Comments on Behalf of the Natural Resources Defense Council on the U.S. Environmental Protection Agency Draft Bristol Bay Watershed Assessment

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I. INTRODUCTION

On behalf of its 1.3 million members and activists, the Natural Resources Defense Council ("NRDC") submits these comments to the U.S. Environmental Protection Agency ("EPA") with respect to the agency's May 18, 2012 draft Bristol Bay Watershed Assessment ("Watershed Assessment" or "Assessment"). The Assessment was prepared pursuant to EPA's authority under section 104 of the Federal Clean Water Act ("FWPCA" or "Clean Water Act") and specifically in response to petitions submitted under section 404(c) of the Act for EPA action to prohibit, deny, or restrict the specification of the proposed Pebble Mine site in Bristol Bay, Alaska as a disposal area for the discharge of dredged or fill material.

For the reasons discussed in detail below, NRDC believes that the Assessment is scientifically sound, analytically rigorous, and thoroughly documented, and that, together with the record on which it is based, it compellingly supports a determination that large-scale mining of the Pebble deposit is irreconcilable with the health and integrity of the fishery, drinking water, wildlife, and recreational resources of the Bristol Bay watershed. The watershed feeds one of the world's most productive wild salmon fisheries, which supports indigenous people and their communities, a diverse array of wildlife, and a wide range of irreplaceable fishery and tourism-related economic and subsistence activities. Recognizing the unique importance of the area, offshore oil and gas exploration in Bristol Bay was banned in 2010, premised on the conclusion of federal regulators, as expressed at that time by U.S. Department of the Interior Secretary Ken Salazar, that Bristol Bay is "a national treasure that we must protect" and a resource "too special" to drill.[1]

As EPA's draft Watershed Assessment comprehensively documents, large-scale mining like the proposed Pebble Mine and its associated infrastructure and facilities would unavoidably threaten this "national treasure." Given its sensitive and pristine location, the low-grade quality of the ore, the particular characteristics of the ore body, the complex and near-surface hydrology of the area, the exceptional fishery resources in the region, and the absence of supporting infrastructure, large-scale mining like that proposed at the Pebble Mine would inevitably result in "unacceptable adverse effects" to these critical natural and recreational resources, which is the regulatory threshold for initiating action under section 404(c).

More specifically, based on a rigorous scientific review and carefully considered analysis that consistently understates environmental risk, EPA makes a number of significant factual findings that are antithetical to any proposal for large-scale mining in the region, including development of the Pebble Mine. Those findings include:

- Inevitable and unavoidable harm to Bristol Bay salmon populations and fisheries due to habitat loss and degradation, downstream water flow reduction, population fragmentation, and reduced biodiversity;

[1] Press Release, U.S. Department of the Interior, Secretary Salazar Announces Comprehensive Strategy for Offshore Oil and Gas Development and Exploration (Mar. 31, 2010) available at http://www.doi.gov/news/pressreleases/2010_03_31_release.cfm (hereinafter "U.S. Department of the Interior, Comprehensive Strategy").

- Likely reduction in anadromous and resident salmon production due to road-derived sediments from a new 86-mile access road;

- Inhibition of salmon movement from culvert stream crossings, and a culvert blockage rate of 50% once the mine ceases operations;

- Diminished groundwater to surface water connectivity;

- 98% probability of a pipeline spill with potential contaminant release into streams and wetlands;

- Inevitable reductions to salmon-dependent wildlife;

- Serious threats to Alaska Native health, society, and culture;

- Risk of metal leaching and acid rock drainage, particularly after mine operations have ceased; and

- Catastrophic environmental impacts in the event of a tailings dam failure.

What is more, as is discussed in Sections VI.D and VI.E infra, EPA's Assessment, if anything, actually underestimates potential risks due to its explicit exclusion of important risk factors. If included, those risk factors would unquestionably increase the intensity and duration of significant harm to the region and its resources, including most notably the Bristol Bay wild salmon fisheries. For example, EPA's maximum mine scenario only estimates 6.5 billion tons of waste when, if fully developed, the waste at Pebble Mine would exceed 10 billion tons. In addition, EPA's baseline analysis assumes no accidents, failures, or other releases of mining products or wastes, with reliable collection of all water from the site and effective treatment of effluents. This is deliberately and unrealistically conservative given that, in EPA's words, "accidents and failures *always happen* in complex and long-lasting operations."[2] Equally important, the Watershed Assessment does not consider the impacts that would result from the development and operation of a deep-water port in Cook Inlet, secondary development, and increased evapotranspiration, precipitation, and other likely consequences associated with climate change. It also severely underestimates the amount of tailings likely to be released during failure and the distance these tailings would travel. Taken together, these additional foreseeable risk factors unquestionably support a conclusion that EPA's assessment of risk underestimates the actual harm attendant to large-scale mining in the Bristol Bay watershed.

Despite this underestimation of harm, the Watershed Assessment still concludes that large-scale mining in the Bristol Bay watershed would have enormous adverse environmental impacts. Under the circumstances, there is no question that EPA has both the authority and ability to prevent the predicted harm. Section 404(c) authorizes the agency to prohibit, deny, or restrict the use of an area as a disposal site for dredged or fill material when the discharge will have an "unacceptable adverse effect on municipal water supplies, shellfish beds and fishery

[2] U.S. EPA, An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska (May 18, 2012) (hereinafter "EPA Assessment"), Vol. 1, 5-1 (emphasis added).

areas (including spawning and breeding areas), wildlife, or recreational areas."[3] Federally-recognized tribes in the region have requested that EPA use this authority to protect Bristol Bay from large-scale sulfide mining like the Pebble Mine,[4] and their request has been followed by similar requests, including from the Bristol Bay Native Corporation (the largest development corporation and private land-owner in the Bristol Bay region, representing approximately 9,000 shareholders), commercial fishing interests represented by the Alaska Independent Fishermen's Marketing Association and the Bristol Bay Regional Seafood Development Association, the National Council of Churches, sportsmen's groups, chefs and restaurant owners, and conservation organizations. In addition, the Bristol Bay Native Association (a non-profit corporation and tribal consortium representing the 31 federally-recognized tribes in the Bristol Bay region) approved resolutions requesting EPA to use its authority under section 404(c) to protect Bristol Bay.[5]

The Watershed Assessment documents not just the basis for but the necessity of EPA action to protect the water and recreational resources of the Bristol Bay watershed from certain devastation. As described more fully below, therefore, we urge EPA to finalize its Watershed Assessment and move forward expeditiously to prohibit large-scale mining in the region, including the Pebble Mine.

II. OVERVIEW OF THE BRISTOL BAY REGION

The Bristol Bay watershed is characterized by short, warm summers and long, cold winters, with annual average temperatures hovering around freezing.[6] Rain is moderate, and ranges from 460-810 mm annually.[7] The landscape has been shaped by past glaciations and the dominant eco-region type is tundra.[8] About 7,600 people live in the region, in communities ranging in size and character from small rural villages to the region's largest city, Dillingham.[9] Approximately 70% of Bristol Bay residents are Alaska Natives (compared to 14.8%

[3] 33 U.S.C. § 1344(c) (2006).

[4] Six federally-recognized tribes originally petitioned EPA. Those six petitioner tribes are Nondalton Tribal Council, Koliganik Village Council, New Stuyahok Traditional Council, Ekwok Village Council, Curyung Tribal Council and the Levelock Village Council. See A Joint Letter from Six Federally-Recognized Tribes in the Kvichak and Nushagak River Drainages of Southwest Alaska to Lisa P. Jackson, Administrator of the U.S. EPA (May 2, 2010) (hereinafter "Letter from Six Federally-Recognized Tribes"). EPA later received additional requests from Ekuk Village Council, Clarks Point Tribal Council, and Twin Hills Village Council (collectively "Tribes").

[5] Bristol Bay Native Association, A Resolution Requesting the EPA to Invoke Section 404(c) of the Clean Water Act as Appropriate in the Kvichak and Nushagak Drainages of the Bristol Bay Watershed to Protect Habitat and Existing Uses, Res. 2010-32 (Sept. 17, 2010) (on file with author) (hereinafter "Bristol Bay Native Association, Res. 2010-32"); Bristol Bay Native Association, A Resolution in Support of BBNC's Recommendations for Proactive EPA Action to Protect the Waters and Salmon of Bristol Bay, Res. 2012-04 (Mar. 23, 2012) (on file with author) (hereinafter "Bristol Bay Native Association, Res. 2012-04").

[6] The Nature Conservancy in Alaska, Alaska Peninsula and Bristol Bay Basin Ecoregional Assessment: December 2003 15 (2004) (hereinafter "The Nature Conservancy in Alaska, Ecoregional Assessment").

[7] Id.

[8] Id. at 15-16. The combination of "physiographic region and climate class yield 17 different hydrologic landscapes within the Nushagak and Kvichak River watersheds." EPA Assessment, Vol. 1, 2-3.

[9] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 20; John Duffield et al., Economics of Wild Salmon Watersheds: Bristol Bay, Alaska 11 (2007) (hereinafter "Duffield et al., Economics of Wild Salmon Watersheds").

statewide),[10] and the principal economic activities in the region are related to commercial, recreational, and subsistence fisheries.[11] The Bristol Bay region is home to thirty-one federally-recognized tribes.[12]

Alaska Natives in Bristol Bay still overwhelmingly utilize and rely on subsistence hunting and fishing, collecting an estimated 2.1 million pounds of usable subsistence harvest per year.[13] The dollar value on this harvest is difficult to estimate, but has been placed at between $68 and $194 million.[14] Salmon accounts for over one-half of all subsistence harvest by Bristol Bay residents.[15] Many residents mix cash and subsistence livelihoods, and commercial salmon fishing – the preferred commercial occupation – is the primary source of cash income for Bristol Bay residents.[16]

The Bristol Bay region lies near the "Ring of Fire"[17] and is known for significant volcanic and tectonic activity. Regular earthquakes also occur in the region, and in 1964 the region experienced the largest earthquake ever recorded in North America.[18] The Shumagin seismic gap, located along the Alaska Peninsula, is believed to have a very high probability of a major earthquake within the next few decades.[19]

The 40,000 square mile Bristol Bay watershed is considered an intact eco-region and has been formally recognized for the special quality of its natural resources by the creation of two national parks – Lake Clark National Park and Katmai National Park and Preserve – and the largest state park in the country, Wood Tikchik State Park. The largest fresh water body in Alaska – Lake Iliamna – is found just 25 miles to the southeast of the proposed Pebble Mine site.[20] The watershed is home to 35 types of fish, more than 190 birds, and more than 40 terrestrial animals.[21]

Bristol Bay – and the streams and rivers that feed it – is world renowned for the productivity and diversity of its salmon fisheries. It supports globally important commercial fisheries, and provides habitat for shorebirds, waterfowl, marine mammals,[22] and five species of

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[10] Duffield et al., Economics of Wild Salmon Watersheds, supra note 9, at 11; U.S. Census Bureau, 2010 Census Data: Alaska, http://2010.census.gov/2010census/data/.
[11] Duffield et al., Economics of Wild Salmon Watersheds, supra note 9, at 11.
[12] Bristol Bay Native Association, available at http://www.bbna.com/tribal/tribalcouncils.html.
[13] John Duffield et al., Bristol Bay Wild Salmon Ecosystem Economics: 2008 Update 3 (2009).
[14] Id. at 13 (estimating subsistence harvest value at between $68 and $137 million annually); EPA Assessment, Vol. 3, App. E at 23 (estimating subsistence harvest value at between $84 and $194 million).
[15] EPA Assessment, Vol. 1, ES-9.
[16] Duffield et al., Economics of Wild Salmon Watersheds, supra note 9, at 12.
[17] The "Ring of Fire" is the zone of earthquakes surrounding the Pacific Ocean, and about 90% of the world's earthquakes occur there. See U.S. Geological Survey, Earthquake Hazards Program, available at http://earthquake.usgs.gov/learn/glossary/?term=Ring%20of%20Fire.
[18] The Nature Conservancy, An Assessment of Ecological Risk to Wild Salmon Systems from Large-Scale Mining in the Nushagak and Kvichak Watersheds of the Bristol Bay Basin 18 (2010) (hereinafter "The Nature Conservancy, Ecological Risk to Wild Salmon").
[19] Id.
[20] Id. at 2-3.
[21] EPA Assessment, Vol. 1, 2-3.
[22] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 9.

Pacific Salmon[23] — including the largest sockeye salmon fishery in the world,[24] and the third largest King salmon run.[25] The Nushagak River and Kvichak River watersheds yield approximately half of the Bristol Bay sockeye salmon production.[26] These fish are anadromous; they hatch and rear in freshwater systems, migrate to the sea to grow to adult size, and return to freshwater systems to spawn and die.[27] The watershed provides habitat to several other anadromous species, including steelhead, rainbow smelt, and dolly varden.[28] Resident fish also include Arctic Grayling, Northern pike, multiple species of trout, Arctic Char, and whitefish.[29]

The exceptional quality of the Bristol Bay watershed fish populations is largely a result of its high-quality, diverse aquatic habitats, the hydrologic and biochemical connectivity between surface and subsurface waters, and the relatively little human development.[30] However, the region is not immune to outside ecological pressures; in the past 25 years, for example, some anadromous fish populations have declined, and marine productivity has decreased in the region, possibly due to rising temperatures.[31]

In addition to the fisheries, the region is known for its healthy populations of top-level predator species[32] and its high biological productivity, in part due to the exchange of nutrients between the Bering Sea and freshwater and terrestrial habitats in Bristol Bay.[33] Numerous mammals thrive in the Bristol Bay watershed, including brown and black bears, wolves, wolverines, and lynxes.[34] The lowlands of Bristol Bay provide important habitat for many other species of mammals, including foxes, martens, beavers, and moose.[35] A study of Lake Clark National Park, located just northeast of Lake Iliamna, estimated that between 35 and 40 species of mammals could be found in the park.[36] The study focused on small mammals[37] and noted that some of the species found in the area included bats, several species of shrews, pikas and hares, and at least nine species of rodents.[38]

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[23] Id.; EPA Assessment, Vol. 1, ES-5. The watershed supports production of all five species of Pacific salmon found in North America: sockeye (Oncorhynchus *nerka*), coho (O. *kisutch*), Chinook or king (O. *tshawytscha*), chum (O. *keta*), and pink (O. *gorbuscha*).

[24] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 9; EPA Assessment, Vol. 1, ES-5. The fishery represents approximately 46% of the average global abundance of wild sockeye salmon.

[25] Alaska Department of Fish and Game, Our Wealth Maintained: A Strategy for Conserving Alaska's Diverse Wildlife and Fish Resources 38 (2006), available at http://www.adfg.alaska.gov/static/species/wildlife_action_plan/cwcs_main_text_combined.pdf (hereinafter "Alaska Department of Fish and Game, Our Wealth Maintained").

[26] EPA Assessment, Vol. 1, ES-5.

[27] Id. at Vol. 1, ES-5.

[28] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 16.

[29] Id. at 44.

[30] EPA Assessment, Vol. 1, ES-8.

[31] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 19.

[32] Id. at 9.

[33] Alaska Department of Fish and Game, Bristol Bay Critical Habitat Areas Management Plan Public Review Draft A-1 (2010), available at https://secure.wildlife.alaska.gov/refuge/pdfs/bb_public_review.pdf (hereinafter "Alaska Department of Fish and Game, Bristol Bay Critical Habitat Areas").

[34] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 16.

[35] Alaska Department of Fish and Game, Our Wealth Maintained, supra note 25, at 39.

[36] Joseph A. Cook & Stephen O. MacDonald, Mammal Inventory of Alaska's National Parks and Preserves: Lake Clark National Park and Preserve 23 (2004).

[37] Id. at 6.

[38] Id. at 23.

The Bristol Bay watershed is a particularly important region for caribou. The Mulchatna Caribou herd – the third largest in Alaska – ranges throughout the Bristol Bay region. Its numbers have fluctuated greatly: in 1997 the herd was estimated to contain 200,000 caribou[39] – over one-fifth of the state's estimated 900,000 wild caribou[40] – but had decreased to roughly 30,000 caribou by 2008.[41] Several other herds make use of the region, including the Kilbuck, Nushagak, and North Alaska Peninsula herds.[42]

The region is also an important area for birds, including bald eagles. Its coastal wetlands, lagoons, and bays provide staging areas for large seasonal aggregations of waterfowl and shorebirds, such as the Beringian marbled godwit, Aleutian tern, and red-faced cormorant.[43] A number of bays within Bristol Bay have seasonal concentrations of over 100,000 birds, and three lagoons host concentrations of over 500,000 birds annually.[44] Furthermore, the Bristol Bay region provides wintering habitat for several other important bird species, including the Emperor goose, King eider, Steller's eider, and McKay's bunting.[45]

The Bay itself also supports diverse populations of marine species. More than 30 species of groundfish and shellfish depend on the bay,[46] including scallops, crab, and shrimp.[47] Pacific herring and pacific halibut are found in the region,[48] and the bay is also home to many marine mammals, including the Bristol Bay population of beluga whales, killer whales, gray whales, the endangered Steller's sea lion, Pacific walruses, two species of seals, and sea otters.[49] Lake Iliamna is home to freshwater harbor seals – one of very few seal populations worldwide to establish a permanent year-round presence in a freshwater environment.[50]

Considered together, these resources comprise a highly functioning, healthy, diverse, and naturally and economically sustainable ecosystem that, without exaggeration, can be characterized as unsurpassed anywhere in the world. It is truly, in the words of Interior Secretary Salazar, "a national treasure" that deserves and requires our protection.[51]

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[39] Michael T. Hinkes et al., Influence of Population Growth on Caribou Herd Identity, Calving Ground Fidelity, and Behavior 69(3) Journal of Wildlife Management 1147, 1148 (2005), available at http://www.jstor.org/stable/3803353 (hereinafter "Hinkes et al., Influence of Population Growth").
[40] Caribou (Rangifer tarandus granti) Species Profile, Alaska Department of Fish and Game, http://www.adfg.alaska.gov/index.cfm?adfg=caribou.main (follow "Status, Trends, and Threats").
[41] EPA Assessment, Vol. 1, 2-16.
[42] Hinkes et al., Influence of Population Growth, supra note 39, at 1148-49.
[43] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 16-17.
[44] Id. at 17.
[45] Id.; see also Nils Warnock, Public Comments of Audubon Alaska, EPA-HQ-ORD-2012-0276 (July 20, 2012).
[46] Alaska Department of Fish and Game, Bristol Bay Critical Habitat Areas, supra note 33, at A-1.
[47] The Nature Conservancy in Alaska, Ecoregional Assessment, supra note 6, at 17.
[48] Id.
[49] Alaska Department of Fish and Game, Bristol Bay Critical Habitat Areas, supra note 33, at A-22.
[50] Id. at A-23.
[51] U.S. Department of the Interior, Comprehensive Strategy, supra note 1.

III. HISTORY OF THE PEBBLE MINE PROJECT

In July 2006, Northern Dynasty Minerals ("NDM") first applied for water rights permits in preparation for site exploration and construction of the Pebble Mine.[52] In September 2006, NDM submitted corrections to its surface water applications which were requested by the Alaska Department of Natural Resources (DNR).[53] Then, on September 5, 2006, NDM submitted its "Initial Application Package for Constructing a Dam," that, under state law, initiates the application process for a certificate of approval for new dam construction in Alaska.[54] NDM requested permission to build two tailings[55] impoundments, A and G, which would contain the billions of tons of tailings to be generated by the project. Next, NDM submitted a separate application for ground water rights for the same area covered by the surface water applications.[56] In October 2006, DNR sent a letter to NDM announcing that its consistency review packet was complete and that the consistency review would begin the following day.[57]

On the same day, NDM responded to DNR by first acknowledging the notification that its consistency review package was complete, but nevertheless requesting that DNR suspend the consistency review until further notice. NDM's stated reason for seeking a hiatus in the application process was the need to gather more environmental data.[58]

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[52] On July 7, 2006, Northern Dynasty filed Application for Water Right: South Fork Koktuli River (LAS 25874), Application for Water Right: North Fork Koktuli River (LAS 25871), and Application for Water Right: Upper Talarik Creek (LAS 25876). [52] Alaska Department of Natural Resources, Division of Mining Land and Water, Pebble Project – Water Right Applications, accessed at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/index.cfm. The State of Alaska's Department of Natural Resources (DNR) responded to Northern Dynasty's submission by stating that the submission was incomplete. The Alaska DNR requested, among other things, that Northern Dynasty submit more information for their proposals to use ground water, submit separate proposals for the use of surface water, and correct the name of the second proposal from North Fork Koktuli River to Unnamed Tributary of the North Fork Koktuli River. On July 26, 2006, the Alaska DNR issued three documents in response to Northern Dynasty's three submitted documents: ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right: South Fork Koktuli River, ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right: North Fork Koktuli River and ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right. Id.

[53] NDM submitted Response to July 26, 2006 ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right: Unnamed Tributary (NK1.190) North Fork Koktuli River (Sept. 21, 2006), Response to July 26, 2006 ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right: South Fork Koktuli River (Sept. 21, 2006) and Response to July 26, 2006 ADNR Analysis of Application Completeness of July 7, 2006 Application for Surface Water Right: Upper Talarik Creek (Sept. 21, 2006). Alaska Department of Natural Resources, supra note 52.

[54] Dam Safety and Construction Unit, Alaska Department of Natural Resources, Guidelines for Cooperation with the Alaska Dam Safety Program 5-1 (2005), accessed at http://dnr.alaska.gov/mlw/water/dams/AK_Dam_Safety_Guidelines062005.pdf.

[55] As described in more detail, infra, "tailings" are the solid-water-chemical waste that results from the removal of ore from a deposit.

[56] These documents were Application for Groundwater Right: South Fork Koktuli River (LAS 25873), Application for Groundwater Right: Unnamed Tributary (NK1.190) North Fork Koktuli River (LAS 25872) and Application for Groundwater Right Upper Talarik Creek (LAS 25875). Alaska Department of Natural Resources, supra note 52.

[57] Letter from Jim Renkert, Project Review Coordinator, to Michael Smith, Pebble Project Northern Dynasty Mines Inc. (Oct. 13, 2006), available at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/2006/acmp.pdf.

[58] Id.

In August 2007, a wholly-owned subsidiary of Anglo-American PLC, a United Kingdom-based mining company, entered into a 50% partnership with a wholly-owned subsidiary of NDM to form the Pebble Limited Partnership ("PLP").[59] In order to retain its 50% interest in the PLP, Anglo-American is required to continue its staged investment of $1.425 billion to advance Pebble Mine toward permitting and operations. Both NDM and Anglo-American have equal rights of management, operatorship, and control in the PLP.[60]

In February 2011, NDM released a "Preliminary Assessment of the Pebble Project, Southwest Alaska" ("Wardrop report") that updated and substantially revised the project's economic analysis and environmental footprint.[61] The Wardrop report described a "large industrial facility" – an open pit mine, underground mining, tailings facilities, and associated infrastructure – located "within a vast region of Alaska notable for its undeveloped wilderness, isolated and sparsely populated communities, Alaska Native culture and traditional ways of life, significant salmon fisheries, and other fish and wildlife populations."[62] It contemplated three development cases – 25, 45 and 78-year plans – and selected the 45-year case as the "base case" for the Preliminary Assessment. Notably, although the Wardrop report only described development scenarios for the first 25 years,[63] it simultaneously concluded that "even the 78-year Resource Case would exploit only 55% of the total resource."[64]

In February 2012, PLP released an "Environmental Baseline Document" ("EBD") intended to characterize the environmental studies conducted by PLP or its predecessors at Pebble from 2004 to 2008.[65] Fully financed by PLP, the EBD purports to describe the existing physical and chemical (climate, water quality, trace elements), biological (wetlands, fish and aquatic invertebrates, wildlife, habitat), and social environments (land and water use, socio-economics, subsistence) within the Bristol Bay and Cook Inlet regions where development of the Pebble Mine is proposed. The EBD has not been subject to independent peer review.

IV. DESCRIPTION OF THE PROPOSED PEBBLE MINE

PLP plans to build an enormous gold, copper, and molybdenum mine at the headwaters of Bristol Bay. Located between Katmai National Park to the south and Lake Clark National Park to the north,[66] the proposed Pebble Mine would be sited 25 miles north of Lake Iliamna –

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[59] Press Release, Anglo American PLC, Anglo American Has Become a 50% Partner with the northern Dynasty Partnership in the Pebble-Copper-Colg-Molybdenum Project in Southwestern Alaska, By Making a Staged Cash Investment of US$1.425 Billion (Aug. 1, 2007), available at http://www.angloamerican.com/media/releases/2007pr/2007-08-01.

[60] Id.

[61] Wardrop, Preliminary Assessment of the Pebble Project, Southwest Alaska (Feb. 17, 2011), report to Northern Dynasty Minerals Ltd., available at http://www.northerndynastyminerals.com/i/pdf/ndm/Pebble_Project_Preliminary%20Assessment%20Technical%20Report_February%2017%202011.pdf (hereinafter "Wardrop, Preliminary Assessment").

[62] Id. at 6.

[63] Id. at 4 ("Phases of development beyond 25 years will require separate permitting and development decisions to be made in the future . . . .").

[64] Id. at 81.

[65] Pebble Project, Environmental Baseline Document, available at http://www.pebbleresearch.com/.

