Nomination of the Koktuli River
(North Fork, South Fork, Main Fork)

Alaska's First
Outstanding National Resource Water

Petitioners:
Trout Unlimited, Inc. – Alaska Program
Nushagak-Mulchatna Wood-Tikchik Land Trust
Alaska Alpine Adventures, LLC (Dan Oberlatz)
SnoPac Products, Inc.
Alaska Independent Fishermen's Marketing Association
Renewable Resources Coalition
Nunamta Aulukestai

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Executive Summary

On behalf of Trout Unlimited, Inc. – Alaska Program, the Nushagak-Mulchatna Wood-Tikchik Land Trust, Alaska Alpine Adventures, LLC (Dan Oberlatz), SnoPac Products, Inc., Alaska Independent Fishermen's Marketing Association, Renewable Resources Coalition, and Nunamta Aulukestai (collectively "Petitioners"), we submit the following nomination to designate the Koktuli River as Alaska's first Outstanding National Resource Water (ONRW).

The Clean Water Act establishes three different tiers of protection for the nation's waters through its antidegradation policy. States must adopt a similar or more stringent tiered structure through which the states can designate their most outstanding waters as ONRWs. By designating a river or stream as an ONRW, it means that no new or increased pollution discharges can occur within that waterbody. Additionally, no new or increased discharges can occur in a tributary to an ONRW if it results in lower water quality in the ONRW. The Alaska Department of Environmental Conservation is charged with implementing Alaska's antidegradation policy, including identifying ONRWs with the help of the public. As of the submission of this nomination, no ONRWs have been designated in Alaska.[1]

The Koktuli River is legendary even by Alaska standards. Its meandering route across the rolling tundra of Southwest Alaska beckons to anglers and backcountry recreationists from around the globe - drawing outdoor enthusiasts of all kinds to the its clean sparkling water, world-class wildlife viewing and hunting opportunities, and trophy trout and salmon.

The Koktuli River system, an ecological powerhouse located in the heart of the Bristol Bay watershed, is the headwaters to the most productive sockeye salmon fishery in the world. It is one of Alaska's highest valued waters – a source of pristine water sustaining critical fish and wildlife habitat in one of the most intact watersheds left on the planet. The Koktuli River drainage supports over a dozen species of fish, including five Pacific salmon species, and serves as prime spawning, rearing, and migration habitat. The Koktuli's remote nature and pristine water quality are crucial factors that sustain the millions of salmon that are spawned, grow, migrate and return to spawn in its gravels every year – upholding a large part of the world-renowned Bristol Bay salmon population.

Photo by: Ben Knight
Fishing Koktuli River

[1] More details available at: http://dec.alaska.gov/water/wqsar/trireview/pdfs/ONRW.pdf.

In addition to its outstanding ecological capacity, the Koktuli River is well known across Alaska, the nation, and the world, for the exceptional recreation opportunities that exist because of its pristine water quality, and bountiful wildlife and fishery resources. Anglers from all over the world travel to the Koktuli River each year to experience some of the best backcountry fishing opportunities Alaska has to offer. In addition, the Koktuli River system and the larger Bristol Bay watershed is a critical component to the local lifestyle – it supports the world's largest sustainable commercial sockeye salmon fishery and generations of subsistence users.

While the Bristol Bay region is remarkable by all standards and has many exceptional waters, the Koktuli River is truly outstanding. Protecting the Koktuli River system's pristine water quality for its recreational, commercial and subsistence values is an important part of maintaining the integrity of this unique world-class watershed. This nomination reflects a widespread desire to protect its outstanding qualities and to recognize an important class of streams of which the Koktuli River so exemplifies through the designation of Alaska's first ONRW.

I. BACKGROUND

A. Nominated Waterbody: The Koktuli River (North Fork, South Fork, Mainstem)

The waterbody being nominated for Outstanding National Resource Water designation comprises all of the tributaries of the Koktuli River, its associated sloughs and floodplains, as well as the North and South Forks from their sources, to where the Mainstem Koktuli meets the Mulchatna River.[2]

The three maps (Figures 1-3) and two appendices (Appendix I and II) detail the location of the waterbody, as well as current land status.

