to protect a substantial regional economy with resources of a national and global scale.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-0188</u> [10,340 on-time duplicates]

The people up there are self-sufficient and live sustainably. Don't destroy the salmon and their way of life. Stop killing the Earth, the Oceans and people who want to be live responsibly.

I am writing to urge the EPA to initiate the 404c process to prohibit the disposal of mine waste in the pristine waters of the Bristol Bay watershed. Bristol Bay supports the world's largest remaining wild salmon fishery. It is the economic engine for the region, supplying some 14,000 jobs and generating an estimated $480 million in annual revenue.

The science demonstrates that large-scale mining, such as the Pebble Mine, represents a long-term risk to the sustainability of this important fishery – and all the people and businesses that rely on it. The revised watershed assessment determines that the likely impacts of the proposed Pebble Mine are even bigger than before. It concludes that the proposed mine could result in 90 miles of streams destroyed from the mine footprint; 4,800 acres of wetlands could be lost, and 34 miles of streams harmed as a result of reduced flows.

Once again, I urge the EPA to take immediate action to initiate Section 404c of the Clean Water Act to protect the world's greatest wild salmon fishery, the Alaska native cultures who rely on the wild salmon, and 14,000 jobs!

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions.**

EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-0189</u> [248 on-time duplicates]

The fishermen and industry of Bristol Bay thanks the EPA for its updated Bristol Bay Watershed Assessment and thorough process. We believe the strong scientific evaluation of the world's largest and most valuable sockeye salmon fishery should lead to protection of Bristol Bay's 14,000 American jobs under the Clean Water Act.

The Assessment documents that even without a catastrophe or a series of leaks and spills, mining the Pebble deposit will destroy up to 87 miles of salmon streams and up to 4,800 acres of wetland salmon habitat. These impacts alone are unacceptable and adverse, and additional impacts from withdrawing water from salmon streams and returning treated water to those streams could have further dramatic impacts on wetlands, fish spawning, and fish rearing habitat. Moreover, road development and culverts will have negative impacts for fish passage.

As your report notes, [the Bristol Bay commercial salmon fishery generates the largest component of economic activity and was valued at approximately $300 M in 2009 (first wholesale value) and provided employment for over 11,500 full- and part-time workers at the peak of the season. These estimates do not include retail expenditures from national and international sales.] (8) When you take into account the national and international sales of Bristol Bay's sockeye salmon, the numbers easily exceed $1 billion annually.

No doubt remains that EPA must safeguard the Bristol Bay fishery from inappropriate mining development. We request that your agency act now under the Clean Water Act to initiate a 404c process that would restrict large-scale mining activities from harming sensitive spawning and rearing habitat in the Bristol Bay watershed.

<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-0392</u> [31,503 on-time duplicates]

Thank you for the diligent work, transparent process, and extensive scientific review reflected in the Bristol Bay Watershed Assessment, which evaluates the destructive impacts of large-scale mining in the Bristol Bay region of Alaska.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, Native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega-mining. Bristol Bay and its Healthy sockeye fishery support 14,000 jobs across multiple industries and generates more than $1 billion in economic activity every year. It also supplies nearly half of the global supply of sockeye salmon.

It is time for the Pebble Partnership to stop playing games and politics with what are clearly unacceptable impacts. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 90 miles of streams and up to 4,300 acres of wetlands, which would reduce vital salmon habitat, would be destroyed by mining the deposit. That alone should be enough to stop this project. Add in the unsupportable notion that up to 23 billion tons of toxic mine waste will be stored, treated, and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed. What is with you knuckle heads at the EPA? Either you support Environmental Protection or you do not! By allowing this to happen or continue you are supporting, by accident or design, the screwing up of the ecosystem which in turn screws up the environment!

Stop it! Stop it now! Your lax attitudes and virtually non enforcement of existing laws have damaged enough people and animals!

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-0393 [1,407 on-time duplicates]

The last thing this nation needs is another mine; especially one that will last only a few decades. Bristol Bay needs protection far more than mining corporations and shareholders need profits. Support sustainable salmon fishing and ban the mine.

Thank you for releasing the Bristol Bay Watershed Assessment. It is extremely clear to me that your scientific evaluation leads to one simple conclusion, the world's largest and most valuable sockeye salmon fishery should be protected immediately. Your assessment clearly documents that mining the Pebble deposit will destroy up to 87 miles of salmon streams and up to 4,800 acres of wetlands that salmon depend on for survival. These impacts alone are unacceptable. The Bristol Bay salmon fishery provides employment to 14,000 full and part-time workers.

According to recent reports from the University of Alaska, the value of the Bristol Bay sockeye salmon fishery exceeds $1.5 billion annually. Hard working Americans are looking to you to protect their jobs. If the Pebble mine is allowed to move forward and the impacts that your study so clearly describes take place, good people will be out of work. Commercial fishermen depend on fish. Fish need habitat. No habitat means no jobs. Only the EPA and the Obama administration can protect the habitat that keeps us fishing.

I write today to request that your agency act immediately under the Clean Water Act to protect Bristol Bay's fishing jobs, our $1.5 billion dollar industry, and the people who depend on this fishery for their way of life.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-0394 [1,060 on-time duplicates]

I commend the EPA for its careful work, transparent process and extensive scientific analysis in evaluating the impacts of large-scale mining in the Bristol Bay, Alaska. The report makes clear to hunters, anglers and conservationists that now is the time to protect Bristol Bay's natural resources, native peoples, jobs and industry and tremendous recreational opportunities from the unavoidable consequences of huge surface mines in this sensitive environment.

Bristol Bay and its healthy sockeye fishery supports 14,000 jobs. Across multiple industries and generates more than $1 billion in revenue every year while supporting nearly half of the global supply of sockeye salmon as well as brown bears, wolves, moose, caribou and other wildlife.

The EPA's Assessment finds that up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated and monitored "in perpetuity," in an area with high potential for earthquakes, and it becomes clear that action is required to protect Bristol Bay now.

Dozens of distinguished Alaskan fish and wildlife experts have told President Obama that "The proposed Pebble Mine in Bristol Bay poses numerous significant and potentially long-lasting threats to one of the world's foremost sport fishing and hunting regions. Specifically, fish habitat (including spawning and rearing grounds), wildlife habitat and recreational areas are all threatened by several hard rock mining proposals - most notably, the Pebble Mine."

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate large-scale mining in the Bristol Bay watershed, while allowing reasonable development to proceed.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-0395</u> [36,392 on-time duplicates, sponsored by the World Wildlife Fund]

I ask that the EPA exercise its authority under the Clean Water Act to stop the proposed Pebble Mine and protect the Bristol Bay watershed. The findings of the Watershed Assessment lead me to believe that we should protect Bristol Bay and its economically, ecologically and socially important salmon fishery, rather than put this resource at risk for the development and operation of Pebble Mine.

I appreciate the EPA's acknowledgement of the ecological resources of Bristol Bay. It supports the largest wild salmon fishery in the world that generates $1 billion in revenue each year, 14,000 jobs across multiple industries, and has sustained native tribes, local communities, and commercial fishery livelihoods for generations.

The EPA's review provides clear evidence of the disastrous and long lasting impacts the mine would have from the day-to-day operations, even at the smallest of scales (Pebble 0.25 Footprint). If a mine of this nature were to be developed in the Bristol Bay watershed, it would devastate the area's pristine ecological and economical resources.

My concerns regarding the development of Pebble Mine are two-fold:

1) Development and operations: If developed, the Pebble Mine will be one of the largest open pit mines in the world. As the Watershed Assessment states, development and operations of the mine would last from 20 to 100 years. The Pebble Mine would result in losses of 24-90 miles of streams known for spawning and rearing of salmon and 1,200-4,800 acres of wetlands. Regardless of the mine's scale, the transportation corridor needed to operate it would negatively impact streams, rivers,

and wetlands that support salmon spawning and rearing. Related operations failures such as leakage and wastewater treatment plant, culvert, and tailings dam failures, acknowledged in the Assessment mentions would threaten the region's freshwater and marine ecosystems and resources.

2) Post-mining waste management If developed, the Pebble Mine would require the world's largest earth-filled dam capable of containing between 2.5-10 billion tons of mine waste that would require treatment in perpetuity. The Bristol Bay salmon fishery has sustained native tribes, local communities, and commercial fishery livelihoods for generations. Treating mine waste in perpetuity, combined with the potential of dam failures, would put this salmon fishery at risk.

These impacts are unacceptable. Please protect the Bristol Bay watershed and its salmon fishery through the use of EPA's authority under the Clean Water Act to stop the development of the Pebble Mine.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-0592 [23,141 on-time duplicates, sponsored by the National Parks Conservation Association]

I am alarmed that private companies could build an industrial mining district on lands adjacent to Lake Clark National Park and Preserve. This national park was created by Congress to protect a portion of Bristol Bay's wild salmon habitat, as well as the larger ecosystem, economy, and traditional cultures so closely tied to the fish.

The mission of the park is in grave danger if mines are allowed to be built in the watershed that flows into our national park. Bristol Bay's fishing industry, which infuses our country with $480 million annually, might be harmed forever.

According to new analysis by the EPA, the Pebble mining district could be much larger than anticipated and its impacts could be far more extensive. Now companies are exploring 15 additional sites in the region. We already know that the effects of Pebble Mine alone could be severe and permanent, but the possibility of even more mines being carved into the headwaters of our last intact wild salmon fishery is outrageous. This threat must be stopped.

The state of Alaska has allowed mining claims to be staked across More than 130,000 acres of the Chulitna River watershed, Lake Clark's largest freshwater tributary. Development companies could build three large mines here, plus a mess of roads and infrastructure with additional threats to the environment. The state of Alaska may not be serious about protecting wild salmon habitat, but I am and I know you are, too. Industrial, open-pit mining in Bristol Bay is not worth the risk, and it certainly does not belong upstream of our national park.

Please, act now to protect Bristol Bay's wild salmon and the integrity of Lake Clark National Park and Preserve permanently. Thank you for keeping up the fight to save Bristol Bay's one-of-a-kind wild salmon fishery!