[66] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 2; Alaska Geographic, Lake Clark National Park and Preserve, available at http://www.alaskageographic.org/static/212/lake-clark-national-park-and-

the largest freshwater lake in Alaska, a crucial incubator of Bristol Bay's wild salmon fishery, and a haven for a rare colony of freshwater seals as well as numerous other species.[67] The proposed Pebble Mine would be located in the Nushagak and Kvichak river drainages, a rich salmon spawning ground.[68] The mine footprint would cover at least 54 square miles (on 90 square miles of state land) and would include both an underground block caving mine at the Pebble East Deposit and an above-ground open pit mine at the Pebble West Deposit.[69] The total size of the mine has yet to be publicly disclosed and exploration is still ongoing,[70] with more of the potential mine deposit still being explored.[71] PLP has submitted no permit applications since NDM's 2006 water rights application. Although a final mine plan has not been released, EPA can nonetheless reasonably ascertain the scope and impacts of any large-scale mining operation in the Bristol Bay watershed given the nature of the mineral deposits, the requirements for successful mining development, and publicly available information about potential mining activity.[72]

A. The Underground and Open Pit Mines

An underground mine 5,000 feet deep is proposed at the Pebble East Deposit, to be accessed by block caving – a method that poses severe environmental risks to the surrounding landscape, water quality, and wildlife. With this approach, a main haulage shaft is dug beneath the deposit, the ore body above the haulage shaft is weakened with explosives, and then gravity forces the rubble into the haulage shaft from which it is removed.[73] This process can cause large amounts of subsidence, with a range of associated environmental impacts, including, for example, collapse of surface materials, degraded water quality, lowered water table, and chronically unstable ground.[74]

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preserve; Alaska Geographic, Katmai National Park and Preserve, available at http://www.alaskageographic.org/static/201/katmai-national-park.

[67] David E. Withrow & Kymberly M. Yano, National Oceanic and Atmospheric Association: National Marine Fisheries Service, Recent Counts of Freshwater Seals in Alaska's Lake Iliamna (2008); The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 2-3.

[68] Id. at 9.

[69] Id. at 3; Northern Dynasty Mines Inc., Application for Water Right: North Fork Koktuli River Exhibit A, 1-33 (July 7, 2006), available at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/2006/swnfkorig.pdf; Knight Piesbold Consulting, Northern Dynasty Mines, Inc., Tailings Impoundment A Initial Application Report Figure 3.1 (Sept. 5, 2006), available at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/2006/damafig.pdf. See also Wardrop, Preliminary Assessment, supra note 61, at 34-43.

[70] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 2; Stephen Hodgson & Ken Brouwer, Northern Dynasty Mine's Pebble Project: A Strategic Resource for Alaska, Mining Engineering 29, 29-30 (Apr. 2007) (hereinafter "Hodgson & Brouwer, NDM's Pebble Project").

[71] Pebble Partnership, Updated Mineral Resource Estimate for Pebble Prospect at 1 (Feb. 1, 2010), http://www.pebblepartnership.com/perch/resources/press-release-feb-2010.pdf.

[72] EPA Assessment, Vol. 1, 4-1.

[73] Steve Blodgett & James R. Kuipers, Technical Report on Underground Hard-Rock Mining: Subsidence and Hydrologic Environmental Impacts 5 (2002) (hereinafter "Blodgett & Kuipers, Underground Hard-Rock Mining"); David Chambers, Block Caving at the Proposed Pebble Mine (2008) (hereinafter "Chambers, Block Caving at Pebble Mine; Northern Dynasty Minerals Ltd., Maps and Models, "Block Caving," accessed at http://www.northerndynastyminerals.com/ndm/PD_MM.asp.

[74] Steve Blodgett, Subsidence Impacts at the Molycorp Molybdenum Mine Questa, New Mexico 2, 8, 12 (2002) (hereinafter "Steve Blodgett, Subsidence Impacts"). The author noted that at San Manuel, "[i]n 1965 the subsidence pit over the South ore body was more than 500 feet deep, 3000 feet long, and 2000 feet wide," id. at 8, and at the

An open pit mine is proposed to access the ore lying closer to the surface at the Pebble West Deposit.[75] As described in 2006, the open pit would be at least 2 miles wide and 1,700 feet deep.[76] More recently, the 2011 Wardrop report described a 25-year mine plan that included an open pit over two miles wide and 2,500 feet deep[77] – which, if constructed, would make it one of the largest mines in the world and the largest open pit mine in North America.[78] EPA estimated that an open pit would encompass a surface area between 5.5 and 17.8 km^2 at a depth of between 2,625 and 3,937 feet.[79] The open pit mine is expected to generate significant amounts of dust from its operations due to the blasting, hauling and drilling, and material handling,[80] as well as unspecified quantities of acid mine drainage from billions of tons of waste rock.[81]

B. The Tailings and the Tailings Dams

The proposed Pebble Mine is projected to generate at least 10 billion tons of waste rock that will be stored at the mine site.[82] In its Assessment, however, EPA severely underestimates this amount, characterizing the maximum mine scenario at only 6.5 billion tons.[83] This waste rock, or tailings, will contain sulfides, including pyrite,[84] which will comprise 3% of the total tailings.[85] Overall, sulfides will constitute 5% to 10% of the mine's tailings.[86] When sulfuric minerals are exposed to air and water, they oxidize and create acid mine drainage, which can, as discussed below, significantly decrease the pH levels of the watershed and make the affected streams uninhabitable for salmon and other aquatic organisms.[87]

To hold the waste, NDM proposed in 2006 to construct two tailings storage facilities located on an unnamed tributary of the North Fork Koktuli River and the upper reaches of the

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Questa mine, "[b]y 2002, the maximum depth of surface subsidence in Goat Hill Gulch was ~200 feet." Id. at 2. He also discussed massive surface subsidence in Blodgett & Kuipers, Underground Hard-Rock Mining, supra note 73, at 5, and reported that at the Inspiration Copper Mine, "the subsidence had lowered the ground surface from 50-300 feet[.]" Id. at 12. For an example of a rubble-ized subsidence, see Blodgett, Subsidence Impacts, supra, at 4.

[75] Northern Dynasty, Maps and Models, Distribution of high/low grade mineralization and drilling at the Pebble deposit accessed at http://www.northerndynastyminerals.com/ndm/PD_MM.asp.

[76] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 3.

[77] Wardrop, Preliminary Assessment, supra note 61, at 35.

[78] William Hauser, Potential Impacts of the Proposed Pebble Mine on Fish Habitat and Fishery Resources of Bristol Bay 2 (2007), available at http://www.renewableresourcescoalition.org/sites/www.renewableresourcescoalition.org/files/HauserSep07.pdf (hereinafter "Hauser, Potential Impacts").

[79] EPA Assessment, Vol. 1, 4-15, Table 4-3.

[80] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 49.

[81] Id. at 54; David M. Chambers, Pebble Engineering Geology: Discussion of Issues 3 (2007).

[82] Pebble Partnership, Updated Mineral Resource Estimate for Pebble Prospect 1 (Feb. 1, 2010), http://www.pebblepartnership.com/perch/resources/press-release-feb-2010.pdf. See also Northern Dynasty Mines Inc., Tailings Impoundment G: Initial Application Report, 2; Northern Dynasty Mines Inc., Tailings Impoundment A: Initial Application Report, 2.

[83] EPA Assessment, Vol. 1, 4-15, Table 4-3.

[84] Pyrite is the most common sulfide; when exposed to the atmosphere during mining and excavation, pyrite reacts with oxygen and water, causing acid mine drainage.

[85] Northern Dynasty Mines, Inc. Pebble Project, Application for Water Right: South Fork Koktuli River, 3 (2006), available at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/2006/swsfkorig.pdf.

[86] Hodgson & Brouwer, NDM's Pebble Project, supra note 70, at 33.

[87] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 54.

South Fork Koktuli basin. The dam on the South Fork of the Koktuli River – denominated tailings impoundment A – would hold roughly 2 billion tons of tailings solids.[88] Three embankments – raised in stages to their maximum height as the mining progresses – would ultimately reach heights of 700, 710, and 740 feet. Tailings impoundment G, on an unnamed tributary of the North Fork of the Koktuli River, would include two dams, at 450 and 175 feet high, and hold approximately 500 million tons of tailings solids.[89] The total lengths of these dams as projected in 2006 would be 9 miles, and the tailings compounds would cover 7,600 acres, or 12 square miles.[90] The largest of the embankments for tailings impoundment A – at 740 feet high and 4.3 miles long – would possibly be the largest dam in the world.[91] The dams would be built in stages. After a dam is filled at each stage, the height would be raised to the next level.[92] With capacity to hold only 2 billion (of the projected 10 billion) tons of mine waste, the tailings storage facilities would nevertheless completely submerge Frying Pan Lake. NDM has conceded that additional tailings sites and dams would be needed as the size of the deposit expands.[93]

In 2011, NDM disclosed a new design for the tailings facilities.[94] Based on a 25-year mine plan, the Wardrop report described an enlarged tailings storage facility at Site G ("TSF G"). Created by three embankments – at 685, 400 and 100 feet – TSF G would hold approximately 2 billion tons of tailings.[95] As noted above, this would not supply enough tailings storage for either the 45-year "base case" upon which NDM based its financial analysis or the total anticipated waste in excess of 10 billion tons.

V. HISTORY OF THE EPA BRISTOL BAY WATERSHED ASSESSMENT

A. The Native Tribes' Petition

In May 2010, six federally-recognized tribes from the Bristol Bay region – including the Nondalton Tribal Council, Koliganik Tribal Council, New Stuyahok Traditional Council, Ekwok Village Council, Curyung (Dillingham) Tribal Council and the Levelock Village Council – sent a letter to EPA requesting that it proactively initiate a section 404(c) action to protect the Bristol Bay watershed before PLP could develop further plans for the Pebble Mine.[96] The need for the

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[88] Northern Dynasty Mines Inc., Tailings Impoundment A: Initial Application Report, 1.
[89] Northern Dynasty Mines Inc., Tailings Impoundment G: Initial Application Report, 1.
[90] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 3; Hauser, Potential Impacts, supra note 78, at 6.
[91] Margaret Bauman, Size of Tailings Dam Sparks New Concerns Over Pebble, Alaska Journal of Commerce, (Oct. 15, 2006), available at http://www.alaskajournal.com/Alaska-Journal-of-Commerce/October-2006/Size-of-tailings-dams-sparks-new-concern-over-Pebble/. China's Three Gorges Dam, often described as the largest dam, is 610 feet high and 1.3 miles wide. PBS.org, Great Wall Across the Yangtze, available at http://www.pbs.org/itvs/greatwall/dam.html.
[92] Northern Dynasty Mines Inc., Tailings Impoundment A: Initial Application Report, 14. Northern Dynasty Mines Inc., Tailings Impoundment G: Initial Application Report, 13.
[93] Hodgson & Brouwer, NDM's Pebble Project, supra note 70, at 31.
[94] Wardrop, Preliminary Assessment, supra note 61, at 49-52.
[95] Id. at 49-50.
[96] Letter from Six Federally-Recognized Tribes, supra note 4. Ultimately, EPA received petitions from nine federally recognized tribes, BBNC, commercial fishermen, sportsmen, conservationists, and others to initiate action under section 404(c).

petitions arose out of the adoption in 2005 by the Alaska DNR of a land use plan for the Bristol Bay area. Although that plan was ostensibly intended to make the state permit review process more efficient,[97] DNR's process for developing the land use plan – and the resulting land use plan itself – were deeply flawed, including, among other things, its designation of the Pebble Mine site as land best suited for mineral development.[98]

The process laid out sixteen possible categories for land use in the Bristol Bay region. Although one of the major uses of land for Bristol Bay residents is supporting their subsistence lifestyle (an average of 80% of protein consumed by residents comes from fish and wildlife subsistence sources[99]), subsistence use was not included as a category.[100] Furthermore, the category for Fish and Wildlife Habitat and Harvest Areas focused largely on marine resources and did not include moose or caribou among the species that could be considered for the designation, despite the fact that both species are harvested by both native and non-native hunters and are a part of subsistence use.[101] Finally, while DNR did include a category for recreational use, it excluded hunting and fishing from its definition of recreation.[102]

Most directly relevant here is the fact that, although the land on which the Pebble Mine would be located is used predominantly by local residents to support a subsistence lifestyle and by others for recreation based around fishing and hunting, DNR's land use plan ignored those current uses and elected instead to prioritize mineral extraction. In addition, the land use plan flies in the face of the 45-year history of state and federal efforts to conserve the Kvichak and Nushagak river drainages.[103] Because the Army Corps will consider and likely rely on this fundamentally flawed land use plan in its decision whether to grant a permit for the Pebble Mine, petitioner Tribes determined that EPA's intervention under section 404(c) is essential.[104]

In August 2010, the Bristol Bay Native Corporation sent a letter requesting that EPA protect Bristol Bay under section 404(c).[105] EPA received additional requests from Ekuk Village Council, Clarks Point Tribal Council, and Twin Hills Village Council, and received letters

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[97] Alaska Department of Natural Resources, Bristol Bay Area Plan For State Lands 1-4 (2005) available at http://dnr.alaska.gov/mlw/planning/areaplans/bristol/pdf/bbap_complete.pdf.
[98] Id. at 3-102.
[99] EPA Assessment, Vol. 1, ES-9.
[100] Alaska Department of Natural Resources, Bristol Bay Area Plan For State Lands, supra note 97, at 3-73.
[101] Id. at 2-9.
[102] Id. at A-11.
[103] Geoffrey Y. Parker, Section 404(c) of the Clean Water Act and the History of State and Federal Efforts to Conserve the Kvichak and Nushagak Drainages of Alaska, 2 Seattle Journal of Environmental Law 219, 219 (1971) (hereinafter "Parker, Section 404(c) of the Clean Water Act").
[104] The Native Tribes' letter laid out various reasons why proactive action by EPA is necessary, including (1) the health of the Kvichak and Nushagak River drainages is essential to the wellbeing of the salmon on which Alaska Natives subsist and would be put at risk by permitting the Pebble Mine; (2) the PLP has terminated its Technical Working Group, used to consult with federal and state officials about the environmental impact of the mine, and that the termination (and lack of cooperation that it reflects) will create an unacceptable information deficit for state and federal officials as the project review proceeds; and (3) the land's flawed classification of the site as mineral land – despite major subsistence and recreation uses – may result in the Army Corps issuing a permit for the Pebble Mine based on a fundamentally erroneous premise. Letter from Six Federally-Recognized Tribes, supra note 4.
[105] Bristol Bay Native Corporation, BBNC Submits Request to EPA to Protect Bristol Bay Resources (Aug. 12, 2010), available at http://www.bbnc.net/index.php?option=com_content&view=article&id=144:bbnc-submits-request-to-epa-to-protect-bristol-bay-resources&catid=36:news-a-events&Itemid=44.

supporting the initiation of a 404(c) action from the Alaska Independent Fishermen's Marketing Association, the Bristol Bay Regional Seafood Development Association, the National Council of Churches, and numerous other sportsmen and conservation groups.[106] The Bristol Bay Native Association also approved resolutions requesting EPA to use its authority under section 404(c) to protect Bristol Bay.[107]

B. Procedural Background of the EPA Watershed Assessment

In response to the concerns raised by Native Tribes and others, EPA announced on February 7, 2011 that it would conduct "a scientific assessment of the Bristol Bay watershed to better understand how future large-scale development projects may affect water quality and Bristol Bay's salmon fishery[.]"[108] EPA's regional administrator explained that the Bristol Bay watershed "is essential to the health, environment and economy of Alaska," and that "[g]athering data and getting public input now, before development occurs" would assure that future decisions by the agency "are grounded in the best science and information and in touch with the needs of these communities."[109]

On May 18, 2012, after fifteen months of scientific review and analysis, EPA released for public comment a "draft scientific study of the Bristol Bay watershed and its natural resources."[110] The Assessment was conducted and released in response to "growing interest in large-scale mining in the watershed from a number of stakeholders and local communities with a range of views[.]"[111] EPA's stated goals for undertaking the Watershed Assessment are to attain a better understanding of potential environmental impacts of mining activities on the watershed,[112] and to provide a "sound scientific and technical foundation for future decision making."[113]

Upon release of its Assessment, EPA announced that the draft would be subject to a 66-day public comment period, eight public hearings,[114] and independent scientific peer review. An

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[106] See, e.g., Letter from Alaska Independent Fishermen' Marketing Association to Lisa P. Jackson, Administrator of the EPA (May 13, 2010); Letter from Bob Waldrop, Executive Director of the Bristol Bay Regional Seafood Development Association to Lisa P. Jackson, Administrator of the EPA (June 20, 2010). EPA also received additional letters both supporting and opposing the agency's issuance of action under section 404(c).

[107] Bristol Bay Native Association, Res. 2010-32, supra note 5; Bristol Bay Native Association, Res. 2012-04, supra note 5.

[108] Press Release, U.S. Department of Environmental Protection, EPA Plans Assessment of Bristol Bay Watershed (Feb. 7, 2011), available at http://yosemite.epa.gov/opa/admpress.nsf/0/8c1e5dd5d170ad99852578300067d3b3?OpenDocument.

[109] Id.

[110] Press Release, U.S. Department of Environmental Protection, EPA Releases for Public Comment Draft Scientific Study of Bristol Bay Watershed (May 18, 2012), available at http://yosemite.epa.gov/opa/admpress.nsf/d96f984dfb3ff7718525735900400c29/6979fe30fc6583f385257a020061b472!OpenDocument.

[111] Id.

[112] Id.

[113] Notice of the Peer Review Meeting for EPA's Draft Report Entitled an Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, AK, 77 Fed. Reg. 40,037-01 (July 6, 2012).

[114] Public hearings were held from May 31, 2012 to June 7, 2012 in Seattle, Anchorage, Dillingham, Naknek, Levelock, Igiugig, Nondalton, and New Stuyahok. United States Department of Environmental Protection, Bristol Bay webpage, accessed at http://yosemite.epa.gov/R10/ECOCOMM.NSF/bristol+bay/bristolbay.

independent contractor assembled the peer review panel, whose names were announced on June 5, 2012. The panel's draft charge questions were simultaneously released for a three-week public comment period.[115] Peer review of the Watershed Assessment will take place from August 7 to August 9, 2012. Members of the public may observe the first two days of the proceedings and provide oral testimony on August 7.[116]

C. Scope and Findings of the EPA Watershed Assessment

EPA has explained that its Assessment "does not provide an in-depth assessment of a specific mining project," but rather reviews the environmental impacts that could result from mining activities "at a scale and with the characteristics that are realistically anticipated, given the nature of mineral deposits in the watershed, the requirements for successful mining development, and publicly available information about potential mining activity."[117] In other words, the environmental impacts identified in the Assessment would result from *any* economically viable mine in the area. And though not an analysis of the Pebble Mine specifically, this "publicly available information" about "potential mining activity" to which EPA refers is the baseline data and plans developed by PLP.[118]

EPA analyzed two mine scenarios – a "minimum" and "maximum" mine size – based on the amount of ore processed (2 billion vs. 6.5 billion metric tons) and mine life spans (25 to 78 years). The minimum mine would include a 1,358 acre mine pit to hold 2 billion tons of tailings; a 3,686-acre tailings impoundment behind a 685-foot-high earthen dam; a 3,286-acre waste rock pile; and an 86-mile road, with four pipelines running product concentrate, return water, diesel, and natural gas.[119] The maximum size mine – the "most likely" mine to be developed – is based on the Wardrop report.[120] It would include a pit and waste rock pile of a combined 9,486 acre area, potentially an underground mine, and three tailings impoundments, with a combined area of 10,807 acres.[121]

EPA's analysis first considers "routine operation," which assumes no engineering failures during operation or in the centuries after operation — an assumption that EPA cautions is unrealistic because accidents and failures of some kind are a certainty in mining.[122] Yet even assuming flawless planning, engineering, operation, and maintenance, EPA's Watershed Assessment anticipates severe impacts to the Bristol Bay environment. Loss of headwater stream and wetland areas in the mine footprint will destroy critical salmon habitat and spawning and rearing areas. Downstream water flow reduction will irreparably degrade salmon populations and

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[115] An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaksa—Peer Review Panel Members and Charge Questions, 77 Fed. Reg. 33,213-02 (June 5, 2012).
[116] Notice of the Peer Review Meeting for EPA's Draft Report Entitled an Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, AK, 77 Fed. Reg. 40,037-01 (July 6, 2012).
[117] Press Release, EPA Region 10, EPA Releases for Public Comment Draft Scientific Study of Bristol Bay Watershed (May 18, 2012), available at http://yosemite.epa.gov/opa/admpress.nsf/d96f984dfb3ff771852573590040c29/6979fe30fc6583f385257a020061b472!OpenDocument.
[118] EPA Assessment, Vol. 1, ES-10.
[119] Id. at Vol. 1, ES-11.
[120] Id. at Vol. 1, 4-19.
[121] Id. at Vol. 1, ES-11.
[122] Id. at Vol. 1, 5-1.

fisheries and damage one of the very keys to salmon health and volume in this area — their biodiversity. Operation of a mine would also require the construction of an access road, causing detrimental impacts to salmon through population fragmentation, exposure to sediment, and decreased groundwater-surface water connectivity. Furthermore, salmon prevalence supports ecosystem strength as a whole, and degraded salmon populations would impair the region's wildlife. Alaska Natives would also suffer health and cultural harm from mining, as their way of life has for centuries depended on salmon for subsistence, as well as for cultural, social, and spiritual identity.

EPA next moves from the inevitable impacts of "routine" mining to describing the environmental impacts of failures that have occurred in other mines and have the potential to occur here. Again, the Assessment identifies significant adverse impacts. Culvert failure has a 50% probability, and pipeline spills of chemicals have a 98% probability. The long-term effectiveness of tailings dams is unproven, and due to the "ephemeral" nature of human institutions over time, EPA expects maintenance and treatment of the mine site to eventually terminate.[123] This could have detrimental and indefinite consequences on the surrounding environment due to acid mine drainage and metal leaching. And if a tailings dam failure were to occur, catastrophic damage extending hundreds of miles – and hundreds of years – can be expected.

The Watershed Assessment is also notable for what it omits. EPA elected to exclude consideration of certain significant mining-related environmental stressors from which additional and likely *greater* impacts will result. Indeed, undervaluations of potential harm pervade the report. For instance, the Watershed Assessment estimates the maximum mine scenario at 6.5 billion tons, which is significantly smaller than the over 10 billion ton resource estimate in the Wardrop report. In addition, the development and operation of a deep-water port in Cook Inlet, secondary development, and increased evapotranspiration, precipitation, and likely other consequences of climate change are all absent from the analysis. This intentionally conservative approach only serves to bolster the Assessment's significance as a directive for proactive EPA action in Bristol Bay because, despite its conservatism, the report identifies substantial impacts of mining that will cause unacceptable adverse effects on the Bristol Bay environment.

VI. THE WATERSHED ASSESSMENT AND RECORD ON WHICH IT IS BASED ESTABLISH THAT MINING WOULD HAVE UNACCEPTABLE ADVERSE IMPACTS ON THE BRISTOL BAY ENVIRONMENT

If the Pebble Mine or other large-scale mining development is permitted in Bristol Bay, there is a high likelihood of unacceptable adverse effects to local fisheries, wildlife, and municipal waters, three of the central resources that section 404(c) is designed to protect.[124] EPA's Watershed Assessment in fact reveals that the unacceptable environmental damage

[123] Id. at Vol. 1, 7-14.

[124] Our focus on these factors is not meant to suggest that the effects of the mine with respect to other 404(c) factors – such as shellfish beds and recreation – are irrelevant, but only to emphasize that the impacts to local fisheries, wildlife, and water will be particularly severe. Furthermore, the available research particularly stresses the impacts to fisheries, wildlife, and water, many of which also adversely affect recreation. While it is known that shellfish are abundant in the area, and common sense would indicate that decrease in water quality will impact these shellfish, data on these impacts are less well developed.

resulting from "routine" mining operations is not just likely – it is "inevitable and foreseeable."[125] EPA defines "routine" as a best case scenario of no accidents, failures, or other releases of mining products or wastes, with "reliable collection" of all water from the site, and "effective treatment" of effluents.[126] The agency properly highlights, however, that this is *not realistic* "because accidents and failures *always happen* in complex and long-lasting operations."[127] When just a few of the possible "accidents and failures [] likely to occur over the decades that a mine is in operation, and over the centuries that a [tailings storage facility] remains in the post-closure period"[128] are incorporated into the analysis, the results are catastrophic.

A mine and its associated transportation corridor would inevitably carve out huge swaths of land from the region, eliminate and modify salmonid habitat, and alter the water flow in the area, causing serious reductions in the region's salmon population. Declining salmon populations would be detrimental to the productive Bristol Bay sockeye salmon fishery and would negatively impact the aquatic and terrestrial ecosystems of the region, which depend on salmon for nutrients. Severe downstream pollution of the watershed is also highly likely.

The inevitable and the likely adverse effects identified in the Watershed Assessment, while each individually significant and adverse, do not reflect the full extent of probable harm. EPA's judicious Assessment is by design a conservative underestimation of projected environmental damage that would result from mining in Bristol Bay. These undervaluations range from data considerations such as maximum mine scenario,[129] stream length of anadromous fish habitat,[130] spawning salmon abundance,[131] and salmon olfactory sensibility,[132] to the blanket exclusion from analysis of the significant infrastructure that would be associated with mine development. Though power generation and transmission, secondary development, and – critically – construction and operation of a deepwater port at Cook Inlet "could have significant repercussions for the Bristol Bay ecosystem[,]" they were not considered.[133] The port alone would threaten a highly endangered, genetically distinct, and geographically isolated species of beluga whales. The mine and new road would also increase traffic to the region and undoubtedly spur industrialization and development as major infrastructure is introduced. This would enable not only the Pebble Mine but other large-scale mining in the region, as well as secondary development – *the most significant* of impacts for Bristol Bay[134] – to further compound the impacts to fragile fish and wildlife populations.

[125] EPA Assessment, Vol. 1, ES-14.
[126] Id. at Vol. 1, 8-1.
[127] Id. at Vol. 1, 5-1 (emphasis added).
[128] Id. at Vol. 1, 4-37.
[129] Id. at Vol. 1, 4-15, Table 4-3.
[130] Id. at Vol. 1, 2-20.
[131] Id. at Vol. 1, 5-10.
[132] Id. at Vol. 1, 5-56.
[133] Id. at Vol. 1, 3-2. Other possible accidents excluded from consideration were spills of process chemicals on site or during transportation, failure of a tailings slurry pipeline, diesel fuel spills, waste rock slides or erosion, fires, and explosions. Id. at 6-1.
[134] Id. at Vol. 3, App. G at 9.