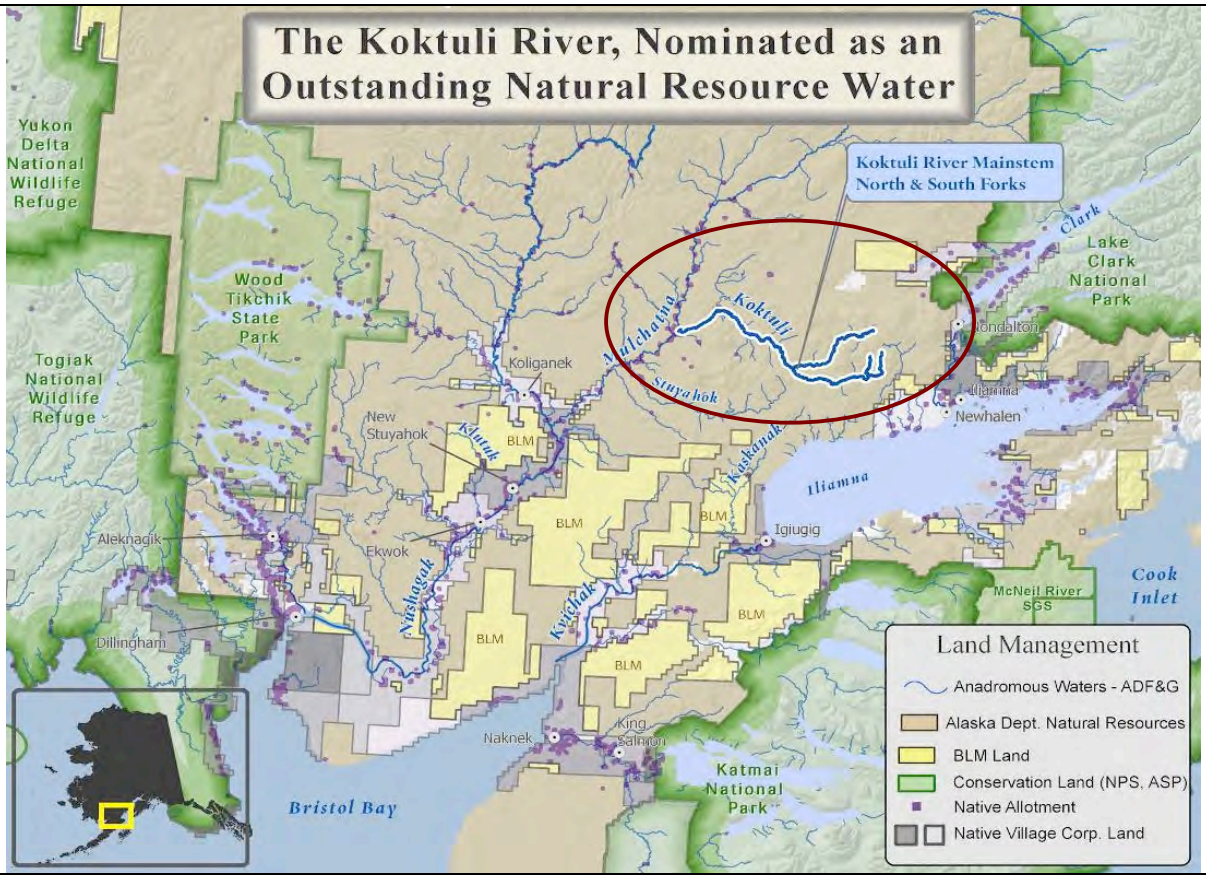

Figure 1: Overview map showing general location of the Koktuli River.

[2] The system nominated as Alaska's Outstanding National Resource Water includes Mainstem, North and South Forks of the Koktuli River, from the North Fork headwaters near Latitude 59.95 N and Longitude -155.323 W and the South Fork headwaters near Latitude 59.896 N and Longitude -155.278 W, to where the Mainstem discharges into the Mulchatna River at Latitude 59.933 N and Longitude -156.428 W

The map also provides land status information of surrounding area.