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-0738 [587 on-time duplicates]

As one of the nation's 60 million anglers, I thank you for completing the revised comprehensive draft study on the Bristol Bay watershed and the scope of its natural resources. This assessment overwhelmingly supports what the sportfishing community has been advocating for – denial of Pebble Mine permits under the Clean Water Act. I urge you to use your authority under section 404(c) of the Clean Water Act to protect the region's unmatched salmon fishery and recreational fishing from water quality impairment and habitat degradation.

Sportsmen and women care deeply about protecting Bristol Bay's fisheries and fish habitat, and have a strong heritage and legacy of conservation. Bristol Bay is one of the world's great recreational fishing destinations, mainly because the bay's freshwater habitat is largely untouched by development, with a tradition that has been passed down for generations. It supports the world's largest sockeye salmon runs, healthy runs of king, coho, chum and pink salmon and provides habitat for important sportfish species such as rainbow trout. All told, annually, the Bristol Bay fisheries generate more than $450 million dollars for the state's economy and provide over 12,000 jobs.

The operations at Pebble Mine will create up to 10 billion tons of toxic waste, which will need to be contained in perpetuity because of their acidic byproducts. The millions of tons of waste will be held back from the pristine waters of Bristol Bay by the world's largest earthen dam, which could be destabilized by one of the region's frequent earthquakes. If the byproducts of Pebble Mine contaminate the surrounding waters, the impact on the region's fish and wildlife populations will be devastating. Not only will the contamination affect fish and wildlife but also recreational and commercial fishermen, Alaska's native populations, local businesses and others that rely on and enjoy Bristol Bay.

Thank you for preparing the Bristol Bay watershed assessment.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1131 [7,522 on-time duplicates, sponsored by American Rivers]

As a supporter of American Rivers, I am deeply concerned about the potential destructive impacts that large-scale mining would have on the Bristol Bay watershed in Alaska. I appreciate the diligent work of your agency, including a transparent process and extensive scientific review to evaluate the impacts of mining through the Bristol Bay Watershed Assessment. It is clear from your assessment that now is the time to use EPA's authorities under the Clean Water Act to prevent the construction of large scale mines in the watershed.

The rivers of Bristol Bay (including the Kvichack and Nushagak Rivers and their tributaries) are not an appropriate place for one of the largest open-pit mines in the world. According to the EPA's Assessment, there will be a direct loss of 55 to 85 miles of streams and 4 to 6.7 square miles of wetlands from the Pebble Mine. This is unacceptable, especially in such an important unspoiled area.

The Nushagak River is the world's largest producer of Chinook salmon. Tailings spill from the mine would eliminate 28% of the Nushagak Chinook run, with an additional 20% reduction in the Mulchatna Furthermore, the healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supports nearly half of the global supply of sockeye salmon. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 90 miles of salmon streams and up to 4,300 acres of vital salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated, and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

The EPA's Assessment highlights the importance of protecting Bristol Bay's natural resources, native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega mining. I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities, such as the proposed Pebble Mine, while allowing reasonable development to proceed.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1132 [68 on-time duplicates]

As a jeweler, I am committed to responsible gold sourcing policies that recognize areas of high conservation or ecological value, such as Alaska's Bristol Bay, and that promote responsible mine waste disposal.

I am writing to express support for the protection of Bristol Bay's wild salmon fishery from the proposed Pebble gold and copper mine.

I commend the U.S. Environmental Protection Agency (EPA) for completing its revised scientific study on the risks of mining the Pebble deposit. The Bristol Bay watershed assessment highlights the global significance of Alaska's Bristol Bay fishery, and the threat of large-scale mining to the long-term sustainability of this world-class resource, and the communities it supports.

I encourage the EPA to use its authority under Section 404c of the Clean Water Act to restrict the disposal of harmful mine waste into the pristine waters and wetlands of Bristol Bay to ensure the lasting protection and sustainability of the wild salmon fishery.

This science-based process is a responsible approach to Bristol Bay protection.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1155 [1,193 on-time duplicates]

Dear Environmental Protection Agency:

Salmon = long term jobs = money = subsistence = recreation = culture = long term economic power = profit for diverse interests = minimal government oversight = no pollution = no reclamation.

Gold = short term jobs = huge profit for small group of investors at expense of Alaskans = pollution = tax payer clean up liability =destruction of salmon economy = reclamation.

Salmon are renewable and valuable as food and an economic engine. Gold is just something you wear to flaunt wealth. Is there really a question as to which is more valuable?

Thank you to the EPA for the diligent work, transparent process and extensive scientific review in evaluating the destructive impacts of large-scale mining in the Bristol Bay, Alaska region through its Bristol Bay Watershed Assessment.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega mining. Bristol Bay and its healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon.

It is time for the Pebble Partnership to stop playing games and politics with what are clearly unacceptable impacts. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

Please bear in mind that Pebble CEO John Shively told a crowd in March 2013: "At closure, we will have to have a system for closure and we will have to have a very substantial amount of money set aside so if we're not available to work on closure, the government or somebody else can do it." I'm certain no American taxpayers are interested in having the "government" handle closure and cleanup issues for the Pebble Mine.

In addition, because employees in the State of Alaska's Department of Natural Resources have already said (in a nationally televised episode of "Frontline") that if the Pebble Partnership brings a mine application it would likely be approved, Bristol Bay is clearly a case in which the help of the federal government is required to protect a substantial regional economy with resources of a national and global scale.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-1156</u> [114,799 on-time duplicates, sponsored by the Natural Resources Defense Council]

I applaud EPA for undertaking such a rigorous scientific study of the Bristol Bay watershed. Your agency has now completed two thorough assessments of the region, and they have both come to the same conclusion: Massive mining projects like the Pebble Mine would be devastating to Bristol Bay.

The time for study is now over. It is time for action to protect Bristol Bay's environment, wildlife and people. Your painstaking review has provided overwhelming evidence that large-scale mining in such an ecologically sensitive area would pose grave and unacceptable risks to a natural treasure.

Bristol Bay's wild salmon fishery provides 14,000 jobs and is valued at more than $1.5 billion annually. It also supplies nearly half of the global supply of sockeye salmon. Salmon sustain the culture, language and spirituality of Alaska Natives, who have relied on subsistence fishing for thousands of years.

The proposed Pebble Mine would risk this economic, cultural and ecological powerhouse by gouging one of the world's largest gold and copper mines out of the headwaters of Bristol Bay. It would generate billions of tons of contaminated waste, devastate up to 90 miles of streams, destroy thousands of acres of wetlands and threaten the area's legendary salmon runs -- the linchpin of the Bristol Bay ecosystem, which supports wildlife such as bears, eagles, wolves and seals.

Your agency's findings all demonstrate that building a mine of this scale in this location is an unacceptably destructive venture, and it must be stopped. I urge you to do so by using EPA's authority under Section 404(c) of the Clean Water Act -- for the sake of the Bristol Bay watershed, its world-class salmon fishery and its people.

Regardless of what they promise, anyone with common sense knows that it is not possible for the operators of any large project to protect the environment forever from the devastating effects of massive spillage of toxic materials. This project must not proceed!

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1157 [2,515 on-time duplicates]

I am writing to ask you to terminate the Bristol Bay watershed assessment, as it is both deeply flawed and unnecessary. Since the report assesses impacts based on an unrealistic, hypothetical mine plan, it fails to meet basic scientific standards and the conclusions from the report offer no grounds for determining how an actual mine would operate. Until a mine plan is submitted and the actual facts are presented, it is far too early to examine impacts from a mine in Bristol Bay.

The EPA's reliance on reports from avowed anti-mining groups and "experts" like Ann Maest, who recently admitted to falsely presenting environmental reports to a court, further demonstrates that this study is biased and formulated with questionable data designed to achieve a predetermined result.

In addition, the United States already has a strong environmental permitting process that operates under the National Environmental Priority Act (NEPA). A study of this nature prior to initiation of permits is unnecessary and negates the existing NEPA process.

Using this flawed and unnecessary document as grounds to issue a preemptive denial for the Pebble project would send shock waves through the U.S. economy and stop tens of thousands of jobs. It's time that the EPA stops wasting my taxpayer dollars and Jeopardizing American jobs. I urge you to end the Bristol Bay Watershed Assessment immediately. Thank you.

The EPA is becoming a political action bureaucracy rather than being a shining example of how science works. Your perceived purpose, to those of us that represent traditional scientific endeavor, is to destroy the United States of America as formed under the Constitution.

> **EPA Response: Comment noted. The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari**

et al. (2011), and assume that modern conventional mining practices and technologies are used. EPA has authority to conduct risk assessments of this nature under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry.

The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to the reports she co-authored from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.

EPA-HQ-ORD-2013-0189-1158 [499 on-time duplicates]

Please stop this biased watershed study before it kills more American jobs.

The Bristol Bay Watershed Assessment was clearly designed with the purpose of providing the basis for a preemptive permit denial under section 404(c) of the Clean Water Act for the Pebble deposit, before the company has even submitted a mine plan. Not only would this be the first time the EPA has preemptively vetoed a permit prior to the established permitting process, it would also be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices!

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments in projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

The facts are clear: We already have a stringent environmental permitting process, and conducting this assessment outside the permitting process of permits is unnecessary and negates the existing National Environmental Priority Act process.

The consequences of the EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs. I urge you to stop this biased study now, and refrain from issuing a preemptive permit veto. Socialism always fails.

EPA Response: Comment noted. EPA has authority to conduct risk assessments of this nature under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-1159 [24 on-time duplicates]

The EPA's action to develop this premature assessment—giving grounds to issue a preemptive permit denial for the Pebble mine—the clearly oversteps Congressional and state authority by bestowing your agency with unprecedented powers to preemptively deny on environmental permits under the Clean Water Act.

This option will have vast consequences that could send shockwaves through the American economy, costing thousands of American jobs. A balanced process to measure environmental and socioeconomic impacts of development projects already exists under the National Environmental Priority Act (NEPA), which was enacted by Congress and promoted by the Environmental community. Preemptive permit denials would nullify the NEPA process, trample Congressional authority, and make a mockery of state's rights.