Furthermore, no matter how the mine is built and operated, the post-closure results are likely catastrophic. There are simply *no examples* of successful long-term treatment systems for inactive mines.[135] A review of recent pipeline spills in North America found that neither existing technology nor contemporary practice assure against catastrophic spills.[136] Today Bristol Bay is a watershed of superb quality, diverse aquatic habitats, high surface and subsurface water connectivity, and diverse and stable fish habitats, "untouched by human-engineered structures and flow management controls."[137] Our urgent concern is for the Bristol Bay of tomorrow should the region be opened to large-scale mining development.

Our comments follow EPA's tiered structure, analyzing first the inevitable and then the likely consequences of mining the Pebble deposit, followed by a discussion of possible catastrophic failure. Our subsequent sections describe the additional – and often *more* significant adverse impacts – of mining associated infrastructure and activities that EPA elected to omit from its analysis.

A. Adverse Impacts of Mining in Bristol Bay are Inevitable

1. Loss of Headwater Stream and Wetland Areas in the Mine Footprint Will Eliminate and Modify Critical Salmonid Habitat

If a mining project such as the Pebble Mine is permitted in Bristol Bay, even idealized failure-free operations would inevitably cause severe impacts on salmon habitat. The mine would eliminate headwater streams within and upstream of the mine footprint[138] and degrade downstream habitat through loss of headwater streams and wetlands.[139] Under the EPA minimum mine size scenario, 87.5 km of first- through third- order streams and 10.2 km^2 of wetland habitat would be eliminated or blocked. At maximum size, the mine would eliminate 141.4 stream kilometers and 17.3 km^2 of wetlands.[140] These numbers reflect uncertainty only to the extent that they may undervalue stream length and wetland area affected.[141] Degradation at this level would eliminate or block 7% (minimum mine scenario) to 10% (maximum mine scenario) of the watershed's total anadromous stream kilometers, home to coho salmon, sockeye salmon, Chinook salmon, and Dolly Varden spawning and rearing habitats.[142]

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[135] Id. at Vol. 1, 4-31, 5-45.
[136] Id. at Vol. 3, App. G at 14.
[137] Id. at Vol. 1, ES-8.
[138] The mine footprint consists of the area devoted to mining, including the mine pit, waste rock piles, TSFs, ore processing facilities, and other mine-related constructs. Id. at Vol. 1, 5-12.
[139] A wetland is classified as eliminated if it falls within the boundaries of the mine pit, waste rock pile, or tailings storage facility. Id. at Vol. 1, 5-14.
[140] Id. at Vol. 1, 5-14.
[141] Id. at Vol. 1, 5-14, Box 5-1. The Assessment underestimates the amount of habitat that would be lost to mining. It excludes certain areas from the mine footprint, bases its estimate of stream losses on a dataset that underestimates the reach and extent of streams in the vicinity, and bases its estimate of wetland losses on maps that underrepresent the amount of wetland and aquatic areas within PLP's mine mapping area. Comments of Thomas Yocom, Comments of Bristol Bay Native Corporation on the U.S. Environmental Protection Agency Draft Bristol Bay Watershed Assessment, Appendix A (Jul. 23, 2012).
[142] Id. at Vol. 1, 5-16, 8-1.

While Northern Dynasty decries as "myth" the EPA determination that fishery damage could result from a "modern" mine "occupying less than one-twentieth of 1% of the land base,"[143] EPA has correctly emphasized that loss of relatively small portions of documented and anadromous headwater streams would have severe implications for fish well outside that geographical area.[144] The Alaska Bureau of Land Management recognized this fact as early as 1971, when it published findings that "seemingly 'minor' spawning areas may produce up to sixty percent or more of the total Kvichak run[.]"[145]

The headwater streams at risk of elimination provide necessary fish spawning habitat to coho salmon in the North and South Fork Koktuli River watersheds, and to coho and sockeye salmon in the Upper Talarik Creek watershed.[146] They also offer essential rearing habitat to Chum salmon, sockeye salmon, Chinook salmon, coho salmon, rainbow trout and others, all known to rear within and upstream of the mine footprint.[147] In the most comprehensive published field inventory, one or more relevant fish species was detected in 96 percent of the 108 small waters sampled in the Nushagak and Kvichak River drainages in the Pebble vicinity.[148] Indeed, small headwater streams "collectively [] produce millions of salmon and determine water flow and chemistry of larger rivers."[149]

And these impacts are larger than at first glance. While the mine will outright eliminate some populations of salmon, many aspects of the mine – such as the mine site itself, the access road, and the pipelines – will also cause habitat fragmentation in salmon populations.[150] Smaller populations are more vulnerable to extirpation,[151] causing greater impacts to local salmon populations. This elimination of many small populations of salmon would have crucial effects on the fishery. Bristol Bay's salmon fishery is made up of many distinct, locally adapted populations,[152] and the success and health of the Bristol Bay fishery depends on the fact that different populations do well in different years.[153] It is estimated that the Bristol Bay salmon return is over twice as stable due to this diversity than if it were made up of only one

[143] Press Release, Northern Dynasty Minerals Ltd., Northern Dynasty Comments at Public Hearings on the EPA's Draft Bristol Bay Watershed Assessment Report (May 31, 2012), available at http://www.northerndynastyminerals.com/ndm/NewsReleases.asp?ReportID=528336&_%20Type=News-Releases&_Title=Northern-Dynasty-Comments-at-Public-Hearings-on-the-EPAs-Draft-Bristol-Bay-....
[144] EPA Assessment, Vol. 1, 5-16.
[145] Parker, Section 404(c) of the Clean Water Act, supra note 103, at 233 (quoting Bureau of Land Management, Iliamna Unit Resource Analysis, pt. 4, Lands (1971)).
[146] EPA Assessment, Vol. 1, 5-16.
[147] Id. at Vol. 1, 5-16.
[148] Id. at Vol. 3, App. G, at 5. Fish species include coho salmon, dolly varden, rainbow trout, and arctic grayling, as well as other species including round whitefish, pond smelt, lamprey, slimy sculpin, northern pike, sticklebacks and burbot.
[149] Id. at Vol. 3, App. G, at 5.
[150] Hauser, Potential Impacts, supra note 78, at 12.
[151] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 41.
[152] Ray Hilborn et al., Biocomplexity and Fisheries Sustainability, 100 Proceedings of the National Academy of Sciences 6564, 6564 (2003), available at http://www.pnas.org/content/100/11/6564.
[153] Christopher Habicht et al., Genetic and Ecological Divergence Defines Population Structure of Sockeye Salmon Populations Returning to Bristol Bay, Alaska, and Provides a Tool for Admixture Analysis, 136 Transactions of the American Fisheries Society 82, 82 (2007), available at http://doc.nprb.org/web/publication/project_0303_Habicht%20et%20al%202007.pdf.

population.[154] In fact, the Bristol Bay sockeye salmon population is in reality a combination of hundreds of genetically distinct populations, "each adapted to specific, localized environmental conditions."[155] This diversity is "critical" to keeping the fishery stable and productive,[156] and without it, annual variability of sockeye salmon runs would more than double, causing more frequent fishery closures.[157] The proposed Pebble Mine has the potential to greatly reduce this diversity, just as other once-robust salmon fisheries have suffered biodiversity losses – and associated population declines – as a result of mining.[158]

2. Salmon Populations and Municipal Groundwater Will be Severely Impacted by Streamflow Changes

Large scale flow reductions in the watershed would be part and parcel of any mining operation undertaken in Bristol Bay. With the documentation for its 2006 water permit applications, NDM requested the use of up to 35 billion gallons of water each year.[159] This would require that all surface and ground water within the area be redirected to mine use,[160] consistent with the EPA water capture scenario at start-up.[161] During operation, EPA's analysis of the downstream effects of mining found streamflow reductions of up to 32% (maximum mine scenario) and 63% (minimum mine scenario), even factoring in operational flow return to streams.[162] Once the mine is closed, treated water from the pit would not be available for streamflow for at least 100-300 years.[163]

Flow reduction is detrimental to salmon survival. At each stage of the EPA models, flow reductions would occur across Upper Talarik Creek and North and South Fork Koktuli watersheds of a magnitude significant enough to change ecosystem structures and functions.[164] Above the mine, fish stocks would be completely destroyed; downstream from the mine stream, flow reductions would diminish and degrade fish habitats.[165] Since the number of fish produced is determined by the quality and quantity of habitat available, this loss of flow is likely to cause reductions in resident and anadromous fish populations.[166] Sockeye, coho, and Chinook salmon spend at least a year rearing in freshwater before migrating to the ocean, and therefore depend on

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[154] Daniel E. Schindler et al., Population Diversity and the Portfolio Effect in an Exploited Species, 465 Nature 609, 609 (2010), available at http://www.nature.com/nature/journal/v465/n7298/abs/nature09060.html (hereinafter "Schindler et al., Population Diversity").
[155] EPA Assessment, Vol. 1, 2-22.
[156] Schindler et al., Population Diversity, supra note 154, at 609; see also EPA Assessment, Vol. 1, 2-22.
[157] EPA Assessment, Vol. 1, 2-22.
[158] Id.
[159] Robert Moran, Water-Related Impacts at the Pebble Mine, Pebble Science (2007), available at http://pebblescience.org/Pebble-Mine/water-impact.html.
[160] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 15. For a full discussion of the effects of the proposed Pebble Mine on surrounding waters, see Wild Salmon Center and Trout Unlimited, Bristol Bay's Wild Salmon Ecosystems and the Pebble Mine: Key Considerations for a Large-Scale Mine Proposal (2012), 51-67, available at http://www.wildsalmoncenter.org/pdf/PM-Report.pdf.
[161] EPA Assessment, Vol. 1, 5-48.
[162] Id. at Vol. 1, 5-26 – 5-27.
[163] Id. at Vol 1, 5-27.
[164] Id. at Vol. 1, 5-31, 5-17 Table 5-3.
[165] Hauser, Potential Impacts, supra note 78, at 7.
[166] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 15.

the availability and quality of freshwater more than species that migrate shortly after hatching.[167] Low flow conditions are recognized as a potentially limiting factor in salmon populations and affect all life stages of fish.[168]

The effects of low flow conditions are not limited to the risks they present to salmonid spawning and rearing habitat.[169] Loss of streamflow would also affect connectivity between the main channel and off-channel habitats, cause fish stranding or isolation if reductions exceed typical recession rates, reduce macroinvertebrate production, and increase fragmentation of stream habitats through increased frequency and duration of stream drying.[170] The elimination of streams caused by the mine and the corresponding decrease in flow volumes downstream would result in greater competition for resources — especially food and cover — among fish in the region.[171] Loss of connectivity to wetlands, which contribute refugia and food supply, would further impact fish populations.[172]

Reduction of the extensive connectivity that exists between groundwater and surface water in the Nushagak River and Kvichak River watersheds is also a great concern. Groundwater is a key water supplier to the upper sections of the streams in the region.[173] NDM's 2004 Environmental Studies and their 2006 water rights application show that groundwater from the mine area is an important contributor to stream flow.[174] Water temperature data collected by PLP and published in its EBD indicates that streams in the watershed are influenced by upstream lakes and groundwater contributions.[175] Groundwater-infused streamflow from headwater tributaries is critical to fish that remain in streams during the winter, as well as egg development and hatch and emergence timing, because it moderates mainstem temperature, reducing both winter freezing and summer heating. [176] Headwater streams and wetlands also contribute "disproportionately" to groundwater recharge by sending nutrients, water, organic material, and macroinvertebrates to higher order streams in the watershed, as well as invertebrate and detritus exportation downstream – an important energy subsidy for juvenile salmonids.[177]

In light of this connectivity, PLP studies that identify numerous seeps in the streams draining the TSF 3, mine pit, and waste rock pile footprints offer disturbing evidence that the Pebble Mine would have direct impacts on groundwater sources[178] — and there is no easy engineering "fix." The inherent complexity of the groundwater-surface water interactions would render uncertain any proposal to regulate or control these effects during large-scale development.[179]

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[167] EPA Assessment, Vol. 1, 2-11.
[168] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 31.
[169] EPA Assessment, Vol. 1, 5-43.
[170] Id.
[171] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 26.
[172] EPA Assessment, Vol. 1, 5-27.
[173] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 18.
[174] Id.
[175] EPA Assessment, Vol. 1, 5-29.
[176] Id. at Vol. 1, 5-21, 5-29, 5-45.
[177] Id. at Vol. 1, 2-21, 5-20, 5-21.
[178] Id. at Vol. 1, 5-21 – 5-22.
[179] Id. at Vol. 1, 5-45.

Changes in streamflow or streamflow sources can also lead to stream temperature changes – a particular threat to salmon. Temperature controls the metabolism and behavior of salmon, and fluctuations can produce vulnerability to disease, competition, predation, or death.[180] Migration, spawning, and incubation timing are closely tied to seasonal water temperatures. This contributes to the diversity of spawning migration in Bristol Bay, and, in turn, to the persistent nature of sokeye salmon populations and extended nutritional availability to wildlife.[181] Temperature also influences the amount of dissolved oxygen in streams, with lower flow rates generally leading to less dissolved oxygen, which is a key limiting factor for fish survival.[182]

Finally, low flow conditions will cause negative impacts to salmon from a general reduction in velocity[183] and reduced downstream water quality from sediment deposition.[184] Overall, it is likely that the mine's water flow reductions would limit salmon growth and survival, leading to increased infection rates and crowding, and, in turn, to heightened competition and predation.[185]

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,"[186] and development of a mine there would be impossible without dramatic transportation infrastructure expansion.[187] 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.[188] According to several studies, this road would cross at least 89 streams[189] and require up to 120 stream crossings.[190] Twenty-four of these streams are documented to provide 1,200 acres of spawning habitat for sockeyes and other salmonids.[191] EPA's mine scenario similarly provides for an 86-mile permanent access road connecting the mine site to a new port in Cook Inlet.[192] 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.[193]

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[180] Id. at Vol. 1, 5-28. See also The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 39-41.
[181] EPA Assessment, Vol. 1, 5-28.
[182] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 37-39.
[183] Id. at 34.
[184] Id. at 39.
[185] Id. at 26, 31-34.
[186] EPA Assessment, Vol. 1, 4-34.
[187] Id.
[188] Wardrop, Preliminary Assessment, supra note 61, at 58-59.
[189] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 43.
[190] Hauser, Potential Impacts, supra note 78, at 10.
[191] Id. at 11. If the road corridor is constructed, connecting roads and spur roads would also likely be built – requiring still more stream crossings. Id. at 14.
[192] EPA Assessment, Vol. 1, 4-34.
[193] Id. at Vol. 1, 5-60.

a. 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.[194] The habitat potentially affected below the road crossings totals 270 km of stream, plus an additional 240 km upstream, if culverts impede fish movement.[195] 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."[196] 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.[197]

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.[199]

b. 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.[200] Under any mine scenario, many stream crossings will likely be culverts instead of bridges; EPA anticipates fourteen.[201] Culverts can serve as a barrier to fish, restrict or eliminate fish movement to upstream habitat, and isolate or modify populations.[202] Such habitat fragmentation increases the chance that fish populations will be extirpated due to a lack of genetic diversity or chance events.[203] 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

[194] Id. at Vol. 1, 5-74.
[195] Id.
[196] Id. at Vol. 3, App. G at 13.
[197] Id. at Vol. 3, App. G at 13.
[198] Id. at Vol. 1, 5-62.
[199] Id. at Vol. 1, 5-62 – 5-63.
[200] Id. at Vol. 1, 6-43.
[201] Id. at Vol. 1, 5-60.
[202] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 41.
[203] Id.

traverse.[204] 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.[205]

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.[206] 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.[207]

Even assuming compliance with fish passage guidelines at installation, culverts will likely threaten salmon migration in the future.[208] 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.[209] 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.[210] 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%.[211] 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.[212]

4. If Salmon Fisheries Are Degraded, Degradation of the Entire Ecosystem and Adverse Effects to Wildlife Will Follow

Salmon are a resource base "that supports much of the coastal ecosystem."[213] They have been called a "keystone"[214] and "cornerstone" species[215] due to their importance to the greater ecosystem. Because a wide number of animals feed on salmon[216] – and because salmon hugely

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[204] EPA Assessment, Vol. 1, 5-61.
[205] Id.
[206] Id.
[207] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 41-42.
[208] EPA Assessment, Vol. 1, 6-43; see also The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 45. It is also noteworthy that standards for culverts on fish-bearing streams in Alaska target road safety and fish passage *but not* habitat quality. EPA Assessment, Vol. 1, 5-61.
[209] EPA Assessment, Vol. 1, 6-43.
[210] Hauser, Potential Impacts, supra note 78, at 12.
[211] EPA Assessment, Vol. 1, 6-43.
[212] Id.
[213] Hauser, Potential Impacts, supra note 78, at 5.
[214] Id.
[215] Mary F. Willson et al., Fishes and the Forest: Expanding Perspectives on Fish-Wildlife Interactions, 48 BioScience 455, 456 (1998), available at http://www.fish.washington.edu/people/naiman/contemporary/papers/willson.pdf (hereinafter "Mary F. Willson et al., Fish-Wildlife").
[216] EPA Assessment, Vol. 1, 5-75; Hauser, Potential Impacts, supra note 78, at 5.

affect ecosystem productivity and regional biodiversity due to nutrient transportation[217] – what harms salmon harms the wildlife that depend on them. EPA has stressed that the inevitable reduction in salmon production caused by potential mining in Bristol Bay would also lead to roughly proportionate reductions in wildlife that feed on salmon, including brown bears, wolves, and bald eagles.[218] While this proportionate loss ratio alone would generate unacceptable effects on wildlife, the far-reaching impact of salmon throughout the local ecosystem suggests losses of a much greater magnitude.

Salmon are invaluable to the ecosystem as a food source. Numerous species consume salmon at all life stages, from salmon eggs to spawned-out carcasses.[219] Salmon provide food sources to all types of terrestrial mammals, including carnivores and "herbivores," [220] many types of birds, [221] and a wide variety of fish.[222] They are also an important food resource to several marine species, such as beluga whales and sea lions, which will follow salmon hundreds of kilometers upstream.[223] Salmon are important to more than megafauna; algae, fungi, bacteria, and many populations of invertebrates feed on salmon carcasses and in turn affect the greater ecosystem.[224] Scientists believe that the presence of salmon, and the seasonal nature of their availability, has shaped the evolution of aquatic and terrestrial consumers, including in many cases a co-evolution between predators and prey.[225]

Salmon are also crucial to the ecosystem because they transport nutrients into freshwater ecosystems. Salmon serve as a "conveyor belt," carrying nutrients to these ecosystems.[226] They accumulate over 95% of their biomass in the ocean,[227] and, when they return to freshwater, a "large fraction" of their marine-derived nutrients ("MDN") are incorporated into freshwater and terrestrial food webs.[228] Because salmon can migrate over 1,000 kilometers inland, these nutrient gains benefit a wide geographic area.[229]

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[217] EPA Assessment, Vol. 1, 5-75; Mary F. Willson and Karl C. Halupka, Anadromous Fish as Keystone Species in Vertebrate Communities, 9 Conservation Biology 489, 490 (1995), available at http://www.jstor.org/stable/2386604 (hereinafter "Willson & Halupka, Keystone Species").
[218] EPA Assessment, Vol. 1, 5-75.
[219] Willson et al., Fish-Wildlife, supra note 215, at 492.
[220] Id.
[221] Id.
[222] Id.
[223] Id. at 493.
[224] Willson et al., Fish-Wildlife, supra note 215, at 457.
[225] Id.
[226] Daniel E. Schindler et al., Pacific Salmon and the Ecology of Coastal Ecosystems, 1 Frontiers in Ecology and the Environment 31, 31 (2002), available at http://www.jstor.org/pss/3867962 (hereinafter "Daniel E. Schindler et al., Pacific Salmon").
[227] Id. at 32.
[228] M. Ben-David et al., Fertilization of Terrestrial Vegetation by Spawning Pacific Salmon: The Role of Flooding and Predator Activity, 83 Oikos 47, 47 (1998), available at http://faculty.washington.edu/kerrb/BenDavid_et_al1998.pdf. Salmon also provide a plentiful supply of both phosphorus and nitrogen. Robert J. Naiman et al., Pacific Salmon, Nutrients, and the Dynamics of Freshwater and Riparian Ecosystems, 5 Ecosystems 399, 402 (2002), available at http://www.fish.washington.edu/people/naiman/CV/reprints/naiman_ecosys_salmon_2002.pdf.
[229] Scott M. Gende et al., Pacific Salmon in Aquatic and Terrestrial Ecosystems, 52 BioScience 917, 919 (2002), available at http://www.nps.gov/glba/naturescience/loader.cfm?csModule=security/getfile&pageid=120186.

Any reduction in salmon populations might severely impact this conveyor belt, as it has been predicted that the presence of salmon creates a positive feedback loop. Nutrients brought by spawning salmon enhance juvenile salmon growth and survivorship because, in aquatic salmon ecosystems, primary production is often severely nutrient-limited.[230] Declining numbers of spawning salmon can thus impede juvenile salmon survival, reducing yet further the nutrients in affected ecosystems.[231]

Returning and spawning salmon are also important to wildlife because their MDN "fuel much of the productivity of the Bristol Bay watershed."[232] Salmon predators such as bears deposit those MDN on the landscape, where they increase plant production that supports moose, caribou, song birds, and other terrestrial wildlife.[233] Non-mammals such as birds and insects are also responsible for transporting salmon away from streams,[234] and the transported carcass is consumed by a variety of scavengers in the terrestrial ecosystem.[235] Nutrients leach into the soils by excretion and decomposition, and are taken up by the vegetation.[236] It is thought that salmon play a significant role in the productivity of riparian ecosystems.[237]

Salmon's contributions extend yet farther and deeper into the surrounding ecosystem. For example, since bear densities are correlated with salmon availability, and bears are important seed dispersers, the presence of salmon leads to better dispersal of seeds.[238] As another example, salmon can cause higher densities of insectivorous birds, which eat insects that destroy vegetation. Increased salmon, then, often leads to increased vegetation.[239]

Finally, salmon act as ecosystems engineers. They are an important source of mechanical energy, and intensively and regularly disturb benthic communities. This alters the composition of sediments and changes the topography of the substrate, which has many effects on the ecosystem, including increasing the survival of salmon eggs.[240] In this multitude of ways, salmon strengthen – and their decline would degrade – the surrounding wildlife.

5. Degradation of Salmon Habitat Would Have Significant Negative Impacts on Alaska Native Cultures

Alaska Natives and Bristol Bay residents in the watershed depend – and have for generations – on salmon for their subsistence. Reduced salmon stocks would seriously threaten

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[230] Naiman et al., Pacific Salmon, Nutrients, and the Dynamics of Freshwater and Riparian Ecosystems, supra note 228, at 401.
[231] Schindler et al., Pacific Salmon, supra note 226, at 32-33.
[232] EPA Assessment, Vol. 1, 5-75.
[233] Id.; C. Jeff Cederholm et al., Pacific Salmon Carcasses: Essential Contributions of Nutrients and Energy for Aquatic and Terrestrial Ecosystems, 24 Fisheries Vol. 10, 6, 11 (1999), available at http://www.nativefishsociety.org/conservation/wild_population/annotated_bib_salmonids_hatcheries/nutrient_enrichment/Pacific.pdf.
[234] Gende et al., Pacific Salmon in Aquatic and Terrestrial Ecosystems, supra note 229, at 919.
[235] Schindler et al., Pacific Salmon, supra note 226, at 34.
[236] Id.
[237] Cederholm et al., supra note 233, at 12.
[238] Gende et al., Pacific Salmon in Aquatic and Terrestrial Ecosystems, supra note 229, at 923.
[239] Id.
[240] Schindler et al., Pacific Salmon, supra note 226, at 33.

their health, way of life, and the survival of their communities. Subsistence-based living is vital to Alaska Native identity, and plays a central economic, social, and cultural role.[241] Two of the last intact, sustainable salmon-based cultures in the world, the Yup'ik and Dena'ina, live in the Kvichak and Nushagak River watersheds.[242]

In Bristol Bay, an average of 80% of protein consumed by residents comes from fish and wildlife subsistence sources, or over 300 pounds of subsistence meats per person per year.[243] Salmon constitute over half of this total subsistence harvest.[244] Nearly everyone in most rural Bristol Bay communities uses meat gathered through subsistence hunting; those who do not hunt receive the meat through communal resource distribution networks. For instance, 88% of the area's population reported consuming caribou meat, and 86% reported consuming moose.[245] In addition to these meats and salmon, Bristol Bay residents also harvest small mammals, birds and their eggs, and plants.[246] As explained above, *all* of these sources would suffer negative impacts from a reduction in salmon quantity and quality. "Any salmon-mediated effects on subsistence wildlife resources in the area would have corresponding impacts on subsistence users."[247]

Significant negative impacts on salmon or other subsistence resources would also negatively impact Alaska Native health and culture. Subsistence resources are deeply connected to mental and emotional health related to traditional culture, language and traditional expression of interpersonal and land relationships, and nutrition and physical health.[248] The Alaska Native cultures living in the proposed mine area have significant ties to these specific land and water resources, which have evolved over *thousands* of years. It would simply "not [be] possible to replace elsewhere these subsistence use areas lost to mine operations."[249] The importance of salmon to the region's indigenous cultures cannot be understated. "The people in this region not only rely on salmon for a large proportion of their highly nutritional food resources; salmon is also integral to the language, spirituality, and social relationships of the culture."[250]

[241] EPA Assessment, Vol. 1, 2-19.
[242] Id. at Vol. 1, ES-8.
[243] Id. at Vol. 1, 2-19. Some village averages are as high as 900 pounds per person. Id.
[244] Id. at Vol. 1, ES-9.
[245] Id. at Vol 1, 2-16.
[246] James A. Fall, Subsistence Harvests and Uses of Wild Resources in Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth, Alaska, 2004 39 (Alaska Department of Fish and Game, 2006).
[247] EPA Assessment, Vol. 1, 5-75.
[248] Id. at Vol. 1, 5-76. Consumption of subsistence foods results in lower cumulative risk of diabetes, obesity, high blood pressure, and heart disease, and provides a range of essential micronutrients, such as iron, and omega-3 fatty acids. Further, alternative food sources may not be economically viable, and there is a high risk of excess consumption of processed simple carbohydrates and saturated fats – similar to urban communities with low availability (and high cost) of fresh produce, fruits, and whole grains. Id., at 6-46.
[249] Id. at Vol. 1, 5-77.
[250] Id. at Vol. 1, 6-46.