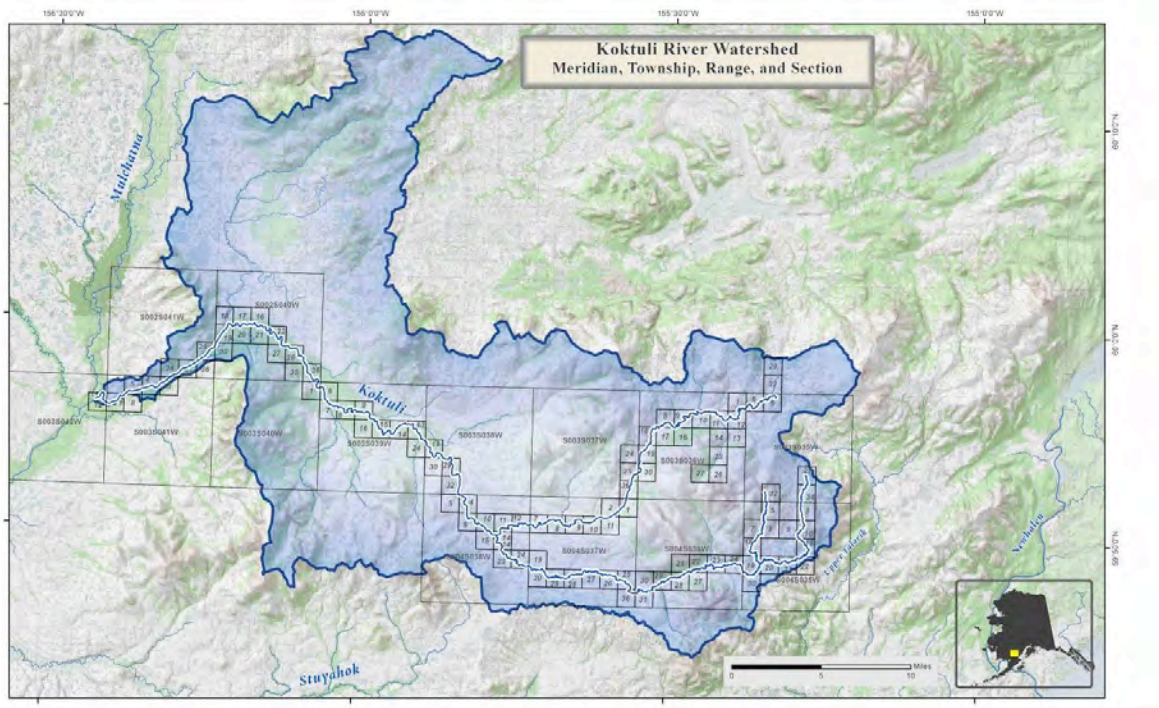

Figure 2. Map of Koktuli River Drainage (Mainstem, North and South Forks) delineated in blue outline. The system nominated as Outstanding National Resource Waters includes Mainstem, North and South Forks, from the North Fork headwaters near Latitude 59.95 N and Longitude -155.323 W and the South Fork headwaters near Latitude 59.896 N and Longitude -155.278 W, to where the mainstem discharges into the Mulchatna River at Latitude 59.933 N and Longitude -156.428 W. Boxes illustrate precise location of river system by Meridian, Township, Range, and Section. (See Appendix I and II for full listing of Meridian, Township, Range and Section information)