The EPA's revised Bristol Bay Watershed Assessment lays the groundwork for a preemptive denial of a water discharge and dredging permit (under section 404c of the Clean Water Act) for the Pebble deposit, which would override the entire NEPA process. Pebble sits on state land that was specifically designated for mining. Since it's one of the largest mineral deposits ever discovered in North America, developing it in an environmentally-sound manner would provide good jobs for remote rural communities and create a stable domestic source of critical mineral resources for manufacturing and national defense. But the devastating reverberations of preemptive EPA action would go far beyond Pebble.

Our economy benefits from over $200 billion per year in domestic and foreign investment in U.S. projects that rely on similar environmental permits. The vast uncertainty created by your agency's arbitrary and capricious action would create a devastating impact on these billions in investment dollars.

Making a decision on the Pebble project now would be premature, and it is urgent that your agency's ends its unconstitutional power grabs. Otherwise, these unfair rules will kill the Pebble project before the permitting process even begins, leaving our nation's entire resource, energy, farming, and home building industries, vulnerable to a similar fate.

I stand with thousands of other Americans in demanding you to protect American jobs and the vitality of American resource industries by reversing your agency's power grabs in Bristol Bay.

> **EPA Response: Comment noted. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. The document is a scientific risk assessment, not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1160 [18,101 on-time duplicates, sponsored by the National Wildlife Federation Action Fund]

Your recently revised risk assessment of large-scale mining in Alaska's Bristol Bay demonstrates the significant and unacceptable effects that the proposed Pebble Mine would have on this wilderness paradise.

Bristol Bay's pure waters and healthy habitat sustain the world's largest and most productive commercial salmon fishery, flourishing wildlife populations, and the centuries-old subsistence lifestyle of Alaska Natives.

The Pebble copper and gold mine--planned for the headwaters of Bristol Bay--would be the largest open pit mine in North America. It would generate up to 10 billion tons of toxic mine waste that would be held behind massive earthen dams located just 20 miles from an active fault line. This is a disaster waiting to happen, and has the potential to devastate one of the last remaining strongholds for healthy salmon populations in the world.

I urge you to exercise your authority under section 404 of the Clean Water Act to prohibit Pebble Mine from dumping dredged and fill materials into the rivers and waters of Bristol Bay in order to safeguard the region's unique waters and the people and wildlife that depend upon them.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-1964 [4,560 on-time duplicates]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment. That is why the following 4,560 Americans proudly signed the attached letter to call on the EPA to STOP this assessment now.

I am writing to voice my strong opposition to the EPA's draft watershed assessment for the vast Bristol Bay region of Alaska because it sets a dangerous precedent, is wholly unnecessary, and relies on dubious source material from biased anti-mining organizations and scientists that recently admitted to falsifying reports submitted in legal proceedings.

The conclusions in the assessment based on a "hypothetical mine plan" appear predetermined, offer little substantive value, and do not take into account the actual mine plan and mitigation efforts. The National Environmental Priority Act (NEPA), enacted by Congress and promoted by the environmental community, created a balanced process to measure science and socioeconomic impacts of development projects. A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. Likewise, as the EPA is forced to deal with budget constraints under sequestration the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Additionally, the EPA's revised Bristol Bay watershed assessment lays the groundwork for a preemptive denial of a water discharge and dredging permit (under section 404c of the Clean Water Act) for the Pebble deposit that would set a dangerous precedent of preemptive action, creating a chilling effect on the U.S. economy and killing American jobs.

Moreover, many of the assessment's recommendations rest on research from discredited "scientist" Ann Maest, a Stratus Consulting contractor who recently admitted to falsifying testimony against Chevron in Ecuador. Maest's questionable methods and evident personal biases call Stratus' contributions into question and tarnish the report's credibility.

Likewise, the reliance on funded research from Earthworks, a leading anti-mining activist organization, further draws into question the assessments findings as predetermined.

This biased and unnecessary report should be discarded, and the proven NEPA process should be allowed to work. Continuing the assessment will throw into question EPA's credibility, drain needed funds from crucial environmental protection efforts, and cost tens of thousands of American jobs.

I urge you to protect American jobs and the vitality of American natural resource independence by discarding this fatally flawed, unnecessary, and biased watershed assessment.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**
>
> **EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to the reports she co-authored from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.**

EPA-HQ-ORD-2013-0189-2743 [44,657 on-time duplicates, sponsored by the Pew Charitable Trusts]

In the coming months, your administration will make an important decision that could determine whether the proposed Pebble Mine or other vast, open-pit operations will be built in Alaska's Bristol Bay watershed. The area's pristine rivers and lakes are home to world-class salmon runs that support recreational sport fishing and allow Native Alaskans to maintain their centuries-old way of life.

I want to thank the Environmental Protection Agency for exercising caution and conducting an assessment under the Clean Water Act to determine the potential impact that Pebble Mine and other industrial operations would have on fisheries and wildlife, Native cultures, and the estimated $480 million in direct economic activity annually for the region. Recently, more than 300 leading scientists expressed "deep concerns" about the prospect of large-scale mining in the Bristol Bay watershed.

Please use sound science and your authority under the Clean Water Act to protect one of America's last great wild places.

<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-2744</u> [479 on-time duplicates]

As a person of faith who is committed to the protection of Bristol Bay, Alaska, I thank you for releasing the Bristol Bay Watershed Assessment, as well as for the transparent process and extensive scientific review that went into creating the Assessment.

Bristol Bay is a stunning piece of God's Creation that supports a one of a kind salmon fishery, a thriving and sustainable economy, and thousands of Alaskan natives whose way of life and culture has been intertwined with the health of Bristol Bay for more than 4000 years. The Watershed Assessment makes it clear that we cannot wait any longer to protect the Bay's Native people, natural abundance, and commercial fishing jobs from the consequences of large scale mining. Bristol Bay and its healthy sockeye fishery supports the sustainable livelihoods of many Native Alaskans, as well as 14,000 jobs across multiple industries.

The Watershed Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining. Furthermore, the Pebble Limited Partnership's multiple filings and documents provide evidence that the mine would generate up to 10 billion tons of toxic waste that must be stored and treated "in perpetuity" behind large earthen dams in a seismically active area. These risks demonstrate a clear need for decisive action to protect Bristol Bay now.

Christian teachings call on us to serve as stewards of God's Earth and seek justice for our neighbors, so I ask you to use your authority to permanently protect Bristol Bay from the irreparable harm the proposed Pebble mine would cause God's people and Creation in and around the Bay. Please act immediately under the Clean Water Act to restrict inappropriate development activities at Bristol Bay such as the proposed Pebble Mine.

<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-4701</u> [9,389 on-time duplicates, sponsored by Resourceful Earth]

9,389 Americans from across the county signed the attached letter in opposition to EPA's Bristol Bay Assessment because we need to be creating jobs and strengthening our domestic supplies of natural resources, not hindering them.

I am writing to voice my strong opposition to the EPA's draft watershed assessment for the vast Bristol Bay region of Alaska because it sets a dangerous precedent, is wholly unnecessary, and relies on dubious source material from biased anti-mining organizations and scientists that recently admitted to falsifying reports submitted in legal proceedings.

The conclusions in the assessment based on a "hypothetical mine plan" appear predetermined, offer little substantive value, and do not take into account the actual mine plan and mitigation efforts.

The National Environmental Priority Act (NEPA), enacted by Congress and promoted by the environmental community, created a balanced process to measure science and socioeconomic impacts of development projects. A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. Likewise, as the EPA is forced to deal with budget constraints under sequestration the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Additionally, the EPA's revised Bristol Bay watershed assessment lays the groundwork for a preemptive denial of a water discharge and dredging permit (under section 404c of the Clean Water Act) for the Pebble deposit that would set a dangerous precedent of preemptive action, creating a chilling effect on the U.S. economy and killing American jobs.

Moreover, many of the assessment's recommendations rest on research from discredited "scientist" Ann Maest, a Stratus Consulting contractor who recently admitted to falsifying testimony against Chevron in Ecuador. Maest's questionable methods and evident personal biases call Stratus' contributions into question and tarnish the report's credibility.

Likewise, the reliance on funded research from Earthworks, a leading anti-mining activist organization, further draws into question the assessments findings as predetermined.

This biased and unnecessary report should be discarded, and the proven NEPA process should be allowed to work. Continuing the assessment will throw into question EPA's credibility, drain needed funds from crucial environmental protection efforts, and cost tens of thousands of American jobs.

I urge you to protect American jobs and the vitality of American natural resource independence by discarding this fatally flawed, unnecessary, and biased watershed assessment.

> **<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**
>
> **EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to the reports she co-authored from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.**

<u>EPA-HQ-ORD-2013-0189-4702</u> [6,006 on-time duplicates, sponsored by Resourceful Earth]

6,006 people signed the attached letter calling on the EPA to end the Bristol Bay study because it is a waste of taxpayer dollars and threatens tens of thousands of American jobs.

We demand that the EPA not operate outside the established environmental permitting process, as it will create a dangerous precedent that could risk $200 billion in economic investment.

I am writing to voice my strong opposition to the EPA's draft watershed assessment for the vast Bristol Bay region of Alaska because it sets a dangerous precedent, is wholly unnecessary, and relies on dubious source material from biased anti-mining organizations and scientists that recently admitted to falsifying reports submitted in legal proceedings.

The conclusions in the assessment based on a "hypothetical mine plan" appear predetermined, offer little substantive value, and do not take into account the actual mine plan and mitigation efforts.

The National Environmental Priority Act (NEPA), enacted by Congress and promoted by the environmental community, created a balanced process to measure science and socioeconomic impacts of development projects. A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. Likewise, as the EPA is forced to deal with budget constraints under sequestration the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Additionally, the EPA's revised Bristol Bay watershed assessment lays the groundwork for a preemptive denial of a water discharge and dredging permit (under section 404c of the Clean Water Act) for the Pebble deposit that would set a dangerous precedent of preemptive action, creating a chilling effect on the U.S. economy and killing American jobs.