B. Adverse Impacts of Mining the Pebble Deposits are Likely

1. A Mine Would Cause Severe Downstream Pollution through Use and Transport of a Wide Range of Chemicals

Although EPA categorizes a pipeline spill as a "possible" failure, the Assessment itself reveals that a spill is more properly analyzed as a foreseeable cost of operation — because it is a near certainty. The probability of a spill from a pipeline transporting copper-gold slurry, diesel, and natural gas between the mine and port site is 98% in 25 years.[251] In only two minutes (a conservative premise that assumes successful automatic shutoff), the pipeline would be expected to release 366,000 L of leachate — a leachate that would exceed limits for six metals, including exceedance of the copper acute criterion by a factor of more than 700.[252] As discussed in more detail below, copper exposure renders salmon unresponsive to alarm cues, less aware of proximal danger, and therefore less prepared to avoid or evade attack, or once attack is initiated, to successfully evade the predator.[253]

A spill could occur at any point of the pipeline. There is a 16% probability that it would enter a stream within the Kvichak watershed, and a 23.4% probability of entering a wetland.[254] If entering a stream, the concentrate would kill fish and invertebrates both immediately and in the long-term. Physical effects could include embeddedness in riffle and spawning areas and increased stream turbidities.[255] A spill could also lead to long-term bio-uptake and transfer of metals within the food chain.[256] Settled concentrate turned toxic sediment would spend years making its way through streams and finally to Iliamna Lake, where it could be toxic to the eggs and larvae of sockeye salmon.[257] Though the precise composition of the product concentrate and its leachate is uncertain, it would certainly be high in copper and sulfur, making it "implausible" that it would be nontoxic to aquatic biota.[258] "Depending on the size, time and location of a pipeline spill, a slurry pipeline break could impact thousands to hundreds of thousands of adult salmon and high-value resident fish – and hundreds of thousands to millions of juvenile fish."[259]

Though not addressed in the Assessment, a mine in the Pebble area would utilize a wide variety of ecologically harmful substances, such as explosives, fuels and oils, antifreeze, water treatment chemicals, herbicides and pesticides, and road de-icing compounds, any of which may be released into surface and ground water.[260] Spills of these chemicals could cause "critical" impacts if they occurred in spawning or rearing habitats,[261] or cause particular harm when occurring simultaneously with other mine impacts.

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[251] Id. at Vol. 1, 8-3.
[252] Id. at Vol. 1, 6-34.
[253] Jenifer K. McIntyre et al., Low –level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators, 22 Ecological Applications 5 (July 2012).
[254] EPA Assessment, Vol. 1, 6-32.
[255] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 89.
[256] Id.
[257] EPA Assessment, Vol. 1, 6-35.
[258] Id.
[259] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 85.
[260] Moran, Water-Related Impacts at the Pebble Mine, available at http://www.pebblescience.org/Pebble-Mine/water-impact.html.
[261] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 65.

Furthermore, cyanide is often used during mining of copper, gold, and molybdenum.[262] Much of the information on cyanide indicates that it breaks down quickly and mostly harmlessly—but this is neither complete nor correct.[263] Cyanide should be listed as a potential concern whenever it is used in mining,[264] because it reacts readily with almost any other available chemical and can form hundreds of compounds, many of which can persist in the environment.[265] These compounds can accumulate in plants and can be chronically toxic to fish. As a result, it is "likely that the negative impacts to aquatic organisms, especially sensitive fish populations, from releases of cyanide…is underestimated and undetected…."[266]

2. Salmon Will Be Severely Impacted by Metal Leaching and Acid Mine Drainage.

Metal leaching and acid rock drainage is "the most costly and potentially environmentally damaging issue facing the mining industry," and, as the EPA Watershed Assessment and any number of studies show, the proposed Pebble Mine is no exception.[267] The rock associated with most metal mines, including the Pebble deposits, contains iron and other metal sulfides, which generate sulfuric acid when exposed to air and water.[268] Sulfuric acid causes acidification of nearby surface waters and dissolves metals in the surrounding rock, mobilizing them into solution. Some of these metals, such as arsenic, cadmium, copper, and lead, become available to the food chain and can threaten the surrounding ecosystems.[269] As EPA explains, copper is the major resource metal in the Pebble deposits and is "particularly toxic to aquatic organisms."[270] Metal leaching and acid rock drainage can originate from various aspects of the mine, including mine waste rock, tailings, and mine structures such as open pits.[271]

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[262] Robert E. Moran, Cyanide in Mining: Some Observations on the Chemistry, Toxicity, and Analysis of Mining-Related Waters 2, available at http://www.claim-gv.org/docs/morancyanidepaper.pdf (hereinafter "Moran, Cyanide").

[263] Id. at 1.

[264] James R. Kuipers and Ann S. Maest, Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements, ES-15 (2006), available at www.earthworksaction.org/files/publications/ComparisonsReportFinal.pdf.

[265] Moran, Cyanide, supra note 262, at 1.

[266] Id. For example, a tailings impoundment in Romania containing a slurry with high concentrations of cyanide and heavy metals experienced a 20- to 25-m breach, and released 100,000 m^3 of contaminated water into two rivers as a result of heavy rains and a sudden thaw caused overtopping of the embankment. Contamination reached the Danube River and the Black Sea, destroying aquatic species in over 1,900 km of the river system. EPA Assessment, Vol. 1, 4-41.

[267] William A. Price, List of Potential Info. Requirements in Metal Leaching & Acid Rock Drainage Assessment and Mitigation Work 4 (2005), available at http://www.frameworkforresponsiblemining.org/pubs/MEND5.10E_Price_Final.pdf.

[268] Wild Salmon Center and Trout Unlimited, Bristol Bay's Wild Salmon Ecosystems and the Pebble Mine: Key Considerations for a Large-Scale Mine Proposal, supra note 160; See also Geoffrey Y. Parker et al., Pebble Mine: Fish, Minerals, and Testing the Limits of Alaska's "Large Mine Permitting Process" 15-16 (2008), available at http://www.law.duke.edu/shell/cite.pl?25+Alaska+L.+Rev.+1+pdf.

[269] Id.

[270] EPA Assessment, Vol. 1, 5-53.

[271] U.S. EPA, Acid Mine Drainage Prediction 2 1994, available at http://water.epa.gov/polwaste/nps/upload/amd.pdf; EPA Assessment, Vol. 3, App. H at 10.

EPA's analysis under routine operations presumes that all runoff water, leachate, and wastewater would be collected and properly treated according to state and federal criteria prior to release.[272] As explained above, these assumptions are intentionally conservative and unrealistically underestimate risk. The agency's concrete findings reveal instead that unacceptable releases are likely to occur both during operation and more severely after closure.

Acid mine or rock drainage has been a "common phenomenon at mines around the world."[273] It results in the elimination of fish and invertebrates from streams and, even after dilution has taken place, reduced abundance, production, and diversity of stream and river ecosystems.[274] In the case of the Pebble deposits, there is significant potential for acid mine drainage.[275] The likelihood of such drainage is predicted by measuring the ratio of rocks with acid-forming minerals to rocks with neutralizing minerals.[276] Over 95% of the 399 samples taken from the proposed Pebble Mine area have been found to be acid-generating.[277] Furthermore, the Pebble deposits are located in an area with moderate precipitation, a high water table, countless small streams and tributaries, and geological formations that are susceptible to ground water movement, making acid drainage "highly likely."[278]

Experimental leachates from Pre-Tertiary waste rocks of the Pebble deposit are acidic and would require collection and treatment. The Tertiary waste rocks in the Pebble area tend to be neutral and would therefore be used for construction of the tailings dam, to line the edges of the TSF, and for other fill purposes[279] – *despite the fact* that they exceed the acute and chronic national ambient water quality criteria for copper.[280] In other words, not only might failure to collect Pre-Tertiary waste rock leachate cause acid rock drainage, but even leachate from mine structures would require treatment to avoid toxic effects of metal leaching.[281] Yet during operation and planned post-closure period, failure of the water collection and treatment system is expected to be a "relatively common occurrence of limited duration."[282]

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[272] EPA Assessment, Vol. 1, 5-47.
[273] Id. at Vol. 1, 6-41.
[274] Id.
[275] Kendra Zamzow, Acid Rock Drainage and Metal Leaching at the Pebble Mine, Pebble Science, 2, available at http://www.pebblescience.org/pdfs/Pebble_acid_mine_drainage.pdf.
[276] S.R. Jennings et al., Acid Mine Drainage and Effects on Fish Health and Ecology: A Review 8 (Reclamation Research Group Publ'n, Bozeman, MT 2008), available at http://reclamationresearch.net/publications/Final_Lit_Review_AMD.pdf.
[277] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 55. Acid drainage may cause receiving waters to have a pH as low as 2.0-4.5. Jennings, supra note 276, at 5. Streams affected by moderate acid are typically poor in taxa richness and abundance, and streams with a pH of 4.5-5.5 can be "severely impacted." The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 105. There is a complete loss of fish in 90% of streams in waters with a pH of 4.5 — and these effects become more severe as the pH decreases. Jennings, supra note 276, at 5. Instream pH levels below 5 have been predicted to occur up to 30 miles from the proposed Pebble Mine. The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 112-113.
[278] Id. at 100.
[279] EPA Assessment, Vol. 1, Tables 5-14, 5-15, 5-16, at 5-49 through 5-51.
[280] Id.
[281] Id. at Vol. 1, 6-38. Both the standard and national copper criteria are determined by invertebrate sensitivities. However, the genus which includes rainbow trout and the five Pacific salmon species is the most sensitive vertebrates in both types of tests. Id. at Vol. 1, 5-55.
[282] Id. at Vol. 1, 6-38.

Worse, after the mine has closed, it would no longer be dewatered and would fill, generating an enormous mixture of waste rock leachate and ambient water, until precipitation and groundwater flow equilibrated.[283] Once full, the pit contents would flow to a stream, most likely the Upper Talarik Creek, becoming its stream source.[284] In theory, collection and treatment should continue until the composition of the site is stable. In practice, mines commonly close or are abandoned prematurely, leaving acidic materials on the surface, and untreated leachate discharge.[285] Under these circumstances, EPA deems "certain" the likelihood of water collection and treatment failures, finding that "[w]hen water is no longer managed, untreated leachates would flow into the streams."[286] And as EPA explains, "[w]eathering to the point where [] contaminants are present in only trace amounts (at levels approaching their pre-mining background concentrations) would likely take hundreds to thousands of years, resulting in a need for management of materials and leachate over that time."[287]

When, for whatever reason, the costs or obligations of mitigation or remediation are passed from the mining companies to public agencies (e.g., several recent large-scale mines in the U.S. have declared bankruptcy),[288] taxpayers necessarily must assume the responsibility of ongoing management, including ensuring that polluted water is treated and the integrity of the mine is maintained – forever.[289] As EPA powerfully articulated:

> Human institutions change… Priorities are likely to change in the face of financial crises, changing markets for metals, new information about the resource, political priorities, or any number of currently unforeseeable changes in circumstance. 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.[290]

Impacts from acid rock drainage can be extremely long lasting and have continued to emanate from mines in Europe, for example, that were established over 1,500 years ago.[291] There are also many challenges associated with mitigation,[292] the successes of which are questionable.[293] One 2006 study, which examined acid rock drainage in 25 hard rock mines in the United States, found that nearly all of the mines that subsequently developed acid drainage

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[283] Id. at Vol. 1, 6-37.
[284] Id.
[285] Id. at Vol. 1, 6-36; The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 54.
[286] Id. at Vol. 1, 8-3.
[287] Id. at Vol. 1, 4-31.
[288] Jennings, supra note 276, at 4. Examples include the Zortman Landusky Mine in Montana, the Summitville Mine in Colorado, and the Brohm Mine in South Dakota.
[289] Id.
[290] EPA Assessment, Vol. 1, 8-13. As a corollary, EPA also adroitly points out that it is "too soon" to know whether mines that are permitted for perpetual water collection and treatment such as the Red Dog Mine in Alaska can successfully do so in perpetuity. Id. at Vol. 1, 6-41.
[291] Jennings, supra note 276, at 4.
[292] Among other factors, mitigation requires large amounts of data collection and must continue forever. This means mine structures are subject to extreme design, monitoring, maintenance, and repair requirements. See William A. Price, The Mitigation of Acid Rock Drainage: Four Case Studies from British Columbia 1, available at http://www.techtransfer.osmre.gov/nttmainsite/Library/proceed/sudbury2003/sudbury03/125.pdf.
[293] James R. Kuipers and Ann S. Maest, Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements, supra note 264, at ES-15.

underestimated or ignored the potential for acid drainage.[294] In addition, when the mine was near surface or ground water and there was a high potential for acid drainage – both true for the Pebble deposits – the surrounding water had an overwhelming likelihood of contamination.[295] The risk at the proposed Pebble Mine is additionally acute; as described in the Wardrop report, one of the proposed tailings storage areas is highly permeable and saturated. This means that the seepage cutoff walls and seepage capture ponds may not achieve full containment.[296]

Metal leaching is perhaps an even larger problem than acid rock drainage,[297] and increased metal concentrations in aquatic environments can negatively influence salmon and the resources on which they depend. Copper and other heavy metals can contaminate fish due to both direct exposure and to contamination of their food resources.[298] While copper is essential to living organisms, even a minute increase in copper availability or exposure can be highly toxic to salmon at extremely low levels. It can be acutely toxic at just a few parts per billion, and chronic effects can occur if fish are exposed to an increase of copper in the parts per trillion range.[299] A two to eight parts per billion increase of copper can negatively impact a salmon's olfactory sense, making it difficult for the fish to find mates or return to their spawning grounds.[300] Olfactory effects of even brief copper exposure reduces salmon ability to evade predators, and renders them significantly less likely to survive once attacked – with a disproportionate impact on copper-exposed salmon as compared to copper-exposed predators.[301] Exposure to elevated levels of copper can reduce salmon viability, increase susceptibility to infections, and increase mortality.[302] Effects from copper also include impaired brain functioning, difficulty breathing, and changes in blood chemistry and metabolism.[303] Indeed, the results of a recently published study add to the growing body of literature regarding the impacts of low levels of dissolved copper on salmon, which EPA should address in the Watershed Assessment.[304]

Environmental impacts can be expected in the Pebble area because, although the "relatively common" water treatment failures would be of "limited duration,"[305] the copper concentrations of the Pre-Tertiary waste rock so significantly surpass medial lethal concentration values that *even less than a day* of emissions of untreated leachate could kill fish. If improperly

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[294] Id. at ES-9.
[295] Id. at ES-12.
[296] William M. Riley & Thomas G. Yocum, Mining the Pebble Deposit: Issues of 404 Compliance and Unacceptable Environmental Impacts, 25 (hereinafter "Riley & Yocum, Mining the Pebble Deposit").
[297] Parker et al., supra note 268, at 16.
[298] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 114.
[299] Id. at 59.
[300] Zamzow, Acid Rock Drainage and Leaching at the Pebble Mine, supra note 275, at 1.
[301] Jenifer K. McIntyre et al., Low–level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators, supra note 253. In the absence of copper, the juvenile alarm response is to become motionless to avoid detection. Copper renders salmon unresponsive to chemical alarm cues, less aware of proximal danger, and therefore less prepared to avoid attack, or once attack is initiated, to successfully evade the predator.
[302] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 62.
[303] WSC, Bristol Bay's Wild Salmon Ecosystems and the Pebble Mine, supra note 160, at 51-60.
[304] Jenifer K. McIntyre et al., Low–level copper exposures increase visibility and vulnerability of juvenile coho salmon to cutthroat trout predators, supra note 253.
[305] EPA Assessment, Vol. 1, 6-38.

collected, this leachate could render the entire Upper Talarik Creek and a large mixing zone of Iliamna Lake toxic to fish and invertebrates.[306]

Several other metals present at the Pebble deposits can also be environmentally harmful, and are on EPA's list of priority pollutants, including antimony, arsenic, chromium, lead, nickel, selenium, and zinc.[307] Dissolved aluminum, for example, can precipitate and form mucus that clogs fish gills.[308] Yellow boy, formed when previously soluble iron precipitates as iron hydroxide,[309] causes oxygen removal, acidification, and depletion of the water's buffering capacity.[310] Some interactions among metals (like copper and zinc) can also produce synergistic and antagonistic effects, further damaging the ecosystem.[311] Because zinc is not present in sufficient quantity in the Pebble deposit to economically justify recovery,[312] "most of it would remain in the tailings and waste rock, accessible to leaching with residual copper."[313]

C. Mining in Bristol Bay Raises a Risk of Catastrophic Damage

Mining in Bristol Bay presents a real risk of catastrophic failure, and subsequent devastation. The Watershed Assessment – and the history books – are replete with examples of mines-turned-environmental calamities in ways that were unanticipated and beyond the predictions of engineering models or government permits. The unknowns surrounding the Pebble Mine are countless — and acute. Risks relating to the area's geology, the lack of human experience with tailings dams of the magnitude proposed for Pebble,[314] or with the long-term behavior of engineered storage systems,[315] for example, are hazards that simply cannot be justified or overlooked.

1. Failure of a Tailings Dam Would Irreversibly Devastate the Bristol Bay Environment

After ore is removed from a deposit, it is ground up and mixed with water and chemicals before the copper, gold, and other metals are separated out. The tailings are stored in perpetuity within large impoundments.[316] Because the Pebble deposits are low-grade (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.[317] PLP initially proposed to extract 2.5 billion tons of ore from the Pebble

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[306] Id. at Vol. 1, 6-39.
[307] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 58-59.
[308] Kendra Zamzow, Acid Rock Drainage and Metal Leaching at the Pebble Prospect, supra note 275.
[309] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 105.
[310] Id. at 105-106.
[311] David M. Chambers, Ph.D., P. Geop., Comments on an Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay Alaska, Center for Science in Public Participation (July 23, 2012) at 6 (hereinafter "Chambers, Assessment Comment Letter").
[312] EPA Assessment, Vol. 3, App. H, 14.
[313] Chambers, Assessment Comment Letter, supra note 311 at 8.
[314] EPA Assessment, Vol. 1, 4-11 (the vast majority of tailings dams are less than 100 feet).
[315] Id. at Vol. 1, ES-21 ("Engineered waste storage systems of mines have only been in existence for about 50 years. Their long-term behavior is not known…").
[316] Moran, Water-Related Impacts at the Pebble Mine, supra note 260.
[317] EPA Assessment, Vol. 1, ES-10.

deposits, which would require two tailings ponds with five total dams,[318] but later announced that the deposit contains nearly 11 billion tons of ore.[319] Since mines are commonly expanded *after* operations begin, it is probable that PLP will seek to extract much more than the initial 2.5 billion ton estimate from Pebble Mine – and more perhaps even than the latest, much larger estimate.[320] If fully mined, the Pebble deposit could process more than 10 billion tons of ore, making it the largest mine of its type in North America. Nonetheless, EPA cautiously estimated the maximum mine scenario at 6.5 billion tons.[321] Whatever the volume of ore mined, over 99% of it will be waste material to be stored in tailings facilities forever.[322]

Tailings management is often considered the "most significant environmental challenge associated with mining projects."[323] Tailings impoundment dams fail at about ten times the rate of water retention dams,[324] and the rate of failure has actually increased in recent years.[325] Many of the dams that fail are relatively young (5-20 years old), and have been built in the "modern age" of engineering.[326] Since the 1970s, tailings dam failures in the United States have caused a cumulative volume of 10 to 179 million gallons of spillage every year.[327] Yet under present federal and state regulatory practices, there is no existing funding for a dam failure cleanup. The bond required for mines does not cover a dam failure, and "funding to fix a dam after failure and for cleanup would need to be secured either through litigation of a responsible party, or through taxpayer support."[328]

EPA places the annual probability of failure at 1 in 1 million years for "state-of-the-art" mines, and 1 in 10,000 for standard mines. Multiple dams – a feature of both EPA scenarios and the Pebble Mine 2006 water rights application[329] – increase the probability to a recurrence frequency of 3,000 to 300,000 years.[330] Furthermore, two structural features specific to the proposed Pebble Mine, in addition to the area's geological features described below, could render failure significantly more likely. Analyses of tailings dam failure relative to dam height show that around 56% have occurred in dams over 15 m, with 22% of incidents in dams higher than 30 m.[331] The Pebble Mine proposal envisions three dams of *over 200 m* in height.[332]

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[318] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 3.
[319] Pebble Partnership, Updated Mineral Resource Estimate for Pebble Prospect at 1 (Feb. 1, 2010), available at http://www.pebblepartnership.com/sites/default/files/pub/PEB-0028%20press%20release%20feb%202010%20Resource%20update.pdf.
[320] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 120.
[321] EPA Assessment, Vol. 1, ES-11.
[322] David M. Chambers, Pebble Engineering Geology Discussion of Issues, supra note 81, at 11.
[323] T.E. Martin et al., Stewardship of Tailings Facilities, 20 Mining Minerals and Sustainable Development 2, 1 (April 2002), available at http://www.pebblescience.org/pdfs/tailings_stewardship-1.pdf.
[324] Michael P. Davies, Tailings Impoundment Failures: Are Geotechnical Engineers Listening?, Geotechnical News, 31, 32 (Sept. 2002), available at http://www.pebblescience.org/pdfs/Dam_failuresDavies2002.pdf.
[325] Id.
[326] Id.
[327] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 91.
[328] Chambers, Assessment Comment Letter, supra note 311, at 5.
[329] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 3.
[330] EPA Assessment, Vol. 1, 8-4.
[331] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 92.
[332] Id. The EPA model assumed three to eight dams, with a possibility of one or more reaching 208 m. EPA Assessment, Vol. 1, ES-15.

Second, very high impoundments and those that contain large volumes of water[333] – both required to mine the Pebble deposit – are particularly likely to fail if, also like Pebble, they are constructed upstream.[334] Moreover, even if a containment dam remains relatively stable, the facility can still fail from an environmental perspective; dams can generate significant amounts of dust and impact groundwater quality due to seepage.[335]

A breach of a tailings dam would unquestionably and irreversibly ravage the Bristol Bay environment through several waves of impacts. The initial flood wave and toxic run, moving at up to 6.1 m/s,[336] would obliterate biota in its path, overtaking and altering the channel and floodplain landscape.[337] The downstream area would be buried in meters of fine-grain sediment, leaving aquatic habitat and biota devastated.[338] Finally, a silt plume would smother benthic organisms, followed by long-term metal oxidization that would release acid and heavy metals.[339]

The EPA report analyzes the impacts of two tailings dam size failures at TSF 1 in which a conservative 20% of impounded tailings would be mobilized. The first scenario considers a partially full dam of 98 m and 227-million m^3 tailings volume, and the second (after approximately 25 years) at full volume of 208 m and tailings of 1,492 million m^3.[340] Immediately following a failure of either magnitude, suitable spawning and rearing habitat for salmon and other native fish would be completely eliminated in the North Fork Koktuli River downstream of the tailings dam.[341] A partial-volume failure would send discharge surging at a more than 1,000-fold increase in magnitude compared to a record flood; full volume failure would result in a 6,500-fold increase.[342] EPA conservatively estimates that partial dam failure runout would reach 30 km to the mainstem Koktuli River, and, at full volume, runout would extend 307 km to the currently pristine waters of Bristol Bay.[343] Suitable salmon habitat in the North Fork Koktuli mainstem would be completely lost for the first ten years after failure, followed by decades of very low-quality spawning and rearing habitat.[344] These projections reflect uncertainty only with respect to potential *underestimations* of downstream habitat impacts and true salmon abundance,[345] because the projections assume only a 20% failure. As discussed more fully in Section VI.D.4 below, these projections are overly cautious: if failure occurs it will likely release more than 20% of the tailings and runout distance will extend significantly farther. The failure scenarios are therefore conservative in that they consistently underestimate the maximum level of impact that could be expected in a worst-case failure scenario. As a result, the Assessment understates the impacts from a worst-case failure.

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[333] Id. at Vol. 1, 4-11.
[334] Davies, Tailings Impoundment Failures: Are Geotechnical Engineers Listening?, supra note 324, at 35.
[335] Martin, Stewardship of Tailings Facilities, supra note 323, at 9.
[336] EPA Assessment, Vol. 1, 6-11.
[337] Id.
[338] Id. at Vol. 1, 6-1, 6-2, 6-3, 6-29.
[339] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 90.
[340] EPA Assessment, Vol. 1, 4-39, 4-50.
[341] Id. at Vol. 1, 6-3.
[342] Id. at Vol. 1, 4-53.
[343] Id. at Vol. 1, 4-57.
[344] Id. at Vol. 1, 8-5.
[345] Id. at Vol. 1, 6-11.