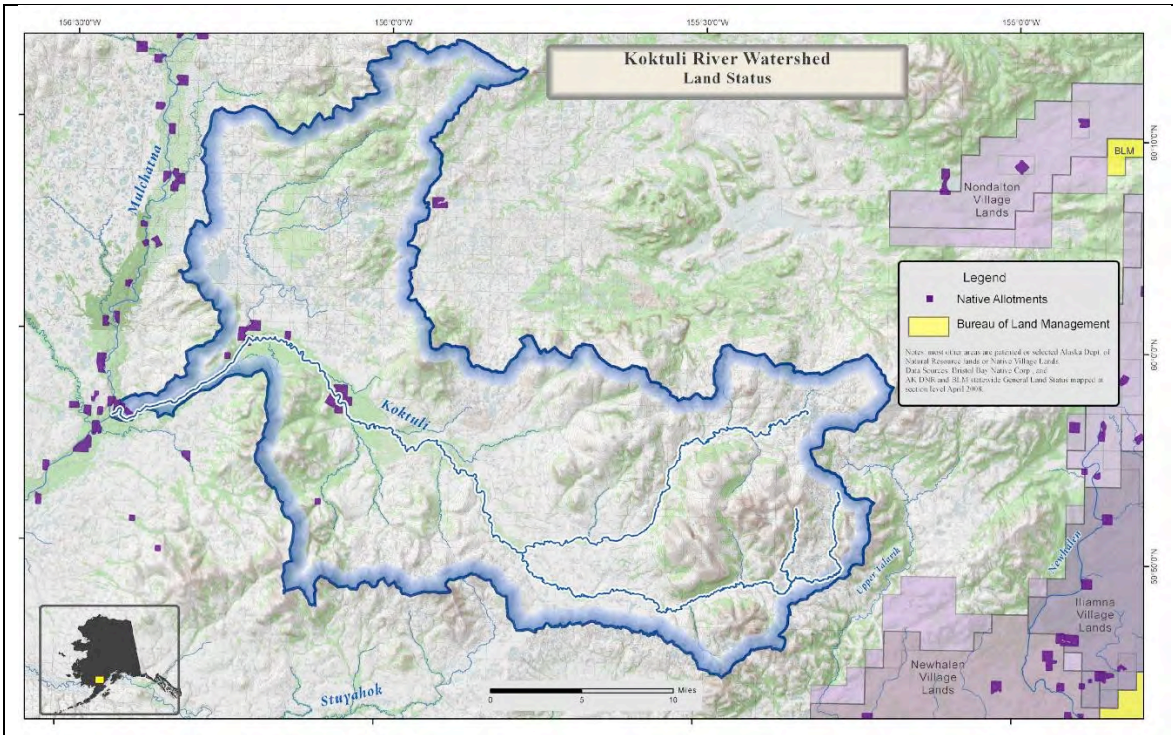

Figure 3: Koktuli River Watershed showing State Land Status and Native Allotments

B. Legal Background

The Clean Water Act ("CWA") is the nation's most important water quality protection statute, and one of its primary goals is to restore and maintain "the chemical, physical, and biological integrity of the Nation's waters." 33 U.S.C. § 1251(a). The Act seeks to achieve this goal in several ways, one of which is the promulgation of water quality standards. Under section 303(c), 33 U.S.C. § 1313(c), the state promulgates water quality standards ("WQS") not only to establish water quality goals for the nation's waters, but also to provide a regulatory mechanism when technology-based standards prove inadequate. *See* Water Quality Standards Handbook: Second Edition ("Handbook"), EPA-823-B94-005a, p. INT-1 (1994). Generally, WQS define the water quality goals for a waterbody by designating the permissible uses of the waterbody, setting criteria to protect the designated uses, and using antidegradation requirements to prevent any worsening of water quality. 40 C.F.R. § 131.6. As a result, WQS are a critical and necessary part of the CWA's mandate to enhance and maintain water quality in order to protect public health and welfare, especially when technology-based standards under the National Pollutant Discharge Elimination System ("NPDES") permit system do not achieve established water quality protections.

Antidegradation is a WQS requirement found in federal regulations with some further analysis provided in section 303(d). The goals of antidegradation are to: (1) ensure that no activity will degrade water quality so as not to support existing uses; and (2) maintain and protect high quality waters. 33 U.S.C. § 1313(d); 40 C.F.R. § 131.12. The federal antidegradation policy requires states to develop rules and implementation procedures to protect existing uses and to prevent clean waters from being unnecessarily degraded, while giving very stringent protection to the highest quality waters in the state. Federal regulations specify that each state must adopt an antidegradation policy "consistent with the following":

(1) Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.
(2) Where the quality of the waters exceed levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected unless the State finds, after full satisfaction of the intergovernmental coordination and public participation provisions of the State's continuing planning process, that allowing lower water quality is necessary to accommodate important economic or social development in the area in which the waters are located. In allowing such degradation or lower water quality, the State shall assure water quality adequate to protect existing uses fully. Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control.
(3) Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of

> exceptional recreational or ecological significance, that water quality shall be maintained and protected.