Moreover, many of the assessment's recommendations rest on research from discredited "scientist" Ann Maest, a Stratus Consulting contractor who recently admitted to falsifying testimony against Chevron in Ecuador. Maest's questionable methods and evident personal biases call Stratus' contributions into question and tarnish the report's credibility.

Likewise, the reliance on funded research from Earthworks, a leading anti-mining activist organization, further draws into question the assessments findings as predetermined.

This biased and unnecessary report should be discarded, and the proven NEPA process should be allowed to work. Continuing the assessment will throw into question EPA's credibility, drain needed funds from crucial environmental protection efforts, and cost tens of thousands of American jobs.

I urge you to protect American jobs and the vitality of American natural resource independence by discarding this fatally flawed, unnecessary, and biased watershed assessment.

> **<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow**

when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to the reports she co-authored from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.

EPA-HQ-ORD-2013-0189-4703 [4,241 on-time duplicates, sponsored by Resourceful Earth]

4,241 people signed the attached letter calling on the EPA to end the Bristol Bay study because it is a waste of taxpayer dollars and threatens tens of thousands of American jobs.

We demand that the EPA not operate outside the established environmental permitting process, as it will create a dangerous precedent that could risk $200 billion in economic investment.

I am writing to ask you to scrap the Bristol Bay watershed assessment because it is a deeply flawed and unnecessary report.

Assessing impacts based on a "hypothetical mine plan" that does not include modern standards and mitigation methods fails to meet basic scientific standards and the conclusions from the report offer no substantive value. Until a mine plan is submitted and the actual facts are presented, it is premature to examine impacts from a mine in Bristol Bay.

The reliance on experts and reports from anti-mining groups and individuals that have recently admitted to falsely presenting environmental reports to a court demonstrates that this study is biased and formulated with questionable data.

Furthermore, we already have a stringent environmental permitting process that operates under the National Environmental Priority Act (NEPA), which creates a process to balance science and economic benefits of projects. A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. As the EPA is forced to deal with budget constraints under sequestration, the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Finally, using this flawed and unnecessary document as grounds to issue a preemptive denial for the Pebble project would send shock waves through the U.S. economy and stop tens of thousands of jobs.

It's time that the EPA stops wasting taxpayer dollars and jeopardizing American jobs.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper

mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-4704 [12,501 on-time duplicates, sponsored by Resourceful Earth]

The Pebble project is one of the most significant mineral deposits ever discovered in the United States. With the potential for billions in economic investment and tens of thousands of jobs, this project is too big and too important to be reviewed based on rushed analysis of a hypothetical mine.

12,501 Americans are pleased to sign the attached letter opposing the EPA's watershed assessment.

I am writing to ask you to scrap the Bristol Bay watershed assessment because it is a deeply flawed and unnecessary report.

Assessing impacts based on a "hypothetical mine plan" that does not include modern standards and mitigation methods fails to meet basic scientific standards and the conclusions from the report offer no substantive value. Until a mine plan is submitted and the actual facts are presented, it is premature to examine impacts from a mine in Bristol Bay.

The reliance on experts and reports from anti-mining groups and individuals that have recently admitted to falsely presenting environmental reports to a court demonstrates that this study is biased and formulated with questionable data.

Furthermore, we already have a stringent environmental permitting process that operates under the National Environmental Priority Act (NEPA), which creates a process to balance science and economic benefits of projects. A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. As the EPA is forced to deal with budget constraints under sequestration, the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Finally, using this flawed and unnecessary document as grounds to issue a preemptive denial for the Pebble project would send shock waves through the U.S. economy and stop tens of thousands of jobs.

It's time that the EPA stops wasting taxpayer dollars and jeopardizing American jobs.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper

mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-4705 [43,600 on-time duplicates, sponsored by Resourceful Earth]

43,600 Americans (attached) oppose the EPA's outrageous and unprecedented attempt to stop mining in Alaska before a mine plan exists.

At a time when millions of Americans are unemployed, the Pebble project has the potential to create tens of thousands of new jobs and generate billions of dollars in local and national revenue.

Pebble presents an incredible opportunity for an impoverished area; to preemptively kill the project before it has the chance to undergo due process is unacceptable.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper

mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-4706 [26,976 on-time duplicates, sponsored by Resourceful Earth]

Southwestern Alaska has had few opportunities for economic development; rural communities in the area are dying and the fishing industry provide few local jobs, as most of the money flows out of state.

As one of the most significant mineral deposits ever discovered in the United States, the Pebble mine could transform the impoverished region, adding jobs and funding crucially needed infrastructure.

26,976 Americans have signed letters (attached) demanding that the EPA follow long-held American environmental procedures and stop operating outside of the review process.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's

guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-4707</u> [621 on-time duplicates, sponsored by Resourceful Earth]

The EPA's revised Bristol Bay watershed assessment report is based on hypothetical, flawed research and relies on biased science from anti-mining groups. Stopping the Pebble mine without giving it a chance for a fair review will eliminate tens of thousands of much-needed American jobs and kill billions in potential economic investment.

622 Americans have written letters (attached) opposing the EPA's actions and demanding that Pebble be allowed to go through the prescribed permitting process.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's

guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-4708 [1,396 on-time duplicates]

The EPA's unnecessary and premature Bristol Bay Watershed Assessment and its potential use as justification to preemptive kill the Pebble project, before a mine plan has been submitted, set a dangerous precedent that will harm our economy and kill American jobs.

If it is eventually approved, Pebble will invest several billion dollars to develop this mine, creating thousands of much-needed jobs in Alaska and throughout the United States But EPA appears willing to kill this project before they even have the chance to start.

This would be the EPA's first preemptive permit veto. If we let EPA take on this new authority, not granted by Congress, then it's game over for the American economy, it's game over for jobs, and the flood gates are open – and the American economy will never recover.

For the sake of American jobs, I urge you to please take a stand to stop this unfair attack on the Pebble mine.

EPA Response: Comment noted. The document is a scientific risk assessment, not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-4709 [391 on-time duplicates, sponsored by Care 2]

In the coming months, your administration will make an important decision that could determine whether the proposed Pebble Mine or other vast, open-pit operations will be built in Alaska's Bristol Bay watershed.

The area's pristine rivers and lakes are home to world-class salmon runs that support recreational sport fishing and allow Native Alaskans to maintain their centuries-old way of life.

I want to thank the Environmental Protection Agency for exercising caution and conducting an assessment under the Clean Water Act to determine the potential impact that Pebble Mine and other industrial operations would have on fisheries and wildlife, Native cultures, and the estimated $480 million in direct economic activity annually for the region. Recently, more than 300 leading scientists expressed “deep concerns” about the prospect of large-scale mining in the Bristol Bay watershed.

Please use sound science and your authority under the Clean Water Act to protect one of America’s last great wild places.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-4710</u> [712 on-time duplicates, sponsored by the United Church of Christ]

As a person of faith who is committed to the protection of Bristol Bay, Alaska, I thank you for releasing the Bristol Bay Watershed Assessment, as well as for the transparent process and extensive scientific review that went into creating the Assessment.

Bristol Bay is a stunning piece of God’s creation that supports a one-of-a-kind salmon fishery, a thriving and sustainable economy, and thousands of Alaskan natives whose way of life and culture has been intertwined with the health of Bristol Bay for more than 4000 years.

The Watershed Assessment makes it clear that we cannot wait any longer to protect the Bay’s Native people, natural abundance, and commercial fishing jobs from the consequences of large scale mining. Bristol Bay and its healthy sockeye fishery supports the sustainable livelihoods of many Native Alaskans, as well as 14,000 jobs across multiple industries.

The Watershed Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining. Furthermore, the Pebble Limited Partnership’s multiple filings and documents provide evidence that the mine would generate up to 10 billion tons of toxic waste that must be stored and treated “in perpetuity” behind large earthen dams in a seismically active area. These risks demonstrate a clear need for decisive action to protect Bristol Bay now.

Christian teachings call on us to serve as stewards of God’s Earth and seek justice for our neighbors, so I ask you to use your authority to permanently protect Bristol Bay from the irreparable harm the proposed Pebble mine would cause God’s people and Creation in and around the Bay. Please act immediately under the Clean Water Act to restrict inappropriate development activities at Bristol Bay such as the proposed Pebble Mine.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-4711</u> [106 on-time duplicates]

I am writing to request the Environmental Protection Agency (EPA) cease conducting the inappropriate Bristol Bay Assessment. Should the EPA choose to proceed, I urge you to extend the comment period for the Revised Draft Bristol Bay Assessment (BBA) by at least 120 days.

The EPA should not proceed with a preemptive decision prior to permit application and completion of the National Environmental Policy Act (NEPA) process. To do so would set a very dangerous precedent and one that could be abused in either direction, either for or against development. In Alaska, such preemptive decisions would have adverse and unintended impacts on entire regions of the state, thereby undermining the true intent of the NEPA and, in this particular case, sentencing numerous Southwest Alaska communities to poverty without giving them the opportunity to evaluate individual project plans.

Every project, no matter the size or location, should have an opportunity to be reviewed under existing legal processes, with all stakeholders involved. Preemption of this process is inappropriate.

Thank you for considering these comments.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. EPA felt it was important to extend the comment deadline for 30 days to provide time for people to give EPA their input, but did not feel that extending it for the requested 120 days was warranted. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-4712 [16 on-time duplicates]

I am an angler who believes in responsible stewardship of our waters and wild places.

We believe that some places – places like Alaska's Bristol Bay – are especially important, and now is the time to protect Alaska's Bristol Bay from large-scale mining.

We oppose the Pebble Mine project, and we hope that the EPA will immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

I'd like to thank the EPA for the diligent work, transparent process and extensive scientific review that reveals the destructive impacts of large-scale mining in the Bristol Bay, Alaska region through the Bristol Bay Watershed Assessment.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, native peoples, commercial fishing jobs, and tremendous recreational opportunities from the unavoidable consequences of mega mining. Bristol Bay and its healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon.