Even understated, these impacts would be devastating. The damage from a dam failure would constitute "a near-complete loss" of the mainstem North Fork Koktuli fish populations for multiple salmon life cycles. It would affect even the salmon that are at sea during the failure, because they would lose spawning and rearing habitat to which to return.[346] Furthermore, tailings persist in streams as sources of metal exposures for decades, and even centuries, causing severe toxic effects and toxic dietary risks to organisms.[347] In fact, "the effects of tailings deposition in streams and floodplains persist for as long as they have been monitored at analogous sites."[348] Dilution of toxicity would take an especially long time in Bristol Bay because the relatively undisturbed nature of the watershed means that background levels of total suspended solids are low.[349] And remediation raises its own set of concerns. Despite net benefits, it would create long-term impacts on aquatic habitat, particularly because new roads would be required to transport equipment and tailings through the currently roadless Bristol Bay environment.[350]

2. Location-Specific Risk Factors Increase the Likelihood of a Pebble Mine Structure Failure

Dam failures can be triggered by such events as high rains, hurricanes, rapid snow melt or ice accumulation.[351] Impoundments are also susceptible to erosion and landslides,[352] and – in the Pebble area in particular – permafrost and earthquakes. First, the proposed dams would lie within a zone of sporadic permafrost.[353] Permafrost can cause underground movement, which may pose major problems for tailings impoundments.[354]

Second, dams in the Pebble area would face a particularly serious threat from earthquakes. The proposed Pebble Mine is located 125 miles from the Alaska Aleutian megathrust,[355] which has been responsible for several of the largest earthquakes ever recorded, including the 1964 Prince William Sound earthquake (magnitude 9.2) and the Aleutian earthquake (magnitude 9.1). Earthquakes can have far reaching impacts: in 2002, the 7.9 Denali earthquake ruptured surfaces over 200 miles away, and caused shocks 2,000 miles away.[356] Seismic mapping of the Pebble area is incomplete, and there is evidence that the nearest fault may be from only sixteen[357] to less than five miles from the mine.[358] The proposed Pebble Mine

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[346] Id. at Vol. 1, 6-8.
[347] Id. at Vol. 1, 6-22, 6-25.
[348] Id. at Vol. 1, 6-29.
[349] Id. at Vol. 1, 6-25.
[350] Id. at Vol. 1, 6-29.
[351] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 91; EPA Assessment, Vol. 1, 4-40.
[352] Moran, Water-Related Impacts at the Pebble Mine, supra note 260.
[353] Northern Dynasty Mines Inc., Tailings Impoundment A Initial Application Report, 13; Northern Dynasty Mines Inc., Tailings Impoundment G Initial Application Report, 9, available at http://dnr.alaska.gov/mlw/mining/largemine/pebble/water-right-apps/index.cfm.
[354] Earle A. Ripley, Robert E. Redman, & Adele A Crowder, Environmental Effects of Mining 65 (1996).
[355] Northern Dynasty Mines Inc., Tailings Impoundment A Initial Application Report, supra note 353, at 5-7.
[356] Bretwood Higman, Seismic Risk at the Pebble Mine, Pebble Science, available at http://pebblescience.org/pebble_mine/seismic_risk.html.
[357] EPA Assessment, Vol. 1, Box 4-3.
[358] Higman, Seismic Risk at the Pebble Mine, supra note 356, at 2.

tailings facilities were designed in 2006 to withstand a 7.8 earthquake 18 miles from the fault.[359] The energy from a "floating earthquake" of the same magnitude at 5 km under the site would be significantly greater,[360] and if an earthquake occurred five miles away, the force at the mine site would be three times greater than the structures were intended to support.[361]

Earthquakes can cause dam failures via several mechanisms. Outright dam collapse due to shaking or dam overflow from a landslide can occur.[362] Earthquakes can also cause static liquefaction, a process by which soil loses its strength and is rendered fluid-like, seriously damaging or causing the collapse of structures built upon it.[363] Earthquakes can also cause subsidence near underground mine workings,[364] risking collapse or leakage. And the cumulative effects of smaller earthquakes can lead to problems over time.[365]

D. EPA's Deliberately Conservative Assessment Underestimates or Excludes Additional Larger Impacts of Mining to the Ecology of the Region

EPA has presented a judiciously conservative assessment that underestimates the environmental impacts associated with mining the Pebble deposit. Limiting its analysis to direct effects on salmon and salmon-mediated impacts, with a clear delineation of inevitable and possible harm, EPA's analysis starkly reveals that even a best-case mining scenario would trigger unacceptable impacts on the Bristol Bay environment. And yet, this conservative analysis omits or understates much of the *most severe harm* that a mine would cause.

1. The Proposed Port Presents a Significant Threat to Endangered Cook Inlet Beluga Whales

In addition to the pit, block caving, and tailings storage facilities, a Pebble Mine would require a range of other structures that will disrupt the natural environment of Bristol Bay. The proposed Pebble Mine and EPA mine scenarios call for construction of a port in Cook Inlet's Iniskin Bay – which would devastate a distinct stock of a highly endangered and geographically isolated species of beluga whales living in Cook Inlet.[366] PLP has proposed to build a permanent deepwater port at Iniskin Bay to serve as a product load-out facility and to facilitate in-bound fuel, equipment, and supply shipments.[367] According to the 2011 Wardrop report, the port facility would be designed to accommodate shipping of at least 1.1 million tons of concentrate

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[359] Northern Dynasty Mines Inc., Tailings Impoundment A Initial Application Report, supra note 353, at 6, Table 3.2.
[360] Chambers, Assessment Comment Letter, supra note 311, at 5.
[361] Higman, Seismic Risk at the Pebble Mine, supra note 356, at 2.
[362] Id.
[363] Institute of Professional Engineers of New Zealand, Liquefaction 1 (March 2011), available at www.ipenz.org.nz/ipenz/forms/pdfs/ChChFactSheets-Liquefaction.pdf. Although the process is not well understood, static liquefaction can occur even in the absence of seismic activity, and these failures may be even more common than those induced by earthquakes. Davies, Davies, Tailings Impoundment Failures: Are Geotechnical Engineers Listening?, supra note 324, at 32-33.
[364] Higman, Seismic Risk at the Pebble Mine, supra note 356.
[365] Hauser, Potential Impacts, supra note 78, at 15.
[366] *See* Beluga Whale (Delphinapterus leucas), NOAA Fisheries Office of Protected Resources, available at http://www.nmfs.noaa.gov/pr/species/mammals/cetaceans/belugawhale.htm.
[367] Wardrop, Preliminary Assessment, supra note 61, at 58.

per year in 28 vessels, as well as 50 million gallons of fuel and 31 container barges per year.[368] Energy requirements for the proposed Pebble Mine would be met with a 378-megawatt natural gas-fired turbine at the mine site, as well as an 8-megawatt natural gas-fired generation plant at the port site.[369] PLP plans to transport liquefied natural gas from the Kenai Peninsula and across Cook Inlet to the port site via a 60-mile sea-bottom pipeline, and then to the mine site via a 104-mile pipeline buried along a road corridor. A 104-mile road corridor (consisting of 86 miles of new road and 18 miles of existing road) would be constructed to connect the mine site to the port.[370] Four pipelines would be constructed between the mine site and the port to transport slurry, diesel fuel, and natural gas.[371] The road and pipelines alone are estimated to disturb approximately 12.5 square miles.[372]

The Cook Inlet beluga whale is the smallest population of beluga whales currently recognized in Alaska and is a genetically distinct and geographically isolated population that lives only in Cook Inlet.[373] In recent years, the population has plummeted from approximately 1,300 to 284 whales.[374] The National Marine Fisheries Service ("NMFS") predicts that beluga whales have a 26% chance of extinction within 100 years and a 70% chance of extinction within 300 years.[375] If the current population of beluga whales disappears, it is "highly unlikely" that other belugas would repopulate Cook Inlet.[376]

NMFS has taken various actions over the past decade in an attempt to halt the decline, but the effort has not been successful. NMFS listed Cook Inlet beluga whales as endangered under the Endangered Species Act in 2008 and designated critical habitat in 2011.[377] NMFS designated more than 3,000 square nautical miles of Cook Inlet "critical" to the species' survival, including much of Iniskin Bay.[378] Despite these protections, however, the belugas' numbers have continued to decline. The 2011 stock assessment found a 20 percent decline since 2010 alone.

Pebble Mine would threaten the whales in several ways. First, the dredging necessary to create the port in Cook Inlet has the potential to re-suspend contaminants in the water; and dredging elsewhere has "seriously impacted" other populations of belugas.[379] Second, the port will cause higher traffic in the area, leading to increased water pollution and contaminants, vessel traffic, and noise. In addition to the increased risk to belugas of ship strikes associated with significantly increased vessel traffic, the noise generated by this increase – resulting both from engine noise and cavitation around the propeller – is a particular threat.

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[368] Id.
[369] Id. at 12, 58.
[370] Id. at 59.
[371] Id.
[372] Hauser, Potential Impacts, supra note 78, at 12.
[373] 76 Fed. Reg. 20180, 20181 (Apr. 11, 2011).
[374] NOAA Fisheries News Release, NOAA's Annual Survey of Cook Inlet Belugas Finds Population at Second-Lowest Level (January 9, 2012), available at http://www.fakr.noaa.gov/newsreleases/2012/cibelugas010912.htm.
[375] National Marine Fisheries Service, Conservation Plan for the Cook Inlet beluga whale (Delphinapterus leucas) 1 (2008), available at http://www.nmfs.noaa.gov/pr/pdfs/species/belugawhale_conservationplan.pdf (hereinafter "National Marine Fisheries Service Conservation Plan").
[376] Id at 10.
[377] 73 Fed. Reg. 62927 (Oct. 22, 2008); 76 Fed. Reg. 20180 (Apr. 11, 2011).
[378] 76 Fed. Reg. 20180.
[379] National Marine Fisheries Service, Conservation Plan, supra note 375, at 55.

Like all marine mammals, Cook Inlet beluga whales depend on sound for vital life functions – such as to navigate, find food, locate mates, avoid predators, and communicate with one another. Artificial man-made noise introduced into their environment can disturb beluga whales and interfere with these important biological behaviors. NMFS has found that anthropogenic noise may impact the survival – and recovery – of the species.[380] For example, beluga whales have been observed reacting to ice breaking ships at distances of over 80 km, the effects of which have lasted more than two days following the event.[381] The inevitable increase in both ambient noise and acute exposure to noise associated with port construction and operation associated with the proposed Pebble Mine would pose a serious risk to this already endangered population.[382]

The risk from noise will only increase as ports expand, ship traffic increases, and development moves into previously undisturbed sites in Cook Inlet, including Iniskin Bay, the proposed Knik Arm Bridge and the Port of Anchorage Redevelopment Project. For a small, geographically isolated population of cetaceans, any limitations on range could endanger the animals' recovery. As NMFS correctly observed, "[d]estruction and modification of habitat may result in 'effective mortalities' by reducing carrying capacity of fitness for individual whales, with the same consequence to the population survival as direct mortalities."[383] This risk is further exacerbated by other development activities in Cook Inlet, including oil and gas exploration, coastal development, construction, toxic contaminants, noise disturbance, military operations, competition with fisheries for prey, habitat modifications, waste discharges, urban runoff and climate change. The cumulative impact of these activities on Cook Inlet beluga whales is significant – and potentially deadly.

2. The Secondary Impacts Associated with Mining the Pebble Deposits are Likely Even Greater than the Direct Environmental Harms

The impacts discussed in EPA's Watershed Assessment relate directly to a large-scale mine in the Pebble area. However, if the Pebble Mine – or any mine – is built in the Bristol Bay watershed, it would inevitably attract additional mining and industrial development and, in turn, even larger impacts to the region. Though EPA purposefully did not incorporate secondary development effects into its Assessment,[384] it acknowledged that new infrastructure would facilitate "ancillary development of the landscape, change in the pattern of human habitation, resource extraction, [and] land and water use," *and that these are likely the most significant* of

[380] 73 Fed. Reg. 63919, 62922 (Oct. 22, 2008) ("noise…may have some impact on this population…"); 74 Fed. Reg. 63080, 63087 (Dec. 2, 2009) ("Anthropogenic noise above ambient levels may cause behavioral reactions in whales (harassment) or mask communication between these animals…[noise] would be expected to have consequences to this DPS in terms of survival and recovery."); NMFS, Conservation Plan at 5 ("This Conservation Plan reviews and assesses the known and possible threats influencing Cook Inlet beluga whales…Potential human impacts include subsistence harvest, poaching, fishing, pollution, *vessel traffic*, tourism and whale watching, coastal development, *noise*, oil and gas activities, and scientific research.") (emphasis added).
[381] Id. at 58-59.
[382] Id. at 58.
[383] 72 Fed. Reg. 19854, 19858 (Apr. 20, 2007).
[384] EPA Assessment, Vol. 1, 7-15.

impacts for Bristol Bay.[385] The environmental impact of ensuing development "can dwarf by orders of magnitude" the direct local effects of the initial infrastructure.[386]

First, it is fairly standard practice for the mining industry to secure a permit for a smaller mine and then later request permits for expansion.[387] NDM's original plan was to extract 2.5 billion tons of ore, but PLP announced in 2010 that the Pebble deposit contains almost 11 billion tons of mineral resources.[388] It is therefore reasonably foreseeable, and indeed virtually inevitable, that the mine will expand far beyond the initial 2.5 billion tons. EPA estimates a minimum of 2 billion tons and maximum of 6.5 billion tons, which is also significantly smaller than the total resource estimate.[389] Next, once the mine is built – introducing critical infrastructure for development – it will open the region for industrial scale mining even beyond Pebble.[390] In evaluating environmental impacts, the development of a new road is "often only the first step toward industrial or commercial development of the landscape in general, including the proliferation of additional roads."[391] The initial infrastructure facilitates and "subsidizes" additional large-scale development, most notably when the initial road connects to a possible trade hub, such as a deepwater port. [392]

It is no secret that interest in Bristol Bay industrialization extends beyond the Pebble Mine. The Wardrop report describes several "high priority" exploration targets outside the Pebble deposit.[393] Each additional facility would increase the likelihood of collection and treatment failures and, as a result, the frequency of untreated leachate discharges and incremental impact on the Nushagak and Kvichak watersheds[394] – and the chance of long-term adverse downstream effects.[395]

Furthermore, the Bristol Bay Area Plan lays out a network of roads and highways in the Bristol Bay region, including "regional transportation corridors" that would connect Cook Inlet to the area of the Pebble prospect, as well as King Salmon, Naknek, Egegik, and Port Heiden, and to Chignik and Perryville on the southern Alaska Peninsula. This is in addition to the Plan's "community transportation projects," which would create extensions, improvements, or new roads within or adjacent to the Bristol Bay watershed (Chigniks Road Intertie, King Cove-Cold Bay Connection, Newhalen River Bridge, Iliamna-Nondalton Road Intertie, and Naknek-South Naknek Bridge and Intertie), and three potential trans-peninsula transportation corridors.[396] Longer roads and pipelines, and the corresponding increase in aquatic area crossings, would increase the probability of each of the mine risks described above, such as culvert failures and pipeline breaks, further damaging the aquatic systems.[397]

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[385] Id. at Vol. 3, App. G at 9.
[386] Id. at Vol. 3, App. G at 5-6 (emphasis added).
[387] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 120-21.
[388] Pebble Partnership, Updated Mineral Resource Estimate for Pebble Prospect, supra note 319, at 1.
[389] EPA Assessment, Vol.1, ES-11.
[390] Hauser, Potential Impacts, supra note 78, at 16.
[391] EPA Assessment, Vol. 3, App. G at 5-6.
[392] Id.
[393] Id. at Vol. 1, 7-3.
[394] Id. at Vol. 1, 7-16.
[395] Id. at Vol. 1, 4-17.
[396] Id. at Vol. 3, App. G at 6.
[397] Id. at Vol. 1, 7-16.

A final impact that the Assessment excludes, but which is "likely to be more significant" than the analyzed salmon-mediated effects, are the mine's impacts on Alaska Native cultures.[398] Dramatic impacts on the traditional culture will result from a shift to a market economy, as well as increased access to the area.[399]

3. The Impacts of Climate Change Will Increase the Risks Associated with Mining in Bristol Bay

EPA's Assessment of the potential environmental impacts of mining in Bristol Bay excludes consideration of the added uncertainty and risk associated with future climate change. This is a significant omission. The data reveal that climate change in the region is a large concern, as substantial changes in temperature have taken place over the last 50 years. Annual average temperatures have increased by 3-5°F, and winter temperatures by 6-9°F.[400] Scientific modeling predicts an increase in frost-free days throughout south-central and south-east Alaska over the next century.[401]

Though predictions of the impacts of climate change on the Bristol Bay watershed are inevitably imprecise, models of a watershed to the east of Bristol Bay anticipate sizeable change by the year 2090. These include dramatic increases in average annual evapotranspiration, decreases in snow pack, 43-640% increases in winter streamflows, and 7-73% reductions in summer streamflow.[402]

As detailed below, failure to consider the effects of climate change in the Bristol Bay watershed underestimates the risk of mining in three areas: (1) the stability of tailings impoundments and other infrastructure, (2) potential flows of contaminants away from the mining site during both catastrophic and non-catastrophic releases, and (3) the stressing and forcing of change on surface and ground water – and resulting effects on ecosystems.

Without an evaluation of the effects of regional climate change on these and all aspects of long-term mining development, the Assessment underestimates the full extent of potential risk. For example, changes in evapotranspiration, precipitation, and runoff will modify plant cover, erosion, flow regimes, flooding and sediment transport. This will in turn affect ecosystem function and carrying capacity. Changes in freshwater delivery, nutrients and sediments may also have profound effects on Bristol Bay itself.[403] These long-term increased risks are important to consider since, once constructed, a mine would exist — and need to withstand the demands of a changing climate — for centuries.

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[398] Id. at Vol. 1, 5-74.
[399] Id.
[400] Johnnie N. Moore, Ph.D., Assessment of Report EPA 910-R-12-004a (July 20, 2012) at 6-7.
[401] Id. at 7.
[402] Id.
[403] Id.

4. Potential Effects of a Tailings Dam Failure Are Significantly Greater than EPA Estimates

As an initial matter, EPA underestimates the amount of tailings. The Assessment uses a 6.5 billion ton maximum mine scenario, which is considerably smaller than the over 10 billion ton resource estimate described in the 2011 Wardrop report.[404] In addition, EPA has based its analysis of tailings dam failure risk on four assumptions, each of which leads to significant underestimations of the effects that a failure would have on the Bristol Bay environment. As described in detail in the comments prepared by Professor Johnnie N. Moore, Ph.D., the Watershed Assessment underestimates the amount of tailings potentially released during failure, the run-out distance of these tailings, their immediate and long-term physical and geochemical effects, the duration of toxicity, and impacts associated with climate change.[405]

First, the Watershed Assessment evaluates two failure scenarios, a "partial-volume failure" (227 million m^3 tailings volume) and "full-volume failure" (1489 million m^3 tailings volume), based on an assumption that a maximum of 20% of total volume of tailings would be released from the impoundment. The seminal study of the relationship between total amount of tailings stored and the amount released, however, predicts, based on a strong regression relationship, a much higher value of 38%.[406] EPA acknowledged that the 20% figure is low ("[b]ased on historical tailings dam failure data, it is reasonable to assume … from 30 to 66% of the impoundment tailings material could contribute to debris flow…"[407]), but – consistent with its overarching conservative approach to this Assessment – chose a value "less than measured historical release volumes."[408] As Moore explains, 20% is an arbitrarily low value, more typical of much smaller tailings impoundments, and does not accurately reflect the likely effects of a tailings dam failure at Bristol Bay.[409]

Next, run-out from a tailings dam failure in the Pebble area would extend much farther than EPA assumptions predict. EPA conservatively estimates that partial dam failure run-out would reach 30 km to the mainstem Koktuli River, and tailings from a full volume failure would extend 307 km to the waters of Bristol Bay.[410] But again, calculations drawn from a leading study of historical impoundment failure data suggest significantly larger run-out distances of 150-300 km for EPA's partial failure scenario, and from 450-1000 km at full volume – still *assuming only a 20% tailings release*. When the more likely 38% rate is analyzed, run-out jumps to 460 km and 1800 km for partial and full releases, respectively.[411] Under any of these

[404] Id. EPA Assessment Vol. 1, 4-15, Table 4-13.
[405] Moore, Assessment of Report EPA 910-R-12-004a, supra note 400, at 2-7.
[406] Id. at 3.
[407] EPA Assessment, Vol. 1, at 4-57, Box 4-9.
[408] Id.
[409] Moore Assessment of Report EPA 910-R-12-004a, supra note 400, at 3.
[410] EPA Assessment, Vol. 1, 4-57. The partial dam 30 km run-out represents a modeling limitation, not a true assessment of the potential reach of the tailings ("We did not extend the analysis beyond the 30-km reach of the North Fork Koktuli River near its confluence with the South Fork Koktuli River"). EPA's report also uses a value of 35 km, but this appears to be a typographical error. Id. at Vol. 1, 4-57.
[411] Moore, Assessment of Report EPA 910-R-12-004a, supra note 400, at 4.

scenarios, "a spill would likely deposit a large amount of contaminated material into Bristol Bay as well as in the floodplain along all streams leading from the tailings site to Bristol Bay."[412]

A scientific study specific to the proposed Pebble Mine is consistent with Moore's analysis, finding that a failure of a tailings dam could lead to the release of billions of tons of mine waste and hundreds of billions of gallons of contaminated water.[413] Depending on which dam failed, even a modest "lower than expected" failure could have "extraordinary" run-out distances, and reach 270 km to Bristol Bay itself.[414] This run-out distance is an estimate based only on the original 2.5 billion tons mining proposal – an amount much less than the mine may actually produce.[415]

Third, although EPA recognizes in its Watershed Assessment that an impoundment failure would deposit large amounts of material on the floodplain, it does not estimate the likely aerial coverage and thickness that would result from such an event – or calculate the duration of toxicity. Based on a review of the literature and historical impoundment failures, it is likely that a tailings dam release "would lead to complete burial of extensive areas of the immediate floodplain between the tailings and Bristol Bay."[416] Deposition of sediment can alter fundamental biological and physical processes and river function, and tailings are especially damaging because they are enriched in toxic reactive metals.[417] Furthermore, these metal-rich wastes can remain for hundreds to thousands of years, "pos[ing] a continuing hazard to human and ecosystem health."[418]

Finally, climate change should be an important consideration in assessing the stability of tailings structure and other infrastructure, as well as transport flow of contaminants in the event of a release.[419] Hydraulic modeling in a watershed to the east of Bristol Bay predicts substantial change to runoff. South-central Alaska has been designated as a region of disproportionate changes in "heavy" and "very heavy" precipitation, and annual average temperatures in the region are also on the rise.[420] The potential impacts that these changes could have on mine structure and rates of failure were not, however, included in EPA's Assessment – and represent yet another example of EPA's conservative underestimation of the risks associated with mining in Bristol Bay.

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[412] Id.
[413] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 90.
[414] Id. at 95.
[415] Id. at 99.
[416] Moore, Assessment of Report EPA 910-R-12-004a, supra note 400, at 5.
[417] Id. at 5.
[418] Id. at 6.
[419] Id. at 7.
[420] Id.

E. Likely Mining Consequences Not Addressed in the EPA Assessment Would Produce Additional Adverse Impacts

1. Subsidence Caused by the Block Caving Will Change Water Flow and Decrease Fishery Productivity

Precise details of the Pebble Mine design have not yet been disclosed, but block caving has been proposed for the Pebble East deposit.[421] Though sometimes thought to be less environmentally damaging than open pit mining, large-scale underground mining can cause "catastrophic" impacts to overlying material and cause wide-ranging ecosystem effects.[422]

Underground mining operations are particularly prone to subsidence. Under EPA's analysis, a block caving method in the Pebble east side deposit would initially occupy a smaller surface area than the maximum mine site, but subsidence would ultimately increase the footprint.[423] In block caving, subsidence and collapse are encouraged: a series of tunnels are dug under a deposit, forcing the collapse of overlying substrate.[424] As ore falls and is subsequently removed, the material in higher levels will crack, which can lead to large surface subsidence.[425] Most hard-rock deposits contain faults and intrusions, hydrothermal alteration of rocks, and many clays and clay-like minerals, all of which reduce rock strength and make subsidence more likely.[426] Finally, water is removed from mine sites in order to facilitate the mining process — further weakening the surrounding area.[427]

Subsidence can have large impacts on surface and ground water[428] and can cause them both to be redirected.[429] The overlying strata is fractured – often to the surface – allowing contact between water and the mineralized material not removed by mining.[430] Subsidence also leads to increased acid production and transportation from the mine.[431] Both the redirection of water flow and the increase of acid can have large impacts on local fisheries.

It is unlikely that subsidence can be mitigated. Mining companies have not managed to successfully reclaim or re-vegetate subsidence areas surrounding a block cave mine, and one researcher concluded that "[n]o evidence was found that subsidence effects at underground hardrock mines using block caving can be managed or mitigated short of not mining."[432] Subsidence is therefore an issue that should be included in the final Watershed Assessment.

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[421] Chambers, Block Caving at the Pebble Mine, supra note 73.
[422] Blodgett & Kuipers, Underground Hard-Rock Mining, supra note 73, at 9.
[423] EPA Assessment, Vol. 1, 4-19.
[424] Blodgett & Kuipers, Underground Hard-Rock Mining, supra note 73, at 5.
[425] Chambers, Block Caving at the Pebble Mine, supra note 73.
[426] Blodgett & Kuipers, Underground Hard-Rock Mining, supra note 73, at 23.
[427] Id.
[428] Id. at 10.
[429] Id. at 12.
[430] Chambers, Assessment Comment Letter, supra note 311, at 7.
[431] Chambers, Block Caving at the Pebble Mine, supra note 73.
[432] Steve Blodgett, Subsidence Impacts, supra note 74, at i.

2. Fugitive Dust Generated by the Mine Will Degrade Aquatic Habitats, Damaging Fisheries

The proposed Pebble Mine would negatively impact the ecology of the region through the generation of fugitive dust. Fugitive dust can be blown from many mine surfaces, including the mine itself, access roads, and tailings ponds, and can also be generated by moving and storing mine materials.[433] One study predicted "conservatively" that fugitive dust would impact over 33 square miles surrounding the mine, but commented that the effects could be much wider.[434] Within the area impacted by the mine are 33 miles of ephemeral, intermittent, and perennial streams, including ten miles of anadromous waters designated by the Alaska Department of Fish and Game.[435] Over the life of the mine, this area would be "significantly degraded," and the dust would impact both streams and vegetation.[436] Impacts caused by fugitive dust can be long-lasting, and ecosystems may be slow to recover.[437]

When fugitive dust is generated, it covers surrounding vegetation, causing increased mortality in plants. This can result in devegetation of large areas surrounding the mine, including areas that support salmon.[438] When vegetation is lost, surface runoff increases, which in turn leads to increased stream turbidity and sedimentation. Fugitive dust can also settle in water and smother both salmon eggs and organisms that serve as food for salmon.[439] Furthermore, fugitive dust can transport heavy metals into the surrounding water, air, and soil. This can be especially problematic in an area that is also exposed to acid mine drainage — which increases the bioavailability of copper[440] and harms sensitive salmon.