40 C.F.R. § 131.12.[3] In 1997, Alaska adopted this three "tier" approach almost word for word, although the State's policy specifies, under (2), that the state may allow "the reduction of water quality for a short-term variance under 18 AAC 70.200, a zone of deposit under 18 AAC 70.210, a mixing zone under 18 AAC 70.240, or another purpose as authorized in a department permit, certification, or approval." 18 AAC 70.015(a). This exemption can be granted only after an applicant submits an application and the department finds that the exemption is necessary for social or economic reasons, that certain water quality criteria will not be violated, and that certain methods of pollution control will be implemented. 18 AAC 70.015(a)(2).

On February 17, 2010, Trout Unlimited, Inc.-Alaska Program, the Nushagak-Mulchatna Wood-Tikchik Land Trust, Alaska Alpine Adventures, LLC (Dan Oberlatz), SnoPac Products, Inc., Alaska Independent Fishermen's Marketing Association, Renewable Resources Coalition, and Nunamta Aulukestai submitted a rule-making petition to the Alaska Department of Environmental Conservation (ADEC) under Alaska Statute (AS) 44.62.220, which allows any interested person or group to petition an agency for the adoption or repeal of a regulation. On March 19, 2010, ADEC denied the petition, which was amended on March 26, 2010. In that decision, ADEC Commissioner Larry Hartig found that ONRW status could not be determined without a permitting process for discharge into the waterbody being underway, ADEC had no process for designating an ONRW in a separate process, and the petition did not provide data that the Koktuli is a Tier 2 waterbody.

EPA's antidegradation regulation also requires the State to "identify the methods for implementing such policy. . . ." 40 C.F.R. § 131.12(a). For enforcement purposes, this is the most important part of the antidegradation requirement. The procedures developed to implement the antidegradation policy must be designed to: (1) prohibit any degradation in some waters; (2) minimize the impacts of degrading activities in others; and (3) assure that in every case, existing uses are protected. *See* Handbook, pp. 4-1 – 4-2.

On July 14, 2010, DEC issued Interim Antidegradation Implementation Methods ("Interim Methods") as guidance. "Guidance" documents do not require a formal rulemaking procedure, and the Interim Methods were developed and implemented without any public

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[3] *See also* Handbook, p. 4-10:

- Tier 1: Protect Existing Uses. Permit no activity that would eliminate, interfere with or lower water quality necessary to support existing uses.
- Tier 2: Maintain "High Quality" Waters. Avoid – or at least hold to an absolute minimum – any lowering of the water quality of waters that meet or exceed standards. In order to allow additional pollution loading, it must be shown that the increase is necessary, there are no alternatives to increasing the pollution, and the activity generating the pollution provides important economic or social development to the community (i.e. jobs, sanitary services, etc.).
- Tier 3: Protect "Outstanding" Waters. Give the most ecologically significant and sensitive, the cleanest, and the most recreationally popular waters the strict protection they need and deserve (i.e., no degradation allowed).

involvement and may be modified or vacated in the same way. The Interim Methods are intended to specify the process and criteria used to determine when waters are degraded by discharges or nonpoint sources of pollution, and what social and economic benefit to the state would be necessary to justify any degradation. They should, but do not, also establish a process for nomination and designation of ONRWs. Now, during the Triennial Review process, ADEC is allowing the submission of ONRW nominations.

While ADEC has no designated process or requirements for designating ONRWs, Petitioners have found guidance from the Region X and Region VIII of EPA for factors to consider when designating ONRWs:

> The factors to be considered in determining whether to assign an ONRW designation may include the following: (a) location (e.g., on federal lands such as national parks, national wilderness areas, or national wildlife refuges), (b) previous special designations (e.g., wild and scenic river), (c) existing water quality (e.g., pristine or naturally-occurring), (d) ecological value (e.g., presence of threatened or endangered species during one or more life stages), (e) recreational or aesthetic value (e.g., presence of an outstanding recreational fishery), and (f) other factors that indicate outstanding ecological or recreational resource value (e.g., rare or valuable wildlife habitat).[4]

Other guidance is also helpful in identifying relevant criteria for designating ONRWs. For example, the Great Lakes Initiative ("GLI") identifies the following criteria:

> Waters that may be considered for designation as Outstanding National Resource Waters include, but are not limited to, water bodies that are recognized as: Important because of protection through official action, such as Federal or State law, Presidential or secretarial action, international treaty, or interstate compact; Having exceptional recreational significance; Having exceptional ecological significance; Having other special environmental, recreational, or ecological attributes; or waters whose designation as Outstanding National Resource Waters is reasonably necessary for the protection of other waters so designated.[5]

Other states, such as New Mexico, provide a detailed list of the materials that must be submitted to nominate surface waters for ONRW designation. Any person may nominate a surface water of the state for designation as an ONRW by filing a petition with the New Mexico water quality control commission pursuant to petition guidelines.[6] A petition to classify a surface water of the state as an ONRW must include: (1) a map of the proposed surface water area; (2) a written statement based on scientific principles to support the

[4] U.S. Envtl. Prot. Agency, Region VIII, EPA Region VIII Guidance: Antidegradation Implementation 9 (1993), http://www2.rivernetwork.org/cleanwater/Region8_ch2_pg5-20.pdf
[5] Final Water Quality Guidance for the Great Lakes System, 60 Fed. Reg. 15,366, 15,413 (1995).
[6] N.M. Code R. § 20.6.4.8 (2000).

nomination; (3) supporting scientific evidence demonstrating that one or more of ONRW criteria has been met; (4) water quality data to establish a baseline for the proposed ONRW; (5) a discussion of activities that might contribute to the reduction of water quality in the proposed ONRW; (6) any additional evidence to substantiate the designation, including an analysis of the economic impact of the designation; and (7) an affidavit of publication of notice for the petition.[7] However, no specific ONRW criteria are included in the New Mexico petition requirements.

Similarly, Virginia adopted a nomination process that requires petitioners to justify an ONRW designation based on specified factors.[8] In Virginia, the State may classify unique and special surface waters of the state as an ONRW upon finding that such waters have (1) exceptional environmental settings and (2) *either* exceptional recreational *or* aquatic community significance. The factors are further broken down to include the following:

1) **Exceptional Environmental Settings**: This category lists those features that singly or in combination make a water body physically attractive. To meet this mandatory requirement, one or more of the following factors must apply:
    a) The water possesses outstanding scenic beauty resulting from the natural features of the basin such as its topography, geology, ecology or physiography; or
    b) The water has already received designation as a national wild and scenic river; or
    c) The water represents an important component of a state or national park, forest, or wildlife refuge; or
    d) The water includes remote, primitive or relatively undeveloped areas with public access by motorized vehicle restricted or unavailable.
2) **Exceptional Recreational Significance**: In order to demonstrate the nominated water body exhibits exceptional recreational opportunities, the water must support recreational activities which do not require modification of the existing natural setting such as fishing, canoeing, rafting, kayaking, tubing, birding, hiking, backpacking with primitive camping, or the like.
3) **Exceptional Aquatic Community Significance**: To demonstrate that a water body nominated for ONRW status contains an "exceptional aquatic community," one or more of the following factors must apply:
    a) The water supports an exceptional wild or natural fishery, or
    b) The water contains an exceptional high diversity of aquatic species (fish or benthic macroinvertebrate) as categorized by the appropriate protocol for that water body type and species, such as the 95th percentile of the EPA's Rapid Bioassessment Protocol II method for measuring macroinvertebrate diversity in

[7] *Id.*
[8] Memorandum from Ellen Gilinsky, Director, Virginia Department of Environmental Quality, on Guidance for Exceptional State Waters Designations in Antidegradation Policy Section of Virginia Water Quality Standards Regulation to Regional Directors (November 15, 2004), http://www.deq.state.va.us/export/sites/default/waterguidance/pdf/042021.pdf.

streams[9] or the 95th percentile of biological metrics provided in more recent EPA bioassessment technical support guidance documents for wadeable streams and rivers,[10] lakes and reservoirs[11] and estuarine and coastal marine waters.[12]