The EPA's Assessment finds that even without a catastrophe or harmful spill, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the 10 billion tons of toxic mine waste that will be stored, treated and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now, and that the action must be from the Federal Government.

I urge you to immediately initiate use of the Clean Water Act to stop the proposed Pebble Mine and any similar development in the Bristol Bay watershed.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-4713 [34,642 on-time duplicates, sponsored by the Sierra Club]

Thank you for the EPA's diligent work, transparent process and extensive scientific review in evaluating the destructive impacts of large-scale mining in the Bristol Bay, Alaska region through its Bristol Bay Watershed Assessment.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega mining. Bristol Bay's healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon.

The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. The proposal would also require up to 10 billion tons of toxic mine waste to be stored, treated and monitored "in perpetuity." It is clear that action is required to protect Bristol Bay now.

Pebble CEO John Shively said in March 2013 that "at closure, we will have to have a system for closure and we will have to have a very substantial amount of money set aside so if we're not available to work on closure, the government or somebody else can do it." American taxpayers should not have to foot the bill for closure and cleanup for the Pebble Mine. Employees in the State of Alaska's Department of Natural Resources have already said (in a nationally televised episode of "Frontline") that if the Pebble Partnership brings a mine application it would likely be approved. So it's clear that the federal government must protect this substantial regional economy with resources of a national and global scale.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-4714 [9,507 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment. For these reasons, 9,510 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs. I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-4715 [7,545 on-time duplicates, sponsored by Causes.org]

Please accept the enclosed 7,542 signatures, collected by causes.org, urging the EPA to initiate Section 404c of the Clean Water Act to protect Alaska's Bristol Bay from the proposed Pebble Mine. The results of the watershed assessment provide sound scientific basis for this action.

I call on CEQ and President Obama to protect Alaska's Bristol Bay - the world's most productive wild salmon fishery - from the proposed Pebble Mine.

Alaska's wild salmon fishery is the economic engine for the region, supplying 14,000 American jobs, generating $480 million a year, and sustaining the Alaska Native communities who rely on it as their primary source of food. It's a renewable resource that can provide our nation with a bounty of healthy food as long as we are responsible stewards.

Please take immediate steps to require the EPA to initiate 404c of the Clean Water Act to protect Alaska's Bristol Bay salmon fishery, and the wildlife, businesses and communities that depend on it.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-4716 [10 on-time duplicates, sponsored by the New Mexico Wildlife Federation]

The Bristol Bay Watershed Assessment defines the need to stop large-scale open pit mining in the headwaters of the world's greatest salmon run. Large-scale mining would directly impact the fishery and the people who rely on it for their livelihoods. Alaska Natives, sportfishing outfitters and commercial fishermen need the assurance that their salmon economy is not threatened by large-scale hard rock mining in the Bristol Bay Watershed.

[Individual handwritten additions]

> I believe in full enforcement of the Clean Water Act for Bristol Bay
>
> I believe it's important to conserve nature areas and protect them for our children and future generations.
>
> I believe this is the worst place to put a hard rock mine! We totally oppose it. What good can come of it?
>
> I believe we should protect the environment.
>
> I believe: Bad place for a gold mine!
>
> I believe: Bad place for a mine.
>
> I believe: It is our duty to protect this area.
>
> I believe: A terrible place for a gold mine.
>
> I believe this will destroy the ecology of the salmon in Bristol Bay.
>
> I believe: Bad Idea!
>
> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-5064 [3,804 on-time duplicates, sponsored by Resourceful Earth]

3,805 Americans have signed letters (attached) opposing the EPA's outrageous and unprecedented attempt to stop mining in Alaska before a mine plan exists. At a time when millions of Americans are unemployed, the Pebble project has the potential to create tens of thousands of new jobs and generate billions of dollars in local and national revenue. Pebble presents an incredible opportunity for an impoverished area; to preemptively kill the project before it has the chance to undergo due federal process is unacceptable.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs. I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

> **EPA Response:** **Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-5086 [27,254 on-time duplicates, sponsored by Resourceful Earth]

The Pebble project is one of the most significant mineral deposits ever discovered in the United States. With the potential for billions in economic investment and tens of thousands of jobs, this project is too big and too important to be reviewed based on a rushed analysis of a hypothetical mine. 27,265 Americans are pleased to sign letters (attached) opposing the EPA's watershed assessment.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs. I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-5087 [12,149 on-time duplicates, sponsored by Resourceful Earth]

Southwestern Alaska has had few opportunities for economic development; rural communities in the area are dying and the fishing industry provides few local jobs, with most of the money flowing out of state. As one of the most significant mineral deposits ever discovered in the United States, the Pebble mine could transform the impoverished region, adding jobs and funding crucially needed infrastructure. 12,155 Americans have signed letters (attached) demanding that the EPA follow long-held American environmental procedures and stop operating outside of the review process.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a

preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process of permits is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs. I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-5088 [46,557 on-time duplicates, sponsored by Earthworks]

Please accept the enclosed 62,996 petition signatures on behalf of the US Environmental Protection Agency (EPA) initiating Section 404c of the Clean Water Act to protect Alaska's Bristol Bay from the proposed Pebble Mine.

> **EPA Response: Comment noted. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7236 [6,362 on-time duplicates, sponsored by the National Parks Conservation Association]

Thank you, EPA, for studying the facts at the core of the controversy over whether to develop Pebble Mine in the heart of Bristol Bay's wild salmon fishery.

A mining district that is likely to cause extensive, unavoidable harm to wild salmon habitat and water quality does not belong in the headwaters of Bristol Bay. It does not belong upstream of our national park either. Thousands of sustainable American jobs and a $480 million annual economy are tied to this healthy fishery. Alaska Native cultures that have lived off of its natural bounty for generations now fear the possible consequences of industrial mining.

Bristol Bay is precious and worth protecting. Please, safeguard our wild salmon stronghold.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-7237</u> [3,981 on-time duplicates]

As an activist with Americans for Prosperity, I urge you to forego this flawed study that attempts to stack the deck against a mine that has not even been proposed yet.

Permit seekers deserve an opportunity to develop their projects and then submit a request for a permit without the federal government working behind the scenes to preempt their proposals. Your study fails to take meaningful considerations into account about how and when a hypothetical mine could operative in the region.

I urge you to abandon your flawed assessment and allow the Pebble Project to request a permit, if they so choose.

> **<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-7238</u> [32 on-time duplicates]

As a jeweler, I am committed to responsible gold sourcing policies that recognize areas of high conservation or ecological value, such as Alaska's Bristol Bay, and that promote responsible mine waste disposal. I urge the EPA to use its authority to keep toxic mine waste out of Bristol Bay's waters.

I am writing to express support for the protection of Bristol Bay's wild salmon fishery from the proposed Pebble gold and copper mine.

Ethical Metalsmiths and it's allies stand poised as the vanguard of the jewelry industry's movement to create a legacy of beauty and justice. One of our most important totems is the Salmon and all that it represents in the way of ecological stewardship and social justice. All actions taken without the full intent of protecting, even encouraging, the growth of wild salmon populations will be met with ever increasing resistance.

In a recent EM trip to the Sierra Nevada, it became even more clear that mining activity in California made it impossible for salmon to survive, EPA research makes it clear that this will happen in the Bristol Bay region too.

I commend the U.S. Environmental Protection Agency (EPA) for completing its revised scientific study on the risks of mining the Pebble deposit. The Bristol Bay watershed assessment highlights the global significance of Alaska's Bristol Bay fishery, and the threat of large-scale mining to the long-term sustainability of this world-class resource, and the communities it supports.

I encourage the EPA to use its authority under Section 404c of the Clean Water Act to restrict the disposal of harmful mine waste into the pristine waters and wetlands of Bristol Bay to ensure the lasting protection and sustainability of the wild salmon fishery.

This science-based process is a responsible approach to Bristol Bay protection.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7239 [11,014 on-time duplicates, sponsored by Greenpeace]

Dear Acting EPA Administrator Robert Perciasepe,

The proposed Pebble Mine would put the livelihoods of the people of Bristol Bay and Bristol Bay ecosystems in danger. Having billions of tons of mine waste stored behind a dam next to the world's largest salmon run is simply reckless. In addition, your own reports state that the Pebble Mine would result in the direct loss of up to 85 miles of streams and 6.7 square miles of wetlands in a place that is critical salmon habitat.

The impact on the surrounding environment and economy could be catastrophic if the mine is allowed to proceed. Please use the EPA's authority -- granted by the Clean Water Act -- in order to ensure the safety of Bristol Bay communities and ecosystems. There is simply too much to lose.

> **EPA Response: Comment noted. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7240 [556 on-time duplicates, sponsored by Americans for Tax Reform]

Before you make a determination about whether or not the Pebble Mine can operate safely, I urge you to allow the project's developers to submit a formal application for review. A preemptive veto would represent an unprecedented abuse of the EPA's authority and show your inability to objectively review permit applications without the approval of radical environmentalists. We urge you to stop wasting taxpayer dollars on a flawed study about a hypothetical mine that doesn't exist.

Not only is this unfair, the rejection of the Pebble Mine project would have dramatic, real world consequences. Studies have shown that construction and operation of the Pebble Mine would be a boon for the region and:

> - Create over 16,000 high-paying jobs per year throughout construction process and nearly 15,000 high-paying jobs per year during production

- Contribute $1.6 billion to our nation's GDP per year during the construction process and an additional $2.4 billion per year afterwards

America needs more projects like this one. Please make sure aspiring job creators are given a fair shake.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-7241 [17 on-time duplicates, sponsored by New Mexico Wildlife Federation]

Dear EPA,

The Bristol Bay Watershed Assessment defines the need to stop large-scale open pit mining in the headwaters of the world's greatest salmon run. Large-scale mining would directly impact the fishery and the people who rely on it for their livelihoods. Alaska Natives, sportfishing outfitters and commercial fishermen need the assurance that their salmon economy is not threatened by large-scale hard rock mining in the Bristol Bay Watershed.