As the mine ages, copper from fugitive dust could affect benthic invertebrates, including mayflies, caddis flies, and stoneflies.[441] Such impacts to these populations would be "crucial" and most likely "long term."[442] These species are important food resources for salmon and other fish, so declines in these populations will negatively impact salmon species. Furthermore, copper could accumulate to concentrations that would cause acute or chronic effects in salmon directly.[443] As one study found: "a certainty exists that, even with mitigation measures employed at the mine, copper and other metals will likely be mobilized in runoff or leached into the surface and/or groundwater" over the life of the mine.[444] Given the potential impacts of fugitive dust, the final Assessment should address this issue.

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[433] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 49-50.
[434] Id. at 53.
[435] Id.
[436] Id.
[437] Id. at 66.
[438] Id. at 50.
[439] Hauser, Potential Impacts, supra note 78, at 1.
[440] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 78.
[441] Id. at 73.
[442] Id. at 53.
[443] Id. at 110.
[444] Id. at 84.

VII. EPA ACTED WITHIN ITS AUTHORITY TO ISSUE THE WATERSHED ASSESSMENT AND MAY USE ITS FINDINGS TO INITIATE 404(C) PROCEEDINGS

A. EPA's Section 104 Authority to Prepare and Publish Reports on Water Pollution Has Never Been Challenged and Is Clearly Supported By Legislative History

Section 104 of the Clean Water Act authorizes the EPA Administrator, in broad terms, to use the tools of research and investigation to prevent, reduce and eliminate pollution of the nation's waters. Among the specific actions authorized, the Administrator may conduct "research, investigations. . . surveys, and studies related to the causes, effects, extent, prevention, reduction, and elimination of pollution."[445] The Administrator is also authorized to "collect and make available, through publications and other appropriate means, the results of and other information, including appropriate recommendations by him in connection therewith," pertaining to the agency's investigations, surveys, and studies.[446] This broad investigative power is an essential corollary to EPA's section 404(c) authority. It enables the Agency to collect relevant data and disseminate its findings, so that any section 404(c) action is grounded in science and the public interest.

The Bristol Bay Watershed Assessment clearly falls within the type of "investigations" and "studies" contemplated by the statute. During House Debates on the Clean Water Act Amendments of 1972, one of the bill's architects, Rep. John Blatnik, stated that section 104's purpose, in combination with other subsections, is to "[i]ncrease the level of research, [e]liminate chance, [p]rovide the basis for calculation," and help agencies "proceed in an informed and responsible manner."[447] During the same debates, the Chairman of the Senate Public Works Committee affirmed that section 104 was intended, among other things, to authorize studies that "consider the effects of exploitation of mineral resources and fossil fuels" on water ecosystems, including fishing, recreation, and "other beneficial purposes."[448] The Watershed Assessment is thus the type of scientific document intended by the bill's authors. It presents a factual and scientific analysis of the watershed that investigates the causes and effects of mining. The Assessment has no regulatory force, but is used to enable "informed and responsible" agency decision-making.

In the past, EPA has not cited its section 104 authority when preparing and issuing scientific assessments, perhaps because this authority has been considered so uncontroversial. However the agency has, without challenge, published several documents similar to the Watershed Assessment. For example:

- In 2002, EPA published an "ecological risk assessment" regarding the environmental impacts of human activities in the Waquoit Bay watershed in Massachusetts.[449]

[445] 33 U.S.C. § 1254(a)(1).
[446] 33 U.S.C. § 1254(b)(1).
[447] House Debate on H.R. 11896 Before The Committee of the Whole House, 92nd Cong. 355 (1972) (Statement of John Blatnik, Chair of the House Committee on Public Works).
[448] Id. at 572.
[449] U.S. EPA, Waquoit Bay Watershed Ecological Risk Assessment: The effect of land-derived nitrogen loads

- In 2008, the agency published a report predicting the future introduction and spread of non-indigenous species in the Great Lakes,[450] conducting a comprehensive scientific assessment of an area covering roughly 94,000 square miles.[451] Critics of the Watershed Assessment have argued that EPA could not possibly have thoroughly surveyed the Bristol Bay watershed, an area roughly 24,000 square miles, however EPA has already successfully conducted a similar assessment of an area more than three times the size.

- In 2009, the agency published a report on the effect of mountaintop mining and valley fills on the aquatic ecosystems of Central Appalachia.[452] While the conclusions of the report were challenged by coal industry supporters, a random sample of roughly 100 comments – of the nearly 800 comments submitted critical of the report – found none contesting EPA's authority to prepare and issue the report.

EPA's Bristol Bay Watershed Assessment is clearly authorized by section 104 of the Clean Water Act, as evidenced by the statutory language and the record of congressional intent. When EPA has issued similar reports in the past, it has done so without controversy regarding its statutory authority. By citing to section 104 now, EPA has simply identified the explicit congressional authority on which its action is based – authority that the agency has for decades used to issue scientific assessments and on which it properly relies here.

B. Objections to EPA's Watershed Assessment Process Are Unfounded

1. Data Quality Act

Northern Dynasty Minerals has suggested that EPA's Assessment has been undertaken in violation of the Data Quality Act.[453] What argument they intend to offer in support of this claim is unclear as none is available.

The Data Quality Act ("DQA"), better known as the Information Quality Act ("IQA"), is a short and simple piece of legislation with no legislative history that merely provides "policy and procedural guidance to Federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information."[454] Notably – and conclusively – it creates no

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on estuarine eutrophication. National Center for Environmental Assessment, Washington, DC; EPA/600/R-02/079 (Oct. 2002), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=15221.

[450] U.S. EPA, Predicting Future Introductions of Nonindigenous Species to the Great Lakes. National Center for Environmental Assessment, Washington, D.C.; EPA/600/R-08/066F (Nov. 2008), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=190305.

[451] "Great Lakes Fact Sheet,"available at http://www.epa.gov/glnpo/factsheet.html.

[452] U.S. EPA. The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields. Office of Research and Development, National Center for Environmental Assessment, Washington, DC. EPA/600/R-09/138A (December 2009), available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=215267.

[453] Northern Dynasty Comments at Public Hearings on EPA's Draft Bristol Bay Watershed Assessment Report (May 31, 2012), available at http://www.northerndynastyminerals.com/.

[454] Consolidated Appropriations Act of 2001, Pub. L. No. 106-554, § 515(a) (2000) (published at 44 U.S.C. § 3516 note).

private right of action.[455] Instead, it tasks the *agency* with developing an administrative mechanism for dealing with information quality challenges. Any dispute as to the quality of the information in the EPA Assessment would therefore need to follow the administrative mechanisms created by EPA to receive and address such challenges.[456]

The only threshold requirement that EPA must (and unquestionably did) meet in releasing the Watershed Assessment is to satisfy the three "quality" criteria of objectivity, utility, and integrity of the information.[457] First, a presumption of objectivity exists for information subject to peer-review[458] – a process that the draft Assessment will undergo in just a couple of weeks.[459] Second, the Assessment will be "useful" in determining the form of future management and development within the Bristol Bay watershed,[460] thereby satisfying the utility requirement.[461] Finally, EPA has protected the "integrity" of the Assessment because it has prevented the unauthorized alteration and destruction of the information contained therein,[462] and thus the final "quality" criteria has been satisfied.

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[455] Family Farm Alliance v. Salazar, 749 F.Supp.2d 1083, 1090 (E.D.Cal. 2010); Salt Inst. v. Thompson, 345 F.Supp.2d 589, 601 (E.D.Va. 2004), aff'd sub nom. on alternate grounds, Salt Inst. v. Leavitt, 440 F.3d 156 (4th Cir. 2006). The disclaimer in the EPA Guidelines also reminds readers that the guidelines "provide non-binding policy and procedural guidance, and are therefore not intended to create legal rights, impose legally binding requirements or obligations on EPA or the public when applied in particular situations." U.S. EPA, EPA/260-02-008, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity, of Information Disseminated by the Environmental Protection Agency ("EPA Guidelines") (2002).

[456] Consolidated Appropriations Act § 515(b)(2); Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, 67 Fed. Reg. 8458 (February 22, 2002); see Family Farm Alliance, 749 F.Supp.2d at 1089. According to the EPA Guidelines, an affected person should first contact the EPA informally to resolve any questions about information quality before submitting a formal Request for Correction ("RFC") to the agency. EPA Guidelines. If the requestor is dissatisfied with EPA's response to the RFC, then she can submit a Request for Reconsideration ("RFR"). Id.

[457] 67 Fed. Reg. at 8459 ("'Quality' is an encompassing term comprising utility, objectivity, and integrity. Therefore, the guidelines sometimes refer to these four statutory terms, collectively, as 'quality.'").

[458] Id.

[459] See An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska—Peer Review Panel Members and Charge Questions, 77 Fed. Reg. 33213 (June 5, 2012). Even in the absence of this presumption of objectivity for peer-reviewed information, the Assessment satisfies the two-pronged "objectivity" test because (1) the draft publication is available to the public, (including being subject to the technical peer review process), which ensures that the information is both transparent and reproducible; and (2) the Assessment is based on accurate, reliable, and unbiased information, derived from sound statistical and research methods. See 67 Fed. Reg. 8459; U.S. EPA, EPA 910-R-12-004a-c, An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska (2012).

[460] See Press Release, U.S. EPA, EPA Releases for Public Comment Draft Scientific Study of Bristol Bay Watershed (May 18, 2012), available at http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/6979fe30fc6583f385257a020061b472!OpenDocument ("The assessment, when finalized following the important public comment and independent peer review, could help inform future decisions on any large-scale mining in Bristol Bay by both federal and non-federal decision-makers.").

[461] The OMB Guidelines require that the information be useful to the agency and to the public and places importance on the transparency of the information to assess its usefulness. 67 Fed. Reg. at 8459. Here, the Assessment was performed as an ecological risk assessment to assess the potential impacts of large-scale mining on salmon and other fish populations, wildlife, and Alaska Native cultures in the Bristol Bay watershed and may inform agency Clean Water Act determinations. Id.

[462] See Office of Management and Budget, OMB Circular No. A-130 Revised, Management of Federal Information Resources, available at http://www.whitehouse.gov/omb/Circulars_a130_a130trans4/; see also National Institute Standards and Tech., Guide to NIST Information Security Documents ("NIST Guide") (August 2009), available at http://csrc.nist.gov/publications/CSD_DocsGuide.pdf. EPA employs corresponding System & Information Integrity

2. Due Process

Northern Dynasty has also publicly questioned the Watershed Assessment as a potential deprivation of its Due Process rights.[463] Again, the basis for this claim is difficult to discern, as no viable challenge exists. To establish a procedural due process claim, a litigant must prove 1) a protectable liberty or property interest, and 2) a denial of adequate procedural protections.[464] Even if PLP could assert a protectable liberty or property interest – which it cannot – the relevant EPA procedures have adequate protections in place to overcome this challenge.

PLP statements thus far seem to point to a claim that the release of the Watershed Assessment and/or potential subsequent EPA 404(c) action will deprive the Partnership of a due process right to proceed to the EIS stage of environmental review. Due process doctrine and precedents do not sustain such a claim. Liberty doctrine does not offer any analogues for PLP's use here.[465] Nor can PLP assert any protectable property interest. Unlike a property interest in an "ongoing commercial enterprise,"[466] an undeveloped project that must someday survive permitting and environmental review (indeed, neither "ongoing" nor as yet an "enterprise") is not protectable. A state-created benefit or entitlement cannot logically arise from something to which PLP is not yet entitled; it cannot legally arise from a regulation authorizing administrative discretion.[467] By analogy, in reviewing whether compensation is required when government action prohibits certain land uses, the Supreme Court explained:

> [T]he owner of a lakebed [] would not be entitled to compensation when he is denied the requisite permit to engage in a landfilling operation that would have the effect of flooding others' land. Nor the corporate owner of a nuclear

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measures (documents listed on pages 29 to 30 of the NIST Guide) to ensure information integrity, pursuant to non-public internal agency guidance documents. Telephone Interview with Vipul Bhatt, Information Security Officer, EPA Office of Information Analysis and Access (July 10, 2012).

[463] Northern Dynasty Comments at Public Hearings on EPA's Draft Bristol Bay Watershed Assessment Report (May 18, 2012), available at http://www.northerndynastyminerals.com/ndm/NewsReleases.asp?ReportID=526103&_Type=News-Releases&_Title=Northern-Dynasty-comments-on-the-EPAs-draft-Bristol-Bay-Watershed-Assessmen.

[464] Foss v. Nat'l Marine Fisheries Serv., 161 F.3d 584, 588 (9th Cir. 1998).

[465] Courts have found protected liberties to include, for example, the freedom from bodily restraint, as well as the right to contract, engage in common occupations of life, acquire useful knowledge, marry, establish a home and raise children, and worship. Bd. of Regents of State Colleges v. Roth, 408 U.S. 564, 572 (1972) (quoting Meyer v. Nebraska, 262 U.S. 390, 399 (1923). In the procedural due process context, liberty has been defined as "those privileges long recognized . . . as essential to the orderly pursuit of happiness by free men." *Id.* Permitting review of an as-yet unapproved project falls far afield these core rights. Indeed, liberty cases generally focus on incomparable situations such as protections for inmates, see, e.g, Sandin v. Connor, 515 U.S. 472 (1995), and public school students, see, e.g., Ingraham v. Wright, 430 U.S. 651 (1977). The most analogous alleged liberty interest has been claimed in the preservation of access to natural areas. Sierra Ass'n. For Env't v. Fed. Energy Regulatory Comm'n, 744 F.2d, 661, 665 (9th Cir. 1984). In light of the significant environmental impacts that a mine in Bristol Bay would cause, Northern Dynasty is far more likely to infringe such a liberty than be denied it. Furthermore, the asserted natural area liberty interest remains uncertain as the *Sierra* court did not need to evaluate the merits of the liberty interest because, as here, the existing regulatory framework contained sufficient due process protections. Id.

[466] Marathon Oil Co. v. U.S. Envtl. Protection Agency, 564 F.2d 1253, 1275 (9th Cir. 1977) (Wallace, J., dissenting) (citing Louis K. Liggett Co. v. Baldridge, 278 U.S. 105, 111 (1928)).

[467] Bd. of Regents of State Colleges v. Roth, 408 U.S. 564, 577 (1972).

> generating plant, when it is directed to remove all improvements from its land upon discovery that the plant sits astride an earthquake fault. [468]

Without a protectable liberty or property interest, no claim of inadequate protections can be made.[469]

However, even if PLP were to meet the first threshold, it fails in the second. A court may not impose additional process protections when, as here, the procedural thresholds of the Administrative Procedure Act ("APA") have been cleared.[470] Both the section 104 Watershed Assessment and the process for section 404(c) action include substantial notice and public comment opportunities to safeguard any protectable interest.[471] EPA has held eight noticed[472] public hearings for the Watershed Assessment[473] and will subject its draft Assessment to peer review.[474] The 404(c) process includes similar notice and public comment requirements.[475] Even where a first proceeding is essentially dispositive of a second – not true of the Watershed Assessment's relationship to a 404(c) determination – and the first proceeding contains *no* procedural safeguards at all, if procedural protections are in place for the second, no due process violation has occurred.[476] EPA conduct thus far and its procedures for future action are therefore in full compliance with the APA,[477] and a claim of deprivation of due process must fail.

3. Peer Review Charge

Although they cite no legal authority, PLP and NDM have both vigorously attacked EPA's draft charge to peer reviewers of the Watershed Assessment.[478] Their principal criticism has been that the draft charge—a set of questions intended to guide peer review of the

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[468] Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1029 (1992). The Supreme Court went on to note that compensation is not required even where "regulatory action may well have the effect of eliminating the land's only economically productive use but it does not proscribe a productive use that was previously permissible under relevant property and nuisance principles." Id. Therefore, even if regulatory action would effectively "kill" an economic use of land, that practical reality does not alter or heighten the due process requirements.

[469] Morrissey v. Brewer, 408 U.S. 471, 481 (1972).

[470] Vermont Yankee Nuclear Power Corp. v. NRDC, 435 U.S. 519, 523-24 (1978). Even in processes found lacking, the remedy does not bar a given agency action (here the Watershed Assessment or a section 404(c) veto), but simply requires sufficient notice and opportunity for public comment. See W. Oil & Gas Ass'n v. U.S. Envt'l Protection Agency, 633 F.2d 803, 813 (9th Cir. 1980).

[471] The EIS process also has sufficient due process, but need not be evaluated here as PLP appears to assert deprivation *of* an EIS, not *by* an EIS.

[472] See, e.g., https://www.federalregister.gov/articles/2012/06/05/2012-13431/an-assessment-of-potential-mining-impacts-on-salmon-ecosystems-of-bristol-bay-alaska-peer-review.

[473] Bristol Bay Ecosystems and Communications, EPA Region 10, accessed at http://yosemite.epa.gov/R10/ECOCOMM.NSF/bristol+bay/bristolbay.

[474] "An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska—Peer Review Panel Members and Charge Questions," 77 Fed. Reg. 33213 (June 5, 2012).

[475] Clean Water Act Section 404(c) "Veto Authority" Fact Sheet, EPA, available at http://www.epa.gov/owow/wetlands/pdf/404c.pdf.

[476] U.S. v. Healy Tibbitts Const. Co., 713 F.2d 1469, 1471 (9th Cir. 1983).

[477] 5 U.S.C.A. § 553.

[478] Statement of Ronald W. Thiessen, President & CEO, Northern Dynasty Minerals Ltd. Docket # EPA-HQ-ORD-2012-0358 (June 26, 2012), available at http://regulations.gov (search docket number, then search within results for "Northern Dynasty").

assessment—has a "narrow focus."[479] They allege that this focus "prohibits" reviewers from performing a more comprehensive critique of the assessment.[480] This concern is specious.

First, OMB and EPA guidelines state that draft charge questions should serve to collect "informed comment on *identified specific issues [in order] to properly focus*" the peer review panel's work, while also permitting a more global evaluation of the report's methodology, scope, assumptions and conclusions.[481] EPA's draft charge does both, asking a series of targeted questions and concluding by inviting reviewers to provide "any other comments concerning the assessment, which have not already been addressed by the charge questions."[482] This question – which did not appear in the draft charge, but was included in the final peer review questions – certainly resolves the objection of an overly-narrow charge. It was, however, an unnecessary addition because a general evaluation of methodology, scope, and validity by the peer reviewers is assumed—indeed, required. According to EPA guidelines, peer reviewers *must* assess these aspects of the report, and they will do so in this case.[483] Judging the soundness and validity of the report is the core of the panel's task, and nothing in EPA's draft charge limits its ability to do so.[484]

Beyond this generalized and unsupported claim, NDM's most prominent objections in its comment are that: 1) the Watershed Assessment failed to sufficiently incorporate the 27,000-page PLP-funded Environmental Baseline Document[485]; 2) EPA's draft charge questions do not invite the peer reviewers to highlight the "positive effects of mineral development"[486]; and 3) the Watershed Assessment's assumptions regarding mine failure and other pollution scenarios were overly pessimistic, omitting due credit to industry best practices.[487] These critiques suggest that NDM/PLP would prefer a very different scientific assessment and review process. The report would make liberal use of non-peer-reviewed data provided by NDM/PLP; its risk analysis section would rely on the most optimistic assumptions about mining impacts; and the draft charge would present leading questions that implicitly undermine the validity of the Watershed Assessment, while focusing instead on the positive impacts of mineral development on salmon ecosystems.[488] None of these steps is warranted by the applicable EPA guidelines or regulations,

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[479] Id. at 1.
[480] Id.
[481] U.S. Environmental Protection Agency Peer Review Handbook, 3rd Edition at 74. Science Policy Council, U.S. EPA. EPA/100/B-06/002 (May 2006); Final Information Quality Bulletin for Peer Review at 15. Office of Management and Budget (Dec. 2004) (emphasis added) (noting that "Peer review is most powerful when the charge is specific and steers the reviewers to specific technical questions while also directing reviewers to offer a broad evaluation of the overall product.).
[482] Final Bristol Bay Assessment Charge Questions to Peer Review Panel. US EPA Region 10(2012). Available at _http://www.epa.gov/region10/pdf/bristolbay/final_peer_review_charge_questions.pdf.
[483] Id. at 57.
[484] Final Information Quality Bulletin for Peer Review at 3. (Noting that "[p]eer review typically evaluates the clarity of hypotheses, the validity of the research design, the quality of data collection procedures, the robustness of the methods employed, the appropriateness of the methods for the hypotheses being tested, the extent to which the conclusions follow from the analysis, and the strengths and limitations of the overall product.")
[485] Statement of Ronald W. Thiessen, supra note 478 at 2.
[486] Id.
[487] See id. at 3.
[488] For example, NDM clearly misunderstands the role of the Draft Charge when it suggests EPA ask such blatantly leading questions as: "Was the rationale for excluding seven of the nine watersheds in Bristol Bay from analysis based on sound scientific logic, or was the rationale based on a pre-conceived conclusion regarding the impacts of

nor would they serve the public or improve the Assessment itself. They would merely serve to present a slanted and misleading picture of potential mining impacts in the Bristol Bay area.

B. Environmental Baseline Document

In fact, EPA included findings from the PLP-funded EBD in the Watershed Assessment. Nonetheless, PLP has criticized EPA for not fully incorporating the EBD into the agency's scientific literature review – something that PLP, by its own delay and inaction, prevented EPA from doing. Its suggestion now that EPA somehow intentionally excluded PLP and its closely-held, self-serving, and non peer-reviewed input is disingenuous.

In February 2011, EPA announced its plans to prepare the Watershed Assessment, soliciting input from the scientific community, tribes, local and state agencies, as well as the public and industry.[489] At that time, EPA announced its plan to complete the review within six to nine months, setting a clear timeline for stakeholders to provide relevant materials for review.[490] Although research for the EBD was effectively complete by 2008, Pebble inexplicably failed to make the EBD public until February 2012, a year after EPA's call for materials and only three months before the draft Watershed Assessment was finalized—too late for the authors to thoroughly review and incorporate 27,000 pages of new documentation.[491]

In addition – and unlike the Watershed Assessment itself – the EBD has not been subject to peer review, nor has its underlying data been made readily accessible in a timely and accessible manner for public review and analysis. Without reliable peer-review of the EBD, provided to EPA in a reasonable timeframe applicable to all stakeholders, the agency could not fairly be expected to rely on it – or to delay release of its draft Assessment until PLP decides, after at least four years of refusing access to its data and analysis, to release them.

VIII. BASED ON THE WATERSHED ASSESSMENT, EPA SHOULD EXERCISE ITS AUTHORITY UNDER SECTION 404(C) AND PROHIBIT THE SPECIFICATION OF THE PEBBLE MINE AREA AS A DISPOSAL SITE FOR DREDGED AND FILL MATERIAL

The EPA Assessment, its record, and the best available science provide a compelling and legally sufficient factual basis for EPA to find that "unacceptable adverse effects" within the

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mining in general," and "Given that the Assessment did not follow EPA's own ecological risk assessment guidelines or the data quality guidelines, that inappropriate data and site specific data known to the authors were not used in the Assessment, and that many of the assumptions and conclusions are not documented or based on an appropriate scientific review of the appropriate information, do you believe that the authors' conclusions in this Assessment represent good scientific practice?" Statement of Ronald W. Thiessen, supra note 478.

[489] "EPA plans scientific assessment of Bristol Bay watershed." U.S. EPA Region 10 News Release (Feb. 7, 2011), available at http://yosemite.epa.gov/opa/admpress.nsf/d96f984dfb3ff7718525735900400c29/8c1e5dd5d170ad99852578300067d3b3!OpenDocument.

[490] Outline for the Development of EPA's Bristol Bay Watershed Assessment. U.S. EPA Region 10, available at http://www.epa.gov/region10/pdf/bristolbay/outline_bristol_bay_watershed_assessment.pdf.

[491] Press Release: Pebble Partnership Releases Environmental Baseline Document (Feb. 15, 2012), available at http://www.northerndynastyminerals.com/ndm/NewsReleases.asp?ReportID=507084.

meaning of section 404(c) will occur in the Bristol Bay watershed as a result of development of the Pebble deposit.[492] Significant degradation is likely – even inevitable. EPA is therefore well within its authority to proceed with 404(c) action after an expeditious review of public comments and peer review, even in the absence of any formal mine application.

A. EPA's Authority Under the Clean Water Act

Section 404(c) of the Clean Water Act gives EPA the explicit authority to prohibit, deny, or restrict permitting by the U.S. Army Corps of Engineers' ("Army Corps") of dredge and fill projects when EPA finds that the discharge "will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas."[493]

The purpose and meaning of this authority must be understood and applied in light of the goals of the Clean Water Act as a whole.[494] The purpose of the Clean Water Act is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[495] To that end, Congress made it "the national goal that the discharge of pollutants into the navigable waters be eliminated . . . ."[496] Significantly, the statute also provides that "it is the national goal that wherever attainable, an interim goal of water which provides for the protection and propagation of *fish, shellfish, and wildlife and provides for recreation in and on the water* be achieved . . . ."[497]

With these words, Congress established a national aim of protecting water and the fish, shellfish, wildlife and water-based recreation that it provides – the very resources that section 404(c) was enacted to protect. Other Clean Water Act provisions, too, focus on that language, indicating that Congress considered protection of those enumerated resources to be especially important.[498] Thus, the Clean Water Act sets two clear goals: eliminating water pollution and preserving the ecological functions of our nation's waterways, with a particular emphasis on protecting fish, shellfish, and wildlife.

EPA's mandate pursuant to 404(c) to consider specific impacts on the environment and the appropriate timing to do so are evident in the provision's text:

> *The Administrator is authorized* to prohibit the specification (including the withdrawal of specification) of any defined area as a disposal site, and he is authorized to deny or restrict the use of any defined area for specification (including the withdrawal of specification) as a disposal site, *whenever he determines*, after notice and opportunity for public hearings, *that the discharge of*

[492] As discussed above, the effects outside the watershed would also cause adverse effects, which would be potentially more devastating than the direct harm.
[493] 33 U.S.C. § 1344.
[494] Samantar v. Yousuf, 130 S.Ct. 2278, 2289 (2010) (quoting United States v. Morton, 467 U.S. 822, 828 (1984)).
[495] 33 U.S.C § 1251(a).
[496] Id. § 1251(a)(1).
[497] Id. § 1251(a)(2) (emphasis added).
[498] See, e.g., id. §§ 1326(a), 1330(a) & 1343(c).

> *such materials into such area will have an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas*. Before making such determination, the Administrator shall consult with the Secretary. The Administrator shall set forth in writing and make public his findings and his reasons for making any determination under this subsection.[499]

Supported by this language and the case law applying it, EPA has correctly interpreted this provision to mean that (1) its discretion is limited to consideration of a number of specifically-enumerated environmental factors; and (2) the agency is authorized to act proactively even before the commencement of the Army Corps's section 404 permitting process.[500]

B. The Discharges Associated with the Pebble Mine Would Violate the Section 404(b)(1) Guidelines and, as a Consequence, Section 404(c)

EPA may act pursuant to section 404(c) if a future discharge is *reasonably likely* to cause "an unacceptable adverse effect on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas."[501] The agency has explained that "absolute certainty is *not* required. Because 404(c) determinations are by their nature based on predictions of future impacts, what is required is a reasonable likelihood that unacceptable adverse effects will occur — not absolute certainty but more than mere guesswork."[502] Indeed, as one court succinctly described, "[EPA's] authority to veto to protect the environment is practically unadorned."[503] The agency's use of that authority is informed, however, by regulations governing the Army Corps' permitting of discharges of dredge and fill material.[504]

EPA's rules governing section 404(c) provide that "[i]n evaluating the unacceptability of such impacts, consideration should be given to the relevant portions of the section 404(b)(1) guidelines (40 CFR part 230)."[505] Although the Army Corps is responsible for implementing those guidelines during the permitting process, as EPA explained when it published its 404(c) regulations, "[w]hile Congress had faith in the Corps' administrative experience, it recognized EPA as the 'environmental conscience' of the Clean Water Act."[506] These guidelines define

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[499] 33 U.S.C. § 1344(c) (emphasis added).
[500] A reviewing court will defer to an agency's reasonable interpretation of a statute it is charged with administering unless the statutory provision in question is unambiguous. Chevron, U.S.A., Inc. v. NRDC 467 U.S. 837, 842-43 (1984). See also Mingo Logan Coal Co. v. U.S. Envtl. Protection Agency, CA No. 10-0541 (ABJ) (D.D.C. Mar. 23, 2012), at 22 ("The record expressly states that EPA's 404(c) authority will be exercised prior to the issuance of a permit, and it also reflects the Conferees' understanding that EPA's responsibilities were to be limited to those specifically assigned.").
[501] 33 U.S.C. § 1344(c).
[502] Denial or Restriction of Disposal Sites; Section 404(c) Procedures, 44 Fed. Reg. 58076, 58078 (Oct. 9, 1979) (emphasis added).
[503] James City Cnty v. U.S. Envtl. Protection Agency, 12 F.3d 1330, 1336 (4th Cir. 1993).
[504] 40 C.F.R. § 231.2(e).
[505] 40 C.F.R § 231.2(e).
[506] Denial or Restriction of Disposal Sites; Section 404(c) Procedures, 44 Fed. Reg. 58081.

"unacceptable adverse effect" as an "impact on an aquatic or wetland ecosystem which is likely to result in significant degradation of municipal water supplies (including surface or ground water) or significant loss of or damage to fisheries, shellfishing, or wildlife habitat or recreation areas."[507]

In considering whether to issue a permit, the Army Corps is permitted to consider the wide array of factors found in those guidelines, both environmental and non-environmental.[508] By contrast, in deciding whether to exercise its authority under section 404(c), EPA may consider *only* the portions of those rules relevant to evaluating adverse effects on the section 404(c) resources. EPA has found the following 404(b)(1) guidelines relevant to its 404(c) analysis:

- Significant degradation of waters of the United States (40 C.F.R. § 230.10(c))[509]
- Secondary effects (40 C.F.R. § 230.11(h))[510]
- Cumulative effects (40 C.F.R. § 230.11(g))[511]

The proposed Pebble Mine – or as EPA's Assessment reveals, any large-scale mine in the area – would implicate each of these criteria and result in "unacceptable adverse effects" on the fisheries, wildlife, municipal water supply, and recreation in the Nushagak and Kvichak drainages within the meaning of section 404(c).

1. The Pebble Mine Would Cause Significant Degradation of the Waters of the United States, which Supports a Finding of Unacceptability Under Section 404(c)

The section 404(b)(1) guidelines provide that no discharge of dredged or fill material shall be permitted if the discharge will cause or contribute to significant degradation of waters of the United States.[512] The guidelines state that impacts leading to "significant degradation" include:

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[507] 40 C.F.R. § 231.2(e).

[508] James City Cnty., 12 F.3d at 1335 ("Congress obviously intended the Corps of Engineers in the initial permitting process to consider the total range of factors bearing on the necessity or desirability of building a dam in the Nation's waters, including whether the project was in the public interest.").

[509] Spruce No. 1 Mine Veto, Final Determination of the U.S. Environmental Protection Agency Pursuant to § 404(c) of the Clean Water Act Concerning the Spruce No 1 Mine, Logan County, West Virginia (Jan. 13, 2011) at 45, (hereinafter "Spruce Mine Veto"), available at http://water.epa.gov/lawsregs/guidance/cwa/dredgdis/upload/Spruce_No_1_Mine_Final_Determination_011311_signed.pdf, rev'd on other grounds, Mingo Logan Coal Co. v. U.S. Envtl. Protection Agency, CA No. 10-0541 (ABJ) (D.D.C. Mar. 23, 2012), appeal docketed, No. 12-5150 (D.C. Cir. July 18, 2012).

[510] See, e.g., id. at 83 ("The adverse secondary effects discussed . . . include substantial changes in aquatic communities, such as loss of fish and salamander diversity and sensitive mayfly and stonefly taxa, as well as shifts to more pollution-tolerant taxa.").

[511] See, e.g., Everglades (Rem, Becker & Senior Corp.) Veto, 53 Fed. Reg. 30,093-094 (Aug. 10, 1988) (veto based in part on cumulative impacts as described at 52 Fed. Reg. 38,519 (Oct. 16, 1987)); see also Jack Maybank Veto, 50 Fed. Reg. 20,291 (May 15, 1985) (veto based in part on cumulative impacts to the area, including functional losses in the St. Helena Sound ecosystem, as described at 49 Fed. Reg. 30,112, 30,114 (July 26, 1984)); Sweeden Swamp Veto, 51 Fed. Reg. 22,977, 22,978 (June 24, 1986).

[512] 40 C.F.R. § 230.10(c).

- Significantly adverse effects of the discharge of pollutants on *life stages of aquatic life* and other *wildlife* dependent on aquatic ecosystems;

- Significantly adverse effects of the discharge of pollutants on *aquatic ecosystem diversity, productivity, and stability*;

- Significantly adverse effects of the discharge of pollutants on *human health or welfare,* including but not limited to effects on *municipal water supplies, fish,* and *wildlife*.[513]

An element of each of those specific determinations is a consideration of the "[p]ossible loss of environmental values."[514] The guidelines also provide that in evaluating these three categories of harm, EPA should engage a range of more specific factual determinations, including how the proposed discharge would impact the "physical substrate" of the water body,[515] "[w]ater circulation, fluctuation, and salinity,"[516] turbidity,[517] contaminant levels,[518] and the "aquatic ecosystem and organisms."[519] 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.[520] 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.

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[513] Id. (emphasis added).
[514] Id. § 230.11(a)-(e).
[515] Id. § 230.11(a) ("Determine the nature and degree of effect that the proposed discharge will have, individually and cumulatively, on the characteristics of the substrate at the proposed disposal site.").
[516] Id. § 230.11(b) ("Determine the nature and degree of effect that the proposed discharge will have individually and cumulatively on water, current patterns, circulation including downstream flows, and normal water fluctuation. Consideration shall be given to water chemistry, salinity, clarity, color, odor, taste, dissolved gas levels, temperature, nutrients, and eutrophication plus other appropriate characteristics.").
[517] Id. § 230.11(c) ("Determine the nature and degree of effect that the proposed discharge will have, individually and cumulatively, in terms of potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site.").
[518] Id. § 230.11(d) ("Determine the degree to which the material proposed for discharge will introduce, relocate, or increase contaminants.").
[519] Id. § 230.11(e) ("Determine the nature and degree of effect that the proposed discharge will have, both individually and cumulatively, on the structure and function of the aquatic ecosystem and organisms. Consideration shall be given to the effect at the proposed disposal site of potential changes in substrate characteristics and elevation, water or substrate chemistry, nutrients, currents, circulation, fluctuation, and salinity, on the recolonization and existence of indigenous aquatic organisms or communities.").
[520] According to the section 404(b)(1) guidelines:

> (1) Secondary effects are effects on an aquatic ecosystem that are associated with a discharge of dredged or fill materials, but do not result from the actual placement of the dredged or fill material. Information about secondary effects on aquatic ecosystems shall be considered prior to the time final section 404 action is taken by permitting authorities.
> (2) Some examples of secondary effects on an aquatic ecosystem are fluctuating water levels in an impoundment and downstream associated with the operation of a dam, septic tank leaching and surface runoff from residential or commercial developments on fill, and leachate and runoff from a sanitary landfill located in waters of the U.S. Activities to be conducted on fast land created by the discharge of dredged or fill material in waters of the United States may have secondary impacts within those waters which should be considered in evaluating the impact of creating those fast lands.

Id. § 230.11(h).

a. Significant Adverse Effects on the Life Stages of Aquatic Life and Other Wildlife Dependent Species

The combined effects of inevitable habitat loss and reduced streamflow, and likely acid mine drainage of high levels of copper and other contaminants, will disrupt the life cycles of the aquatic species and the terrestrial wildlife that depend on them. Bristol Bay provides one of the world's largest runs of sockeye salmon and Alaska's largest run of Chinook salmon. 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. Moreover, because of its proposed location at the headwater streams of the Nushagak and Kvichak drainages, the project presents an especially acute threat. Those streams are important spawning grounds for the region's salmon. Reduced flow downstream would impact all life stages, including the migration of adults, the viability of eggs, the emergence of fry, and the timing of smolt migration. As discussed in detail above, these impacts would reverberate through the ecosystem and disrupt the life stages of a wide variety of other species.

The relationship between salmon and other wildlife in the region is complex and highly evolved. Growth rates, litter size, and reproductive success of a variety of species are determined in part by the robustness of the salmon population. For example, brown bears are larger in the Bristol Bay watershed due to their high-protein salmon-based diets, minks time their reproduction with the availability of salmon, and bald eagles experience greater reproductive success because of these fisheries.[521]

EPA's Watershed Assessment and substantial scientific evidence therefore establish that the effects of large-scale metallic sulfide mining would endanger the life processes of aquatic and terrestrial species in the watershed.

b. Significant Adverse Effects on Aquatic Ecosystem Diversity, Productivity, and Stability

The habitat destruction, reduced water quantity, and compromised water quality associated with a large-scale mining effort in the Pebble region will dramatically impact the aquatic ecosystem's diversity, productivity, and stability. Principally, this will happen by way of harm to the region's salmon populations. Salmon interact with the flora and fauna of the region in myriad distinct and important ways, many of which have been described above. At a more general level, however, salmon are an indispensable species in the watershed's aquatic ecosystems. They are a keystone species and their presence in the watershed is essential to maintaining the structure and character of the ecosystem.[522] The loss of salmon will severely diminish ecosystem "diversity, productivity and stability."[523]

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[521] Willson & Halupka, Keystone Species, supra note 217, at 493; The Nature Conservancy of Alaska, Ecoregional Assessment, supra note 6, at 75, 103.
[522] Hauser, Potential Impacts, supra note 78, at 5.
[523] 40 C.F.R § 230.10(c).

The sheer magnitude of the proposed mine and the vulnerability of a keystone species place the Bristol Bay aquatic ecosystem at a high risk of significant adverse effects.

c. Significant Adverse Effects on Human Health or Welfare

It is appropriate to consider the effects of the proposed Pebble Mine on human health to the extent that the effects are tied to one of the section 404(c) factors. Here, human health and welfare are inextricably tied to the availability of a productive salmon fishery and healthy wildlife in and around Bristol Bay; a negative impact on salmon quality or quantity "would certainly" negatively impact these salmon-based cultures.[524] "Salmon as subsistence food and as the basis for Alaska Native cultures are inseparable."[525] 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[526] and raises significant environmental justice concerns.

The six villages that first petitioned EPA all depend on a subsistence lifestyle. Nondalton gathers an average of 358 pounds of subsistence per person in the village each year. New Stuyahok gathers 700 pounds per person, Levelock gathers 884 pounds per person, Ekwok gathers 797 pounds per person, Curyung (Dillingham) gathers 242 pounds per person, and Koliganek gathers 830 pounds per person.[527] All but one of these villages gathers substantially more subsistence than the area's average of 300 pounds per person.[528] 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."[529] Furthermore, each of these villages has its traditional subsistence area close to the location of the mine or in the Nushagak watershed area. The Koktuli River, whose tributaries

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[524] EPA Assessment, Vol. 1, 5-76. Elements of the Alaska Native cultures that are interrelated with subsistence resources include nutrition and physical health, mental and emotional health, language, extended family relationships, strong social networks surrounding food sharing, and economic viability. Id.

[525] Id. at Vol. 1, 2-19.

[526] The requested relief is consistent with the federal government's trust responsibility to protect Native American tribes. In Seminole Nation v. United States, for example, the Court observed that "[the federal government's] conduct, as disclosed in the acts of those who represent it in dealings with the Indians, should therefore be judged by the most exacting fiduciary standards." 316 U.S. 286, 297 (1942). All agencies of the federal government are bound by this obligation to consider the Native Americans' best interests in their decisions and actions, including EPA. See, e.g., Nance v. U.S. Envtl. Protection Agency, 645 F.2d 701, 711 (9th Cir. 1981) ("It is fairly clear that any Federal government action is subject to the United States' fiduciary responsibilities toward the Indian tribes…. As a result of the letters from the Undersecretary of the Interior, and the Crow Tribe, and the failure of EPA to respond to those letters before approving the redesignation, the responsibility to exercise those fiduciary obligations is fairly placed upon the EPA.") In this case, this fiduciary obligation applies to EPA's decision whether to protect petitioners' subsistence fishing and hunting grounds from contamination and degradation caused by the permitting of the proposed Pebble Mine in the heart of the Bristol Bay watershed. See also Exec. Order No. 12,898, 59 Fed. Reg. 7,632-33 (Feb. 11, 1994) ("To the greatest extent practicable and permitted by law . . . , each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States . . . . ").

[527] Duffield et al., Economics of Wild Salmon Watersheds, supra note 9, at 11.

[528] Id.

[529] EPA Assessment, Vol. 1, 2-19.

will be used to store the tailings, feeds into Nushagak River and is part of its watershed.[530] Thus, contamination of the Koktuli River may affect all of the villagers who fish in the Nushagak watershed.

Under these circumstances, EPA can properly find that the adverse environmental effects of the Pebble Mine will significantly jeopardize human health and welfare.

d. Significant Adverse Effects on Municipal Water Supply

EPA defines municipal water supplies for purposes of 404(c) as "including surface or ground water."[531] As described above, extensive connectivity exists between ground and surface water in Bristol Bay. Largely due to this connectivity, ground and surface water would suffer unacceptable adverse impacts as a result of large-scale mining in the area.

Surface-groundwater connectivity would be severed in many places by the mine site, roads, and pipelines, dramatically degrading the watershed, and the quality of its water. In addition, contaminated water from the mine site would be treated and discharged as a replacement for a portion of the groundwater that would otherwise be feeding stream systems. A "key aspect" of post-closure hydrology is that groundwater flows away from the mine site. [532] This replacement water could have substantially different chemical characteristics than the native waters.[533] Because seepage collection systems are "notoriously inefficient (even ineffective) and expensive to operate," the result could be centuries of downgradient surface water contamination.[534] In addition, the Pebble site is below freezing for seven months of the year, and wastewater treatment and discharge would take place during the remaining five-months. This significantly affects the feasibility of successful mine site wastewater treatment because the quantity of water that would need to be treated and discharged during the shortened time window is unprecedented.[535]

The effects on ground and surface water are especially significant because the total wastewater treatment that will be required for discharges from Pebble Mine's tailings impoundments, waste rock disposal areas, and mine pit to the region's water could exceed 26 million gallons per day for Wardrop's 25-year scenario, and as much as 58.5 million gallons per day (greater than the wastewater treatment capacity of the City of Anchorage) at full-pit underground mine exploitation.[536] In order to prevent degradation of surrounding water quality, *all* contaminated mine site wastewater must be captured and treated. But the Pebble site is both

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[530] U.S. Department of the Interior, Bureau of Land Management, Alaska, Bay Proposed Resource Management Plan/Final Environmental Impact Statement Released December 7, 2007 (2007), available at http://www.blm.gov/ak/st/en/prog/planning/Bay_Plan/bay_feis_documents.html. See maps Map 3.52 "Subsistence Use Area, Dillingham," "Map 3.53 Subsistence Use Area, Ekwok," "Map 3.58 Subsistence Use Area, Koliganek," "Map 3.59 Subsistence Use Area, Levelock," "Map 3.62 Subsistence Use Area, Nondalton," "Map 3.68 Subsistence Use Area, New Stuyahok."

[531] 40 C.F.R. § 231.2(e).

[532] Chambers, Assessment Comment Letter, supra note 311, at 4.

[533] EPA Assessment, Vol. 1, 5-44.

[534] Chambers, Assessment Comment Letter, supra note 311, at 4.

[535] Comments of William M. Riley, Comments of Bristol Bay Native Corporation on the U.S. Environmental Protection Agency Draft Bristol Bay Watershed Assessment, Appendix D (Jul. 23, 2012).

[536] Riley & Yocom, Mining the Pebble Deposit, supra note 296, at 24.

"highly permeable" and "highly saturated," and over time, it is likely that contaminated water will "seep through the tailings and enter the highly permeable groundwater system that provides base flow to local streams."[537] Even though tailings are considered to have low permeability, they are likely to migrate over time into the groundwater system and release contaminants to surface waters.[538] The "uncommonly porous nature" of the project area "place[s] into serious doubt the ability of a conventional, unlined tailings impoundment to capture toxic tailing leachate before it enters the local groundwater."[539] And tailings dams, once constructed, would exist *forever*. "[G]iven the relatively ephemeral nature of human institutions over these timeframes, we would *expect* that eventually monitoring, maintenance, and treatment would cease," and the water quality of leachate would from that point on control the area's water quality.[540]

The "inherent" complexity of the groundwater-surface water interactions "can make regulating or controlling such interactions during large-scale landscape development very difficult."[541] Attempts to avoid harm or remediate the interconnectivity are therefore likely be futile and adverse impacts severe.

2. The Cumulative Impacts of the Pebble Mine Are Unacceptable Under Section 404(c)

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."[542] 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.[543] Other projects – proposed or authorized – that might contribute to additional adverse environmental

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[537] Id. at 25.
[538] Id. at 37.
[539] Riley, Assessment Comment Letter, supra note 535.
[540] EPA Assessment, Vol. 1, 7-14 (emphasis added).
[541] Id. at Vol. 1, 5-45.
[542] 40 C.F.R § 230.11(g).
[543] The full text of the guidelines describes cumulative impacts as follows:

> (1) Cumulative impacts are the changes in an aquatic ecosystem that are attributable to the collective effect of a number of individual discharges of dredged or fill material. Although the impact of a particular discharge may constitute a minor change in itself, the cumulative effect of numerous such piecemeal changes can result in a major impairment of the water resources and interfere with the productivity and water quality of existing aquatic ecosystems.
>
> (2) Cumulative effects attributable to the discharge of dredged or fill material in waters of the United States should be predicted to the extent reasonable and practical. The permitting authority shall collect information and solicit information from other sources about the cumulative impacts on the aquatic ecosystem. This information shall be documented and considered during the decision-making process concerning the evaluation of individual permit applications, the issuance of a General permit, and monitoring and enforcement of existing permits.

Id. § 230.11(g).

effects in the vicinity of where the particular discharge would occur,[544] as well as past or present projects that may have affected the current baseline conditions of the region,[545] 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. Permitting one mine will inevitably and irrevocably open the region to significant industrial development inconsistent with the sustainable use and conservation of its natural resources. Cumulative environmental impacts may occur from discharges associated with building a power plant to run the Pebble Mine, the roads and culverts over which trucks will travel on their way to Cook Inlet, the pipelines carrying slurry, natural gas, and diesel, and the dredging and infrastructure required to build a deepwater port in the Cook Inlet. In addition, a mine in the area would likely expand as the ore body is developed, causing greater impacts than current projections estimate.

Moreover, as EPA has recognized, "once the infrastructure for one mine is built, it would likely facilitate the development of additional mines."[546] In the wake of a permit being issued for Pebble Mine, numerous other mining claims that have already been staked out in this pristine, now-undeveloped region, and whose success or failure depend upon the industrial foundation of a first mine, would resurface. With additional structures and mining projects also comes a heightened likelihood and frequency of failures—from small to catastrophic.[547] 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."[548]

Finally, while EPA was careful to generate a scientific analysis with individual lines of cause and environmental effect, in reality, each of the causation stressors described in these comments occur simultaneously, or in temporal proximity, creating synergistic effects.[549] With regard to salmon fisheries, each stressor would slowly reduce salmon resilience,[550] and would act in combination to reduce habitat and food resources, increase metal bioavailability, and reduce

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[544] See, e.g., Spruce Mine Veto, supra note 509, at 73 ("EPA considered cumulative effects to the Coal River subbasin . . . and the Headwaters Spruce Fork sub-watershed . . . if the Spruce No. 1 Mine is constructed . . . and other reasonably foreseeable (proposed and/or authorized but not constructed) surface mining projects within the Coal River sub-basin are constructed."); Jack Maybank Veto, Final Determination of the Assistant Administrator for External Affairs Concerning the Jack Maybank Site on Jehossee Island, South Carolina Pursuant to Section 404(c) of the Clean Water Act (April 5, 1985) at 19, available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/MaybankFD.pdf ("Direct wetland loss and associated impacts on fish, shellfish, and wildlife resulting from the proposed project are magnified when considered in the context of previous wetland alteration in the area of the Maybank Site.").

[545] Id. ("This cumulative effects analysis also takes into consideration the past and present mining projects within the sub-basin and sub-watershed, and the extent to which they have affected the current baseline conditions within the sub-basin and subwatershed.")

[546] EPA Assessment, Vol. 1, 7-1.

[547] Id. at Vol. 1, 7-16.

[548] Id. at Vol. 1, 7-15.

[549] Id. at Vol. 1, 7-2; The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 115.

[550] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, at 116.

genetic variability and disease resistance.[551] Because salmon are crucial players in ecosystem health, these impacts – magnified by each additional development project facilitated by the Pebble Mine infrastructure – would echo throughout the ecosystem.

C. The Requested Action is Consistent with EPA's Past Section 404(c) Actions

Initiating 404(c) proceedings here would be consistent with EPA's past exercise of its section 404(c) authority. The agency has intervened under section 404(c) on thirteen prior occasions,[552] and except where it acted after the issuance of a final permit by the Army Corps, its intervention has been upheld.[553] In this case, the scale and scope of the potential significant adverse impacts of a mine in the Nushagak and Kvishak drainage substantially exceed those threatened by the projects the agency has considered in past 404(c) determinations. Based on the overwhelming evidence in the Watershed Assessment that mining in the pristine Bristol Bay watershed will have devastating and unavoidable consequences, EPA's intervention under section 404(c) would likely be upheld in this case.

1. The Fisheries Impacts Would Surpass Those EPA Has Addressed in Prior 404(c) Determinations and Warrant a Finding of Unacceptability

Potential impact on fisheries has been an important consideration in EPA's past actions under section 404(c).[554] In several cases, the agency has focused on the diversity of fish species affected, recreational fishing considerations, the monetary value of the fishery, and the health of the existing fish populations.[555] Bristol Bay is one of the last places on earth to produce abundant wild sockeye salmon runs, and the Kvichak River specifically produces more sockeye salmon than any other river in the world.

The salmon of Bristol Bay sustain commercial fisheries that are worth around $300 million annually, hold significant recreational importance ($173.1 million annual value), and support Alaska Natives who hunt and fish for their subsistence ($6.3 million annual subsistence harvest value).[556] Considering all economic sectors, the Bristol Bay watershed generates nearly $480 million in one year[557] – making its value over the life of a mine roughly equivalent to that of the Pebble Mine over the same period.[558] The key difference is, of course, indefinite

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[551] Id.
[552] Riley & Yocom, Mining the Pebble Deposit, supra note 296, at 39-41, Table 3.
[553] See, e.g., James City Cnty. v. U.S. Envtl. Protection Agency, 12 F.3d 1330 (4th Cir. 1993); Bersani v. U.S. Envtl. Protection Agency, 850 F.2d 36 (2d Cir. 1988); Alameda Water & Sanitation Dist. v. Reilly, 930 F. Supp. 486 (D. Colo. 1996); City of Alma v. United States, 744 F. Supp. 1546 (S.D. Ga. 1990); but see Mingo Logan Coal Co. v U.S. Envtl. Protection Agency, CA No. 10-0541 (ABJ) (D.D.C. Mar. 23, 2012) (reversing EPA veto because issued after final Army Corps section 404 permit had been granted).
[554] M.A. Norden Veto, 29 Fed. Reg. 29,142 (July 18, 1984); Bayoux Aux Carpes Veto, 50 Fed. Reg. 47267-01 (Nov. 15, 1985); Spruce Mine Veto, supra note 509.
[555] Id.
[556] EPA Assessment, Vol. 1, 2-17.
[557] Id.
[558] The net present value of Bristol Bay fisheries, assuming a $480 million yearly value at a 7% discount rate for 25, 45, and 78 years (taking the discount rate and date ranges from the Wardrop Material Change Report) is roughly

sustainability in the case of the fisheries, and irreversible environmental damage and ore exhaustion (plus over $6 billion in corporate gain[559]) in the case of a mine. Salmon are also central to the cultural heritage of the people who live in the region, and represent an irreplaceable keystone species with a critical role in defining the ecological characteristics of the region.