EPA Response: Comment noted. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-7305 [16,572 on-time duplicates, sponsored by VoteVets.org]

Please find attached a letter from VoteVets.org signed by 16,572 veterans, military family members and VoteVets.org supporters opposed to the proposed mining near Bristol Bay, Alaska.

The signatures were collected this week in response to membership emails on June 23rd and 27th. Some of the signers also wanted to make the agency aware of their specific war or peacetime service, and in those instances you'll find that information attached to their name, city, and state.

Thank you for your consideration,

You can find the petition here: http://action.votevets.org/page/s/bristol-bay

Bristol Bay, Alaska is one of the greatest hunting and sport fishing locations on the planet and the source of American jobs in the commercial fishing industry. Veterans from around the country travel to Alaska every summer to work in the Bristol Bay fishery and earn a living.

I am concerned about the threat of the proposed Pebble Mine. I'm not opposed to responsible resource development, but this open pit mine - proposed by two foreign mining companies - would create 10 billion tons of mine waste and threaten Bristol Bay.

Your recent Assessment documents that the Pebble Mine will destroy up to 87 miles of salmon streams and up to 4,800 acres of wetlands that fish and wildlife depend on. The Bristol Bay salmon fishery provides employment to 10,000 full-time workers and generates $1.5 billion annually to the US economy. Hard working Americans are looking to you to protect their jobs.

I write today to request that your agency use the Clean Water Act to protect Bristol Bay's fishing jobs, its $1.5 billion dollar industry, and recreational opportunities that an open pit mine would ruin for future generations.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7544 [63 on-time duplicates]

As an Alaskan, I am writing to thank the EPA for the diligent work, transparent process and extensive scientific review in evaluating the destructive impacts of large-scale mining in the Bristol Bay region through its Bristol Bay Watershed Assessment.

Your report clearly supports that we cannot wait any longer to protect Bristol Bay's natural resources, native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega mining. Bristol Bay and its healthy sockeye fishery provides 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon.

It is time for the Pebble Partnership to stop playing games and politics with what are clearly unacceptable impacts. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 87 miles of salmon streams and up to 4,300 acres of salmon habitat will be destroyed by mining the deposit. That alone should be enough to stop this project, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7690 [592 on-time duplicates, sponsored by Students of Palisades Charter High School]

STOP PEBBLE MINE!

My passion for nature blossomed as a small child growing up in California. Our Mother Earth is vital for every person and nature influences me every day. I am a 17-year-old activist! I first heard about Pebble Mine from my dear art teacher. She is a huge role model to me and she is the one who initiated my concern and involvement for this cause. Once I heard and investigated the devastation planned for Alaska I knew I had to do something!

After a little research I found the NRDC petition form, and with the help of my public high school's environmental teacher a plan to expose the petition school wide began to form! I printed out dozens of petition forms using the original NRDC structure. Along with the petition form I created an informational letter that explained the tragic plans set for Pebble Mine Alaska. My final touch to appealing to my peers was a visual aspect. I blew up a huge picture of the pristine Alaskan wilderness and next to it I had an equally massive picture of the Rio Grande open mine. This visual struck the hearts of students at my high school and petitions forms began to flood in! I was so proud that my new dream of saving Alaska was turning into reality!

My high school was very supportive of the Stop Pebble Mine cause. I was able to get my school's student council on my team! During class time my Stop Pebble Mine team went into classrooms and soon a couple dozen petitions turned into a couple of hundred! During lunchtime I set up a Stop Pebble Mine booth in the cafeteria area, and within a couple weeks I amassed 582 petitions!

It started with a dream. Then a plan hatched, and after much hard work my efforts turned into a cause! A cause that would make a difference in our world. I am living proof that if you put your soul into an issue you full-heartedly believe in, success will follow. So please stop Pebble Mine!

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7781 [16,887 on-time duplicates, sponsored by the National Council of Churches]

Please find attached a letter from 16,887 Christians around the country who are opposed to the proposed Pebble Mine in Bristol Bay, AK and thankful for the scientific assessment which has confirmed the beauty and bounty of the bay.

For Alaska Natives, Bristol Bay is more than just a body of water. It is an abundant piece of God's creation that feeds families, provides good U.S. jobs, and sets the backdrop for recreation and sport for thousands of Alaskan natives and visitors… But now it is under serious threat.

Join Alaskan churches and fishermen calling for the protection of Bristol Bay by clicking here to add your name to the statement below.

Proposed mining projects would destroy this beautiful spot of God's creation and the natural salmon habitat there that provides for the livelihood of thousands. As Christians, we cannot remain silent while special interests seek to line their own pockets at the expense of American families, sportsmen, and creation. That's why churches, businesses, and local communities are rallying together to urge the EPA to protect Bristol Bay.

Please join them by clicking here to sign the statement below. Share your support on facebook and twitter for the Alaska Natives, visitors to the state, and future generations who might never see Bristol Bay as God created it.

Blessings,

The petition reads as follows:

As Christians, taught to care for God's Creation and seek justice for all of God's people, we are joining the tens of thousands of American workers and Native Alaskans calling for permanent protection of Bristol Bay so that its abundance may continue to for those who depend on it today and remain as a blessing for future generations.

> **EPA Response:** **Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-7782 [32,628 on-time duplicates, sponsored by Earthjustice]

Earthjustice, a public interest law organization, collected 32,628 public comments from citizens urging the EPA to use its authority under the Clean Water Act to stop the proposed Pebble Mine. Most went directly to the EPA's comment period email address, but we have an additional 961 that were gathered through GreaterGood's The Rainforest Site. These signatures have been compiled in the attached PDF file. Individuals signed on to the following letter:

Thank you for the diligent work, transparent process, and extensive scientific review reflected in the Bristol Bay Watershed Assessment, which evaluates the destructive impacts of large-scale mining in the Bristol Bay region of Alaska.

Your report makes clear that we cannot wait any longer to protect Bristol Bay's natural resources, Native peoples, commercial fishing jobs and industry, and tremendous recreational opportunities from the unavoidable consequences of mega-mining. Bristol Bay and its healthy sockeye fishery support 14,000 jobs across multiple industries and generates more than $1 billion in economic activity every year. It also supplies nearly half of the global supply of sockeye salmon.

It is time for the Pebble Partnership to stop playing games and politics with what are clearly unacceptable impacts. The EPA's Assessment finds that even without a catastrophe or series of harmful spills, up to 90 miles of streams and up to 4,300 acres of wetlands, which would reduce vital salmon habitat, would be destroyed by mining the deposit. That alone should be enough to stop this project. Add in the unsupportable notion that up to 23 billion tons of toxic mine waste will be stored, treated, and monitored "in perpetuity," and it becomes clear that action is required to protect Bristol Bay now.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed.

<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-7783</u> [66 on-time duplicates]

I am a salmon processing worker in Bristol Bay, Alaska . I would like to thank you for releasing the second draft Bristol Bay Watershed Assessment.

The Draft Assessment confirms what is already abundantly clear to anyone who works in the Bristol Bay salmon industry: this prolific resource owes its astounding profusion to an unspoiled, one-of-a-kind natural habitat . If this habitat is disturbed, there is little doubt that the bounty, genetic diversity, and resilience of the Bristol Bay salmon populations will be diminished .

The Bristol Bay salmon fishery provides employment to 14,000 full and parttime workers and provides $1.5 billion in value. The wealth generated by this resource reaches far and wide; Bristol Bay salmon are an economic engine that supports families in states across the nation. Add to that the thousands of people who use it recreationally or for subsistence purposes, and it becomes immediately clear that despoiling the upper Bristol Bay watershed through mining is a risk that we as a country cannot afford to take.

I write today to request that your agency act immediately under the Clean Water Act to protect Bristol Bay's salmon jobs, our $1 .5 billion dollar industry, and the people who depend on this fishery for their way of life.

<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-7784</u> [31 on-time duplicates]

I applaud you for undertaking a scientific assessment of the Bristol Bay watershed, which concluded that large-scale mining in such an ecologically sensitive region would jeopardize this natural treasure and its communities. I urge you to now exercise your authority under the Clean Water Act to prohibit the construction of massive mining projects in this location -- including the Pebble Mine.

The Pebble Mine would gouge one of the world's largest gold and copper mines out of the headwaters of the Bristol Bay. It would generate billions of tons of contaminated waste, destroy thousands of acres of wetlands and threaten the area's legendary salmon runs -- the lynchpin of the Bristol Bay ecosystem on which Alaskan Native cultures have subsisted for thousands of years.

Building a mine of this scale in this location is a reckless and destructive venture . No matter how extensive the environmental review or how comprehensive the mitigation, the far-reaching risk to our environment cannot be eliminated. There are no examples of successful, long-term collection and treatment systems for mines. Mining would produce acidic and metals-laden waters that would degrade water quality downstream with virtual certainty, and there is a 98 percent likelihood of pipeline failure per 25 years of operation.

We shouldn't gamble what we can't afford to lose -- and we can't afford to lose the Bristol Bay fishery . I understand that you are under pressure from global mining companies to open up this extraordinary ecosystem to large-scale mining for the sake of corporate profits . I urge you to use your authority under Section 404(c) of the Clean Water Act to proactively protect the Bristol Bay watershed and the communities that depend on it for survival.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-7785</u> [66 on-time duplicates]

Please protect our Bristol Bay watershed in Alaska. Stop the large-scale open pit mining that is being proposed by money hungry people. This area is one of the world's greatest salmon runs and must be protected. Not only will Native Alaskans lose jobs that this area produces, but many fishing companies will be affected also. We need to maintain a safe environment for future generations.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-7786</u> [14 on-time duplicates]

I am writing to voice my strong opposition to the EPA's draft watershed assessment for the vast Bristol Bay region of Alaska because it sets a dangerous precedent, is wholly unnecessary, and relies on dubious source material from biased anti-mining organizations and scientists that recently admitted to falsifying reports submitted in legal proceedings.

The conclusions in the assessment based on a "hypothetical mine plan" appear predetermined, offer little substantive value, and do not take into account the actual mine plan and mitigation efforts.

The National Environmental Priority Act (NEPA), enacted by Congress and promoted by the environmental community, created a balanced process to measure science and socioeconomic impacts of development projects . A draft assessment prior to initiation of permits is unnecessary and negates the NEPA process. Likewise, as the EPA is forced to deal with budget constraints under sequestration the expenditure of limited funds on this exercise puts numerous important EPA enforcement activities at risk.

Additionally, the EPA's revised Bristol Bay watershed assessment lays the groundwork for a preemptive denial of a water discharge and dredging permit (under section 404c of the Clean Water Act) for the Pebble deposit that would set a dangerous precedent of preemptive action, creating a chilling effect on the U.S. economy and killing American jobs.

Moreover, many of the assessment's recommendations rest on research from discredited "scientist" Ann Maest, a Stratus Consulting contractor who recently admitted to falsifying testimony against Chevron in Ecuador. Maest's questionable methods and evident personal biases call Stratus' contributions into question and tarnish the report's credibility.

Likewise, the reliance on funded research from Earthworks, a leading anti-mining activist organization, further draws into question the assessments findings as predetermined. This biased and unnecessary report should be discarded, and the proven NEPA process should be allowed to work.

Continuing the assessment will throw into question EPA's credibility, drain needed funds from crucial environmental protection efforts, and cost tens of thousands of American jobs.

I urge you to protect American jobs and the vitality of American natural resource independence by discarding this fatally flawed, unnecessary, and biased watershed assessment.

> **EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**
>
> **EPA has not made any determination regarding the merits of the reports co-authored by Dr. Maest. However, because of the controversy surrounding Dr. Maest in the Chevron matter, we have removed references to the reports she co-authored from the final assessment. These reports were used only to support our analyses, and their removal does not affect the assessment's findings.**

EPA-HQ-ORD-2013-0189-7950 [50,030 on-time duplicates, sponsored by the Natural Resources Defense Council]

Attached is a file of 50,030 names and addresses of petition signers from a Care2's Online Petition Site. Please note that these are in addition to any comments you have already received via email from individual NRDC Online Activists. The people listed in this file signed a petition regarding Docket #EPA-HQ-ORD-2013-0189.

I call on you to protect the environment and the people of Bristol Bay, Alaska from global mining companies and their reckless plans for the Pebble Mine.

Their colossal gold and copper operation would generate an estimated ten billion tons of waste and devastate the world's greatest wild salmon runs, which are the lynchpin of a spectacular American ecosystem and the generator of 14,000 jobs and $480 million in annual revenue. More than 80 percent of Bristol Bay residents - including its Native peoples and commercial fishermen - oppose this monstrous project and have asked the EPA to stop the mine.

In response, your agency conducted a comprehensive study, which confirms that the Pebble Mine would pose "catastrophic" risks to this irreplaceable natural treasure.

I urge you to act swiftly and decisively on those findings. Please use your authority under the Clean Water Act to stop the Pebble Mine.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

<u>EPA-HQ-ORD-2013-0189-7951</u> [101,185 on-time duplicates, sponsored by the Natural Resources Defense Council]

Attached please find a file of 101,185 signatures that the Natural Resources Defense Council ("NRDC") collected in response to an online mass mailer/petition campaign. Please note that these 101,185 signatures are in addition to the over 84,000 comments from NRDC online activists that the Environmental Protection Agency ("EPA") has already received directly via email. These signatures are also in addition to the over 50,000 signatures gathered from a separate Care2 online petition that NRDC submitted to EPA last Friday, June 20.

I call on you to protect the environment and the people of Bristol Bay, Alaska from global mining companies and their reckless plans for the Pebble Mine.

Their colossal gold and copper operation would generate an estimated ten billion tons of waste and devastate the world's greatest wild salmon runs, which are the lynchpin of a spectacular American ecosystem and the generator of 14,000 jobs and $480 million in annual revenue. More than 80 percent of Bristol Bay residents — including its Native peoples and commercial fishermen — oppose this monstrous project and have asked your Environmental Protection Agency to stop the mine.

In response, EPA conducted a comprehensive study, which confirms that the Pebble Mine would pose "catastrophic" risks to this irreplaceable natural treasure.

I urge you to act swiftly and decisively on those findings. Please direct your EPA to use its authority under the Clean Water Act to stop the Pebble Mine.

I know your administration is under intense pressure from the mining lobby to let this multi-billion-dollar scheme proceed. For the sake of this and all future generations of Americans, please stand up to them and reject this assault on our natural heritage. By doing so, you will secure a lasting environmental legacy for your administration.

By signing NRDC's online petition, each of the 101,185 signers has illustrated their concern over the potential impacts of the proposed Pebble Mine and their belief that EPA's Watershed Assessment – and the record on which it is based – support a determination that large-scale mining is irreconcilable with the health and integrity of the fishery, wildlife, and recreational resources of the Bristol Bay watershed.

I join the 101,185 signers of this petition in support of EPA's Watershed Assessment. We respectfully request the agency to initiate action under section 404(c) of the Clean Water Act to protect the Bristol Bay watershed – and the communities, salmon, and wildlife that depend on it for survival.

> **<u>EPA Response:</u> Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible**

decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-7952 [2,499 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment.

For these reasons, 2,500 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment

was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-7953</u> [4,998 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment.

For these reasons, 5,000 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern

conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-7954 [7,100 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment.

For these reasons, 7,500 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by

Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

<u>EPA-HQ-ORD-2013-0189-7955</u> [3,018 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment.

For these reasons, 3,018 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

<u>EPA Response:</u> Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The mine scenarios

presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-7956 [9,185 on-time duplicates, sponsored by Resourceful Earth]

This is a fatally flawed, unnecessary, and premature study that should be shelved. Conducting a review of a hypothetical mine and relying on reports from avowed anti-mining groups provides no scientific or predictive value, and should not be used as justification to issue a first-of-a-kind preemptive permit veto that risks tens of thousands of American jobs and billions in economic investment.

For these reasons, 9,632 Americans have proudly signed the attached letters calling on the EPA to STOP this assessment now.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

EPA Response: Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment is an ecological risk assessment, and it has been prepared following EPA's guidelines for such assessments. It focuses on the risks of large-scale porphyry copper mining to the region's salmon resources. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.

The assessment is not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow

when taking action under the Clean Water Act Section 404(c). The mine scenarios presented in the assessment are based largely on preliminary plans put forth by Northern Dynasty Minerals in Ghaffari et al. (2011), and assume that modern conventional mining practices and technologies are used. The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-8114 [579 on-time duplicates]

Postcards with one of two statements:

The Bristol Bay Watershed Assessment defines the need to stop large-scale open pit mining at the headwaters of the world's greatest salmon run. Large scale mining would directly impact the fishery and the people who rely on it for their livelihoods. Alaska Natives, sport fishing outfitters, and commercial fishermen need the assurance that their salmon economy is not threatened by large-scale hard rock mining in the Bristol Bay watershed.

Protect Bristol Bay's Fish, Wildlife & Existing Jobs - Save our Salmon - Save Bristol Bay

I believe: …[senders added various sentiments]

OR

Thank you for releasing your draft Watershed Assessment in time for me to comment prior to the fishing season. The assessment makes clear that large-scale mining in Bristol Bay's headwaters would create unacceptable, unavoidable risks to our 1.5B fishing industry. Please use Section 404(c) under the Clean Water Act to help ensure that my job and thousands more like it are not threatened.

WE ARE BRISTOL BAY'S FISHERMEN, AND OUR JOBS ARE NOT EXPENDABLE

To me, Bristol Bay means … [senders added various sentiments]

EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).

EPA-HQ-ORD-2013-0189-14532 [13 on-time duplicates]

We regularly eat wild salmon from the Iliamna watershed, and strongly support the EPA's rationale that massive scale open-pit mining in a sensitive watershed is not compatible.

EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions.

EPA-HQ-ORD-2013-0189-14533 [19 on-time duplicates]

Thank you for conducting the extensive scientific review of evaluating the destructive impacts of large-scale mining in the Bristol Bay, through the Bristol Bay Watershed Assessment. Your diligence and transparency is refreshing to see after nearly a decade of operating in the shadow of Pebble mine and getting no help from our state natural resource managers or elected officials despite numerous requests and a majority of Alaskans wanting to see Bristol Bay protected.

Your report makes clear that we cannot wait any longer to protect Bristol Bay’s natural resources. The salmon and the environment, as well as native peoples, sport fishing industry, and commercial fishermen, and many others depend on that protection. Bristol Bay and its healthy sockeye fishery supports 14,000 jobs across multiple industries and generates more than $1 billion in revenue and value every year. It also supplies nearly half of the global supply of sockeye salmon. People from all over the world travel to Bristol Bay (or dream of traveling here) to fish for its world-class salmon and trout.

It is time for the Pebble Partnership to stop playing games and politics with what are clearly unacceptable impacts. The EPA’s Assessment finds that even without a catastrophe or series of harmful spills, up to 90 miles of salmon streams and up to 4,300 acres of vital salmon habitat will be destroyed by mining the deposit. That alone directly impacts the salmon runs, but add in the unsupportable notion that up to 10 billion tons of toxic mine waste will be stored, treated and monitored “in perpetuity,” and it becomes clear that action is required to protect Bristol Bay now.

I ask that you immediately initiate use of the Clean Water Act to restrict inappropriate development activities such as the proposed Pebble Mine, while allowing reasonable development to proceed. Thank you for taking the time to address this very important issue.

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-14823 [24 on-time duplicates]

Preprinted postcards read:

The Bristol Bay Watershed Assessment defines the need to stop large-scale open pit mining at the headwaters of the world’s greatest salmon run. Large scale mining would directly impact the fishery and the people who rely on it for their livelihoods. Alaska Natives, sport fishing outfitters, and commercial fishermen need the assurance that their salmon economy is not threatened by large-scale hard rock mining in the Bristol Bay watershed.