Never before has EPA had to consider the fate of such a culturally and ecologically important fishery. The special significance of salmon to the Bristol Bay watershed, its people, and its wildlife – and the threat to them all if a mine is permitted – strongly support EPA action in this case.

2. The Size and Scope of the Project Support a Finding of Unacceptability Under Section 404(c)

The sheer size and scope of Pebble Mine surpass any other project EPA has reviewed under section 404(c). One way to compare the proposed Pebble Mine with past cases is by measuring the area of inundated surface directly impacted by the proposed dredge and fill. EPA's minimum and maximum mine sites would eliminate from 55 to 87 miles of stream channel.[560] Current estimates of the proposed Pebble Mine place it within this range, at approximately 68 linear miles of stream channel elimination.[561] In EPA's final determination in the Spruce Mine case, the agency placed significant weight on the many miles of streams in jeopardy – in that case *just 6.6 miles*.[562] The Pebble Mine is expected to destroy over *9,200 acres* of habitat, including wetlands, open water areas, and streams.[563] EPA estimates this figure at between 8,330 and 20,293 acres.[564] In other cases, EPA has concluded that the destruction of less than 1,000 acres of inundated wetlands could support a determination of unacceptability.[565] In other words, the size of the proposed Pebble Mine project is unprecedented in comparison to past section 404(c) proceedings.

A mere calculation of the number of inundated acres affected does not, however, fully capture the scope of what is at stake in the case of Pebble Mine. Not only does such a measure ignore the many cumulative and secondary effects of large-scale mining in the region – detailed at length above – but it ignores the pristine quality and enormous scale of the ecosystem that Pebble Mine would jeopardize. A potential discharge that would so manifestly threaten such an abundance of pristine wilderness is unprecedented.

$5.59 billion, $6.12 billion, and $6.39 billion, respectively. PLP projections for the same date ranges come to $3.84 billion, $6.13 billion, and $6.81 billion, respectively. Wardrop, Preliminary Assessment, supra note 61, at 78.

[559] Id.

[560] EPA Assessment, Vol. 1, ES-14.

[561] The Nature Conservancy, Ecological Risk to Wild Salmon, supra note 18, 31.

[562] Spruce Mine Veto, supra note 509, at 20.

[563] Riley & Yocom, Mining the Pebble Deposit, supra note 296, at 29.

[564] EPA Assessment, Vol. 1, ES-11.

[565] See, e.g., Big River Veto, 55 Fed. Reg. 10,666 (Mar. 22, 1990) (575 acres of wetland); Sweedens Swamp Veto, reported at 51 Fed. Reg. 22,977, 22,978 (June 24, 1988) (32 acres of wetland); Jack Maybank Veto, 50 Fed. Reg. 20,291 (May 15, 1985) (900 acres of wetland).

3. The Impacts on Headwater Streams Are Significant and Support a Finding of Unacceptability Under Section 404(c)

In the Spruce Mine proceeding, EPA emphasized that the discharges at issue would have impacted important headwater streams in the region. Just as important as the project's size was the agency's recognition of the important function headwater streams provide in a healthy, functioning ecosystem. Taking note of the science, EPA wrote:

> Many studies now point to the role headwater streams play in the transport of water, sediments, organic matter, nutrients, and organisms to downstream environments; their use by organisms for spawning or refugia; and their contribution to regional biodiversity . . . . Additionally, destruction or modification of headwater streams has been shown to affect the integrity of downstream waters, in part through changes in hydrology, chemistry and stream biota . . . .[566]

At least as devastating as what was proposed at the Spruce Mine in West Virginia, Pebble Mine would appropriate all of the ground and surface waters within the proposed area of the mine, including the headwaters of the North and South Forks of the Koktuli River and the Upper Talarik Creek. Those headwaters would be subject to mine use over the entire life of the mine – severely limiting the extent to which salmon can return to their upstream spawning area and jeopardizing important aquatic and riparian habitats. If EPA carefully considers the effects on headwater streams, it must find that the proposed Pebble Mine poses unacceptable environmental impacts to the Bristol Bay watershed.

D. EPA May Not Engage in Cost-Benefit Analysis to Reach a Decision Under Section 404(c)

Although the mining industry will offer self-interested claims that EPA should consider the potential economic cost of section 404(c) relief – and PLP can be expected to do so here[567] – those claims have no legitimate legal or factual basis. EPA's power under section 404(c) is at once wide in its discretion and narrowly focused on the environmental priorities of the Clean Water Act. Section 101 prioritizes the goal of protecting fish, shellfish, wildlife and recreation on the water[568] – and section 404(c) does so, too. By contrast, neither section contains any reference to, or authority for, considering the potential economic impact of approving or disapproving a challenged development – or deciding a request for action under section 404(c). Economic considerations are irrelevant and may not be considered.

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[566] Spruce Mine Veto, supra note 509, at 20.

[567] Indeed, Northern Dynasty's comments to EPA's peer review charge object that "peer reviewers would be forbidden from questioning why the BBWA does not consider any positive effects of mine development, despite the significant socio-economic challenges facing the Bristol Bay region and its rapidly declining Native population." Press Release, Northern Dynasty calls on EPA to substantially expand and extend role of independent experts assembled to review 'Bristol Bay Watershed Assessment' (Jun. 28, 2012).

[568] City of Alma v. United States., 744 F. Supp. 1546, 1562 (S.D.Ga.1990) ("[T]he CWA grants EPA wide discretion to employ section 404(c) as it deems appropriate.").

The Court of Appeals for the Fourth Circuit has considered the relationship between the Army Corps' role in the section 404 permitting process and EPA's 404(c) authority. Significantly, it concluded that section 404(c) permits EPA to consider the environment at the exclusion of other values.[569] The Army Corps, on the other hand, must consider an array of factors bearing on the desirability of permitting the construction of a dam – or in issuing any dredge and fill permit under section 404 – including whether the project is in the public interest.[570] Because EPA's authority to veto is based only on its obligation to protect the environment,[571] the Court of Appeals observed that EPA's authority "is practically unadorned," holding that the agency may rest its decision to intervene under section 404(c) *solely* on a finding of unacceptable adverse effects to the environment.[572] Without exception, all district courts that have addressed the issue have adopted that same reasonable interpretation of section 404(c).[573]

The provision's legislative history confirms that Congress intended section 404(c) to serve purely as an environmental check on the Army Corps' permitting authority under section 404. An early House amendment to the bill would have given the Army Corps the power to administer the permitting of dredged or fill material without EPA oversight. Instead, the Army Corp would have been, by itself, "required to determine that the discharge would not unreasonably degrade or endanger human health, welfare, or amenities or the marine environment, ecological systems, or *economic potentialities*."[574] That scheme for the section 404 permit program did not survive the House and Senate conference committee. According to the conference committee report:

> The conferees agree that the Administrator of the Environmental Protection Agency shall have authority to prohibit specification of a site and deny or restrict the use of any site for the disposal of any dredge or fill material which he determines will adversely affect municipal water supplies, shellfish beds and fishery areas (including spawning and breeding areas), wildlife, or recreational areas.[575]

It was this formulation of section 404(c) that made its way into the final version of the bill. The decision to abandon the language of economics and rest the oversight authority with EPA suggests what courts and EPA have always understood: that section 404(c) was intended to fulfill the environmental and ecological priorities of the Clean Water Act.

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[569] James City Cnty. v. U.S. Envtl. Protection Agency, 12 F.3d 1330, 1336 (4th Cir.1993).
[570] Id. For a full discussion of public interest considerations, see Wild Salmon Center and Trout Unlimited, Bristol Bay's Wild Salmon Ecosystems and the Pebble Mine: Key Considerations for a Large-Scale Mine Proposal at 41-46.
[571] James City Cnty., 12 F.3d at 1336.
[572] Id.
[573] Id.; see also Creppel v. U.S. Army Corps of Engineers, Civ. A. No. 77-25, 1988 WL 70103 (E.D. La. June 29, 1988). ("The plain language of section 404(c) does not require a balancing of environmental concerns against "the public interest." There is no mention of this kind of 'statutory balancing' . . . .").
[574] Joint Explanatory Statement of the Committee of Conference, Pub. L. No. 92-500 reprinted in 1 Legislative History of the Federal Water Pollution Control Act Amendments of 1972, at 325 (1973) (emphasis added).
[575] Id.

EPA's own understanding of its enabling statute is in keeping with the courts' interpretation. The agency has defined "unacceptable adverse effect" as the "impact on an aquatic or wetland ecosystem which is likely to result in significant degradation of municipal water supplies (including surface or ground water) or significant loss of or damage to fisheries, shellfishing, or wildlife habitat or recreation areas."[576] Significantly, in EPA's statement of purpose that accompanied the rulemaking, the agency explained that "section 404(c) does not require a balancing of environmental benefits against non-environmental costs such as the benefits of the foregone project. This view is based on the language of 404(c) which refers only to environmental factors."[577] EPA emphasized that "there is no requirement in 404(c) that a cost/benefit analysis be performed, and there is no suggestion in the legislative history that the word 'unacceptable' implies such a balancing."[578]

Accordingly, any claim by PLP of potential economic hardship if EPA precludes mining through 404(c) action must be rejected.

E. EPA May Invoke its 404(c) Authority Proactively to Prevent Large-Scale Mining in the Nushagak and Kvichak Drainages

EPA is entitled to intervene under section 404(c) before the commencement of the section 404 permit process. Despite protestations by mining enthusiasts, the Agency's Watershed Assessment is neither factually nor legally "premature."[579] There is ample evidence to support proactive action here given the sheer magnitude of the anticipated development in the pristine Nushagak and Kvichak drainages and EPA findings that construction of a mine would result in unavoidable impacts on one of the country's most outstanding fisheries. In light of all that is understood about the impacts of large-scale mines on landscapes and ecosystems – as well as the sensitivity of the wilderness at stake in Bristol Bay – there is no need to delay 404(c) action once the Assessment comment period and peer review process are complete.

As a matter of law, EPA unquestionably has the power to act proactively under section 404(c). The interpretation of any statute begins with its plain meaning.[580] By their terms, the first two clauses of section 404(c) provide that "the Administrator is authorized to prohibit the specification (including the withdrawal of specification) of any defined area as a disposal site, and he is authorized to deny or restrict the use of any defined area for specification (including the withdrawal of specification) as a disposal site, *whenever* he determines" the environmental impacts would be unacceptable.[581] This plainly worded passage provides that EPA is free to act

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[576] 40 C.F.R. § 231.2(e).
[577] Denial or Restriction of Disposal Sites; Section 404(c) procedures, 44 Fed. Reg. 58076, 58078 (Oct. 9, 1979) ("When Congress intended EPA to consider costs under the Clean Water Act, it said so.").
[578] Id.
[579] Northern Dynasty Comments at Public Hearing (May 31, 2012). The company's statement that it "welcomed" the Watershed Assessment when it first learned that EPA had initiated the process is notably schizophrenic. Are we to believe that the process was *not* premature at its start, but is so now, when its findings do not support the corporation's mining goals?
[580] Milner v. Dep't of Navy, 131 S.Ct 1259, 1264 (2011), citing Park 'N Fly, Inc. v. Dollar Park & Fly, Inc., 469 U.S. 189, 194 (1985) ("Statutory construction must begin with the language employed by Congress and the assumption that the ordinary meaning of that language accurately expresses the legislative purpose.")
[581] 33. U.S.C. § 1344(c) (emphasis added).

proactively, before an area has been specified as a disposal site – "whenever" the Administrator makes the required determinations.[582] The statute's application isn't limited to occasions where a permit application for a specified disposal site has already been filed, since the administrative action may take the form of a prohibition. In contrast to a "withdrawal" or "denial" of a permit or permit application, a prohibition by definition works to preempt the action it forbids, which, in this case, is the issuance of a permit.

This reading of the statute is also consistent both with EPA's application of it and, on judicial review, with the courts' interpretation. A review of EPA's rulemaking and prior section 404(c) practice reveals that EPA long ago rejected Northern Dynasty's claim that pre-application action is premature. Beginning with the promulgation of the rules governing section 404(c) implementation, the agency stated that it may "prohibit the specification of a site under section 404(c) with regard to any existing or potential disposal site *before a permit application has been submitted to or approved by the Corps or a state*."[583]

In response to public comments critical of this rule, the agency first pointed to the plain language of section 404(c), advancing similar textual arguments.[584] It then directly addressed the rationale for its pre-permit authority, explaining that such authority

> will facilitate planning by developers and industry. It will eliminate frustrating situations in which someone spends time and money developing a project for an inappropriate site and learns at an advanced stage that he must start over. In addition, advance prohibition will facilitate comprehensive rather than piecemeal protections of wetlands.[585]

EPA directly rejected comments foreshadowing Northern Dynasty's current position which argued that "pre-permit actions were inappropriate because it would be impractical to identify unacceptable adverse effects before a specific discharge is proposed."[586] The agency responded that "at least in theory, there are instances where a site may be so sensitive and valuable that it is possible to say that any filling of more than X acres will have unacceptable adverse effects."[587]

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[582] Id.
[583] 40 C.F.R. § 231.1(a) (emphasis added).
[584] Denial or Restriction of Disposal Sites; Section 404(c) Procedures, 44 Fed. Reg. 58076, 58077 (Oct. 9, 1979) ("EPA feels that the statute clearly allows it to use 404(c) before an application is filed.").
[585] Id.
[586] Id. Furthermore, the NEPA process itself requires evaluation of reasonable *and hypothetical* scenarios as part of the EIS analysis of alternatives. 40 C.F.R. §4332(2)(E). The permitting process for a proposed Pebble mine would require PLP to develop an EIS with several reasonable alternatives – hypothetical in nature and different than their proposed discharge. See, e.g., City of Carmel-By-The-Sea v. United States Dept. of Trans., 123 F.3d 1142, 1159 (1997). Evaluation of hypothetical mine scenarios is therefore par for the course in Section 404 permitting.
[587] Id. Over the course of EPA's application of section 404(c), the agency has consistently interpreted this statutory provision to permit proactive use. In exercising its veto authority in 1984, for example, the Administrator explained:

> [w]here the facts warrant it, I may prohibit all future discharges of all dredged or fill material at a site, whether or not the site has previously been specified in a 404 permit. If there is already a permit, my actions would be a 'withdrawal of specification'; if no permit has been issued, my action would be a 'prohibition of specification.'

The Bristol Bay watershed is precisely such a place and therefore warrants proactive use of section 404(c) power.

Notable beyond the fact of EPA's section 404(c) authority, however, is the risk that, by failing to act proactively, EPA may be deemed to have exceeded it. In a recent decision of the federal district court in the District of Columbia, the agency's veto of the Spruce No.1 Surface Mine permit was vacated solely on the ground that the subject permit had already been granted by the Army Corps.[588] Having reviewed the language of the statute, its legislative history, and EPA's implementing regulations, Judge Amy Berman Jackson concluded that "the clear import of the provision, as all the parties agree, is that Congress gave EPA the right to step in and veto the use of certain disposal sites at the start, thereby blocking the issuance of permits for those sites."[589] The problem in the Spruce case, the court held, was that EPA had waited too long to act:

> The Court concludes that EPA exceeded its authority under section 404(c) of the Clean Water Act when it attempted to invalidate an existing permit by withdrawing the specification of certain areas as disposal sites after a permit had been issued by the Corps under section 404(a). Based upon a consideration of the provision in question, the language and structure of the entire statutory scheme, and the legislative history, *the Court concludes that the statute does not give EPA the power to render a permit invalid once it has been issued by the Corps*.[590]

Noting that "the agency has never before invoked its 404(c) powers to review a permit that had been previously duly issued by the Corps,"[591] the court granted summary judgment in favor of the permit holder, concluding that section 404(c) did not authorize EPA to veto a permit once it has been issued.[592] According to the court, it was "unreasonable to sow a lack of certainty into a system that was expressly intended to provide finality."[593] EPA is currently appealing the decision. Whether or not this decision is ultimately upheld on appeal, it clearly reflects the risk of waiting.

Moreover, acting early will protect PLP and other parties with mining claims in the watershed from investing additional resources in a mining project manifestly unsuited to a region like the Bristol Bay watershed. As EPA noted in 1979 in response to comments concerned that the 404(c) regulations might have a significant adverse economic impact, "the use of 404(c) may well have some economic benefits that outweigh some of the costs, through the use of pre-

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M.A. Norden Veto, Final Determination of the Administrator Concerning the M.A. Norden Site Pursuant to Section 404(c) of the Clean Water Act (June 15, 1984) at 16, available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/NordenCoFD.pdf; see also 49 Fed. Reg. 29,142 (July 18, 1984).

[588] Mingo Logan Coal Co. v. U.S. Envtl. Protection Agency, CA No. 10-0541 (ABJ) (D.D.C. March 23, 2012).

[589] Id. at 12.

[590] Id. at 2 (emphasis added).

[591] Id. at 29.

[592] Id. at 33-34.

[593] Id. at 31. This result is not directly applicable to the petitions pending here since no section 404 permit has even been applied for – much less issued – for the Pebble Mine. NRDC believes, however, that EPA's reading of section 404(c) in the Spruce No. 1 Mine proceeding and subsequent court challenge is consistent with the statute and the Clean Water Act as a whole.

application 'vetoes' before industry has made financial and other commitments which lock it into a particular project design and location."[594]

For reasons of statutory and judicial interpretation and economic certainty, therefore, it is not only appropriate but necessary for EPA to act proactively in exercising its authority under section 404(c). Where the environmental criteria identified in section 404(c) are met, the agency has the authority to protect the area and natural resources at risk. Delaying action in deference to the Army Corps would run contrary to the statute, to EPA's own administrative preference ("EPA strongly prefers to initiate the § 404(c) process prior to issuance of a permit . . . ."[595]), and to the interest of all stakeholders in efficiency and certainty.

A reviewing court will apply a deferential standard when evaluating the legality of EPA's section 404(c) determination. Under the Administrative Procedure Act, agency action must be set aside if it is "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with the law," or if it fails to meet statutory, procedural, or constitutional requirements.[596] A court may not vacate an agency's decision unless it

> has relied on factors which Congress had not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise.[597]

In past cases where EPA's section 404(c) decisions have been challenged, the courts have applied that deferential standard of review.[598]

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[594] Id.

[595] Spruce Mine Veto, supra note 509, at 45. rev'd on other grounds, Mingo Logan Coal Co. v. U.S. Envtl. Protection Agency, CA No. 10-0541 (ABJ) (D.D.C. Mar. 23, 2012) (reversing EPA veto because issued after final Army Corps section 404 permit had been granted). See also, Big River Veto, Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water Pursuant to Section 404(c) of the Clean Water Act Concerning the Proposed Big River Water Supply Impoundment Kent County, Rhode Island (Mar. 1, 1990) at 4, available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/BigRiverFD.pdf ("[T]he Section 404(c) regulations explicitly recognize EPA's authority to take actions pursuant to Section 404(c) in advance of and/or in the absence of a permit application (40 CFR §231.1(a))."; Everglades (Rem, Becker & Senior Corp.) Veto, Final Determination of the U.S. Environmental Protection Agency's Assistant Administrator for Water, Concerning Three Wetland Properties (sites owned by Henry Rem Estate, Marion Becker, et. al. and Senior Corporation) for which Rockplowing is Proposed in East Everglades, Dade County, Florida (June 15, 1988) at 4, available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/RemFD.pdf ("Section 231.1 . . . states that EPA's Section 404(c) authority may be used to either veto a permit … (as in the case of the Rem site) or to preclude permitting either before the Corps has made its final decision . . . or in the absence of a permit application (as in the case of the Becker site).").

[596] 5 U.S.C § 706(2)(A)-(D); Citizens to Preserve Overton Park v. Volpe, 401 U.S. 402, 414 (1971).

[597] Motor Vehicle Mfrs. Assn. of U.S. Inc. v. State Farm Mut. Automobile Ins. Co., 463 U.S. 29, 43 (1983).

[598] City of Alma v. United States, 744 F. Supp. 1546 (S.D.Ga. 1990); Creppel v. U.S. Army Corps of Engineers, 1988 WL 70103, Civ. A. No. 77-25, 1988 WL 7010 (E.D. La June 29, 1988). As explained above, the agency has intervened under section 404(c) on thirteen prior occasions. See Riley & Yocom, Mining the Pebble Deposit, supra note 296, at 39-41, Table 3. Except where it did so after the final issuance of an Army Corps permit, its intervention has withstood judicial challenge. See, e.g., Bersani v. U.S. Envtl. Protection Agency, 850 F.2d 36 (2d Cir. 1988); Alameda Water & Sanitation Dist. v. Reilly, 930 F. Supp. 486 (D. Colo. 1996); City of Alma v. United States, 744 F. Supp. 1546 (S.D. Ga. 1990); but see Mingo Logan Coal Co. v. U.S. Envtl. Protection Agency, CA No. 10-0541

IX. CONCLUSION

NRDC applauds EPA for the quality of its scientific review and analysis contained in the draft Bristol Bay Watershed Assessment and for the comprehensive understanding that it brings to the devastating risks to water quality and the region's wild salmon fisheries unavoidably associated with large-scale mining development in the region, including the Pebble Mine. Because public review and comment have now been completed on the draft Watershed Assessment and peer review is underway,[599] the agency will soon have a full factual record on which to base regulatory action under section 404(c).

EPA's Watershed Assessment, as well as the many other studies of the area, provide more than enough information to find with absolute certainty that large-scale mining in Bristol Bay would risk enormous harm to the resources protected by section 404(c). As described in detail above, a mine would cause (i) *inevitable* destruction and modification of salmon habitat and populations, as well as harm to the wildlife and native communities that rely on them; (ii) *likely* habitat fragmentation and extirpation, and chemical, acid, and metal exposure, and (iii) significant risk of *catastrophic* tailings dam failure. This is true even within the framework of EPA's conservative underestimation and exclusion of important and likely larger impacts, such as secondary development, construction and operation of a Cook Inlet port, undervalued tailings magnitude and runout distance in the case of an impoundment failure, and climate change.

Precise final design details for a proposed Pebble Mine would do nothing to lessen the significant risks described in EPA's Watershed Assessment or to alter in any material way its conclusions. As NDM has itself described in formal applications and reports, the Pebble Mine would comprise both an underground block caving mine at the Pebble East Deposit and an above-ground open pit mine at the Pebble West Deposit and would destroy over 9,200 acres of habitat.[600] Assuming development only at a reduced scale, the open pit mine is projected to span over 2 miles and reach a depth of 2,500 feet.[601] Even at that scale, the Pebble Mine would be one of the largest mines in the world and the largest open pit mine in North America.[602] Tailings dams would be constructed to store 2 billion tons – and, more likely, more than 10 billion tons – of mine tailings in perpetuity.[603] The mine will remove up to 35 billion gallons of water annually from wild salmon habitat.[604] The maximum mine size as described in the EPA Assessment – the

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(ABJ) (D.D.C. Mar. 23, 2012) (reversing EPA veto issued two years after final Army Corps section 404 permit had been granted). In James City Cnty. v. U.S. Envtl. Protection Agency, 12 F.3d 1330 (4th Cir. 1993), the Fourth Circuit ultimately upheld EPA's decision to veto a dam permit issued by the Army Corps of Engineers after a series of remands. See 758 F. Supp. 348 (E.D. Va 1990) (overturning EPA's veto), 955 F.2d 254 (4th Cir. 1992) (affirming in part and remanding). On remand, EPA again vetoed the permit and the veto was again challenged. See 1992 WL 315199, 23 Envtl. L. Rep. 20,228 (E.D. Va. Aug. 5, 1992) (overturning EPA's veto). On final appeal, the Fourth Circuit reversed, concluding EPA's veto decision – which was based on harm to existing fish and wildlife species, damage to the ecosystem, destruction of wetlands, and inadequate mitigation – was not arbitrary and capricious. See 12 F.3d 1330 at 1339.

[599] EPA, Bristol Bay, available at http://yosemite.epa.gov/R10/ecocomm.nsf/bristol+bay/bristolbay.

[600] Riley & Yocom, Mining the Pebble Deposit, supra note 296, at 36.

[601] Wardrop, Preliminary Assessment, supra note 61, at 37.

[602] Hauser, Potential Impacts, supra note 78, at 2.

[603] Wardrop, Preliminary Assessment, supra note 61, at 52.

[604] Moran, Water-Related Impacts at the Pebble Mine, supra note 159.

"most likely" mine to be economically worthwhile, and based on the Wardrop report[605] – equals or even underestimates these figures. Given these magnitudes, EPA does not need a design blueprint or a formal mine permit application to evaluate the environmental consequences of a mining project in the Nushagak and Kvichak drainages. Mining development at such a scale – whether the "minimum" or the "maximum" scenario considered by EPA – cannot proceed in this watershed without dramatically compromising the region's physical, chemical, hydrological, and biological integrity.

By acting proactively to conduct the Watershed Assessment, and now continuing to do so through the initiation of 404(c) proceedings, EPA can achieve what it describes as "comprehensive planning rather than piecemeal decision making."[606] Addressing this issue at the front end – before permitting begins in earnest and before mining interests devote even more resources to mine development – is practical, procedurally and legally responsible, and scientifically sound. It promotes long-term clarity for large-scale metallic sulfide mining projects in the region, adheres to legal precedent that pre-permitting 404(c) review is authorized (and possibly required), and reflects good government practice by ensuring that an otherwise piecemeal approach to mining in the region does not unfairly disadvantage individual applicants or allow unavoidably risky projects to slip through the cracks.

We submit these comments to the Watershed Assessment in support of EPA's well-researched and thorough review of the environmental impacts and risks associated with mining in the Bristol Bay region. The Assessment, and the record on which it is based, document the unacceptable adverse impacts that large-scale mining would have on the Watershed, on Bristol Bay itself, and on the communities and people most directly affected. EPA has the authority and the responsibility to prevent the certain devastation that its Assessment describes. If ever there were a case for the exercise of the agency's 404(c) authority, it is this one.

For all of these reasons, we respectfully urge EPA, once its peer review process has been completed, to initiate proceedings expeditiously thereafter to grant the pending petitions for relief under section 404(c) of the Clean Water Act.

Respectfully submitted,

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[605] EPA Assessment, Vol. 1. 4-19.
[606] Id.