Protect Bristol Bay’s Fish, Wildlife & Existing Jobs - Save our Salmon - Save Bristol Bay

I believe: [senders added various sentiments – comments are not included because the senders were under the age of 13]

> **EPA Response: Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-14963 [18 on-time duplicates, sponsored by American Rivers]

As a supporter of American Rivers, I appreciate that the Environmental Protection Agency (EPA) has initiated a scientific assessment of the Bristol Bay watershed, including the Kvichak, Talarik, Nushagak, Mulchatna, and Koktuli Rivers, to better understand how future large-scale development projects may affect water quality and Bristol Bay's salmon fishery.

I am writing to request that you initiate the Clean Water Act's §404(c) process for the Pebble Mine project. While I am not opposed to responsible development, I believe that the size and location of the proposed Pebble Mine are such that it will have severe impacts on wild salmon, the rivers surrounding the deposit, and other natural resources of the region, and that these risks far outweigh any potential benefits. Due to the mine's potential impact on fisheries, wildlife, and the local communities, American Rivers named the Bristol Bay Rivers one of America's Most Endangered Rivers® of 2011.

As you know, the EPA has authority under Section 404(c) of the Clean Water Act to withdraw this area from future designation as a mine disposal site due to the unacceptable adverse impact on fisheries, wildlife, municipal water supplies, and recreation. Recently, the EPA has been reviewing comments on the draft watershed assessment of the mine's potential impacts on salmon. The EPA should stand behind its finding that the mine would cause significant impacts to water quality, fish populations, and stream habitat.

I believe that EPA must employ their §404(c) authority proactively, withdrawing specific areas from future designation as disposal sites. Please consider the cumulative impacts that this project will have on the salmon, the tribes, and the broader community that depends on this beautiful area of Alaska.

Thank you for considering my request.

> **EPA Response:** **Comment noted. EPA agrees that it is important to understand the effects of large-scale mining on the salmon resources of Bristol Bay to make responsible decisions. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

EPA-HQ-ORD-2013-0189-15150 [43,758 on-time duplicates, sponsored by Resourceful Earth]

The EPA's revised Bristol Bay watershed assessment report is based on hypothetical, flawed research and relies on biased science from anti-mining groups. Stopping the Pebble mine without giving it a chance for a fair review will eliminate tens of thousands of much-needed American jobs and kill billions in potential economic investment. 43,779 Americans have written letters (attached) opposing the EPA's actions and demanding that Pebble be allowed to go through the prescribed permitting process.

Stop this biased watershed study now before you kill American jobs.

Clearly this watershed assessment was designed with the purpose of laying the groundwork for a preemptive permit denial under section 404c of the Clean Water Act for the Pebble deposit before the company has even submitted a mine plan.

This would be the first time the EPA has operated outside the established permitting process and would be done based on a questionable study of a hypothetical mine that fails to take into account modern mining practices.

Furthermore, a preemptive permit denial would set a dangerous precedent and set off a wave of uncertainty, creating a chilling effect on the estimated $220 billion in yearly investments for projects requiring permits under the Clean Water Act. There is no doubt this will have a devastating impact on the U.S. economy and American jobs.

We already have a stringent environmental permitting process. Conducting this assessment outside the permitting process is unnecessary and negates the National Environmental Priority Act (NEPA) process.

The repercussions of EPA's actions will be felt far beyond remote rural Alaska and will kill tens of thousands of American jobs.

I urge you to stop this biased study now and refrain from issuing a preemptive permit veto.

> **EPA Response:** **Comment noted. EPA has authority to conduct risk assessments under Clean Water Act Section 104(b). The assessment was conducted in an open and transparent manner using established and rigorously reviewed scientific inquiry. The assessment has not been prepared for the same purposes as a National Environmental Policy Act (NEPA) document.**
>
> **The document is a scientific risk assessment, not a regulatory action, and it does not propose or recommend restrictions on mining. EPA regulations establish a clear process for EPA to follow when taking action under the Clean Water Act Section 404(c). The focus of the assessment was ecological risk. However, there is a summary of economic values and activities in Appendix E. EPA has not made a final decision regarding action under Clean Water Act Section 404(c).**

APPENDIX 2. TECHNICAL COMMENTER INDEX.

This appendix presents comment information (Commenter and Docket Number) for the technical public comments submitted to the federal docket for the April 2013 draft of the assessment. The sections of this response to comments document in which the text of each comment document can be found are indicated in the Chapters & Appendices column.

COMMENTER	DOCUMENT NUMBER	CHAPTERS & APPENDICES
Alaska Chapter of the Wildlife Society	7415	5, 10, 14
Alaska Community Action on Toxics	5541	5, 6, 8, 12, 14
Alaska Conservation Foundation	6803	1, 3, 6, 8, 10
Alaska Department of Law	5060	1
Alaska Department of Natural Resources	5487	1- 3, 5, 6, 8, 13, 14, J
Alaska Marine Conservation Council	5065	14
Alaska Miners Association	2910	2, 6-8, 10, 11
Alaska Oil and Gas Association	5485	2, 6
Alaska State Legislature – Rep. A. Josephson	5320	4, 7
Alaska State Legislature – Rep. L. Gara	5618	4, 7
Alaska State Legislature – Rep. M. Costello	5814	1, 6
Alaska State Legislature – Rep. B. Edgmon	5058	1
Alaska Wilderness League	5656	6, 12
Aleknagik Traditional Council	2917	5, 14
American Fisheries Society	3105	6-14, I
American Fisheries Society, Western Division	5377	6, J
American Sportfishing Association	1371	12, 14
M. Andrew	0016	12
Anonymous	5862, 6267	5, 10, F
M. Apel	0151	6
Borell Consulting Services, LLC	4095, 6804	1, 2, 6
C. Borbridge	5066	3, 5, 6, 8, 14,
Bristol Bay Heritage Land Trust	5317	C
Bristol Bay Native Association	3106	5
Bristol Bay Native Corporation	5438	2-8, 12, 13, F, I, J
J. Bronson	5523	6, 8
M. Bronson	5641	8, I
Senator M. Cantwell et al., U.S. Senate	5815	5

COMMENTER	DOCUMENT NUMBER	CHAPTERS & APPENDICES
Center for Biological Diversity	2922	5, 8-10, 12, 13, C
Center for Science in Public Participation	5540, 5657	1, 2, 4-6, 8-11, 13, 14, I, J
Center for Water Advocacy	5617	1
D. L. Chesser	3253	6
Dr. J. D. Copp	4321	3, 5
Council of Alaska Producers	4285	1
Curyung Tribal Council	5619, 5754	1, 5, 12
N. Dawson	2915	4, 7
K. Denton	0227	10
Earthworks	5556	3-6, 9, 11-14, J
Environmental Entrepreneurs	4512	12
R. L. Farmer	6807	12
E. Ginsburg	9633	3
D. Girvin	6119	6
E. S. Gottlieb	0200	3
Ground Truth Trekking	3928	3, 4, 6, 9
J. L. Hallock, Jr.	2889	3, J
Iliamna Village Council	5488, 5784, 5837	2-8, 10, 12
IUCN SSC Salmonid Specialist Group	5435	5, 6, 12, 13
Kachemak Bay Conservation Society	1118, 4284	2, 5-7, 9, 10, J
Kachemak Resource Institute	9123	2, 7-9
J. Kari	5649	D
B. Killer	9642	9
T. F. King	6636	12
C. Mebane	2927	8
Members of the Fly Fishing Industry – Montana	5655	1
Millrock Resources Inc.	5736	6
Moore Geosciences, LLC	2911	1, 3, 6, 8, 9
Musicians United to Protect Bristol Bay	5542	3
Naknek Family Fisheries et al.	2823	8
National Mining Association	5557	2, 7, 8, J
National Parks Conservation Association	5558	2, 3, 13
Native Village of South Naknek	9133	1, 5, 12

COMMENTER	DOCUMENT NUMBER	CHAPTERS & APPENDICES
Natural Resources Defense Council	5378, 5436	1-3, 5-8, 10, 12-14, G, J
K. Nelson	3458	8
H. Neumann	0238	5, 8, 14
Newhalen Tribal Council	7427	12
North Coast Rivers Alliance	5061	2, 4, 8, 9, 13, 13
Northern Dynasty Minerals Ltd.	3650	2, 3, 5-11, 13, B, I, J
Northwest Mining Association	5559	1, 6
Nushagak-Mulchatna Watershed Council	0693	14
S. L. O’Neal	5528	3-9, 13, 14, A, B, G
G. Y. Parker	5615	6, 8-11, 13, J
Pebble Limited Partnership	5534, 5535, 5536, 5752	1-13, A, C-E, G-J
Pew Charitable Trusts et al.	5655	5, 6
T. Quinn, Ph.D.	7629	3
Region 10 Tribal Operations Committee	5658	2, 12, J
Resource Development Council	5489	2, J
Resource Development Council for Alaska	2912	6
W. J. Richardson	0633	4
W. M. Riley	3660	8
J.M. Robbins	4199, 4200	6, 7, J
M. Satre	6756	1, 6
M. Schelmeske	6280	6
D. Schindler	7906	1, 3, 4
K. Scribner	7882	5
S. Sorset	5887	3
Society of Freshwater Science	5375	7
Stratus Consulting	5433	3, 6, 7
The Nature Conservancy	4315	1, 5, 6, I
The Wilderness Society	5486	7, 13, 14, J
The Wildlife Society	5272	5, 8, 9, 14
L. Trasky	5050	3, 4, 6, 11
Trillium Asset Management, LLC	5111	5
Trout Unlimited	5527	2, 5, E
United States Congress	7353, 7355	5

COMMENTER	DOCUMENT NUMBER	CHAPTERS & APPENDICES
United Tribes of Bristol Bay	5275	5, 12, 13, D
Unknown	5539	8
P. Walsh	4398	6, 7
Weber Sustainability Consulting	4319	5, 6, 8
Wild Salmon Center	5782	8, 13
Wildlife Forever Fund	4201	7
V. Wilson III	5529	3, 5, 6, 12, 14
World Wildlife Fund, Arctic Field Program	5537	2, 3, 5, 6, 13, C
K. Zamzow, Ph.D.	5054	4, 6-11, 13, H