Because DEC has yet to develop antidegradation policy implementation procedures for designating ONRWs, this nomination follows the established criteria from Region VIII and other states as a basis to designate ONRWs in the Bristol Bay region, namely the Koktuli River, North and South Forks and Mainstem. **Based upon the following detailed information provided in this nomination, ADEC should classify Koktuli River, its associated sloughs and floodplains, the tributaries of the Koktuli River, as well as the North and South Forks from their sources to where the Mainstem discharges into the Mulchatna River, as Alaska's first Outstanding National Resource Water.**

[9] Plafkin, James L., Michael T. Barbour, Kimberly D. Porter, Sharon K. Gross and Robert M. Hughes, *Rapid Bioassessment Protocols For Use in Streams and Rivers: Benthic Macroinvertebrates and Fish*, United States Environmental Protection Agency; Office of Water; Washington, D.C. (1989).

[10] Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling, *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers: Periphyton, Benthic Macroinvertebrates, and Fish*, Second Edition, U.S. Environmental Protection Agency (1999), http://www.epa.gov/owow/monitoring/rbp.

[11] Gerritsen, Jeroen, Robert E. Carlson, Donald L. Dycus, Chris Faulkner, George R. Gibson, John Harcum, and S. Abby Markowitz, *Lake and Reservoir Bioassessment and Biocriteria, Technical Guidance Document*, United States Environmental Protection Agency (1998), http://www.epa.gov/owow/monitoring/tech/lakes.html.

[12] Bowman, Michael L., George R. Gibson, Jr., Jeroen Gerritsen, and Blaine Synder, *Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guidance*, United States Environmental Protection Agency, 2000, http://www.epa.gov/ost/biocriteria/States/estuaries/estuaries1.html.

II. RATIONALE FOR THE NOMINATION OF THE KOKTULI RIVER

The Koktuli River is part of the larger Bristol Bay watershed - an intricate system of rivers, lakes, and streams, 250 miles southwest of Anchorage, Alaska. Five major rivers (the Nushagak, Kvichak, Naknek, Egegik, and Ugashik rivers) draining into Bristol Bay produce: (1) one third of the world's sockeye salmon (the most important commercial stock), (2) the world's most famous indigenous trout fisheries, (3) tremendous commercial, subsistence and sport fishing economic value (contributing over $440 million to Alaska's economy each year), and (4) because of the fish, one third of the U.S. grizzly bear population. The Koktuli River system stands as a crucial component of this intricate web of habitat sustaining the biocomplexity of fisheries, especially salmon, populations within the watershed.

The headwaters of the Koktuli River are located approximately 120 miles northeast of the community of Dillingham, Alaska. The Koktuli flows approximately 75 miles from its headwaters to the confluence of the mainstem with the Mulchatna River, which then flows into the Nushagak River and into Bristol Bay. The Nushagak River (including the Koktuli) hosts the largest king salmon run in Alaska; in 2006 ADF&G counted 125,000 into the system. In 2008, the Alaska Department of Fish and Game documented an inshore run of over 10 million sockeye salmon in the Nushagak system (ADF & G, 2008).

Though it is clear under federal regulations that in designating ONRWs "water quality shall be maintained and protected", neither the federal regulations nor the State of Alaska DEC spells out definitive criteria for ONRW designation beyond the suggestion that candidate waterbodies should be "waters of exceptional recreational or ecological standards" or ones already recognized under a park, refuge or Wild and Scenic Designation. But in the words of past member of the Alaska Board of Fisheries Rupe Andrews, who spoke to the value of the Koktuli River, and its nearby Upper and Lower Talarik Creeks, we believe that "Extraordinary places deserve extraordinary protections." (Board of Fish Meeting – December 2006)

Petitioners nominate the Koktuli River system as Alaska's first ONRW for several reasons. First, it has already been recognized by stakeholders (ranging from back country recreationists to commercial fisherman and local businesses to the Alaska state legislature) as an important area through existing "special designations." Second, the Koktuli River holds extraordinary ecological significance both because of its own unique ecosystem and as a major support system for the larger region . Third, the recreation opportunities are outstanding, setting the gold-standard for Alaska backcountry floating and fishing opportunities.

A. Previous/Existing Special Designations

The Kokuli watershed is already recognized as having exceptional ecologic, historic, and recreational value to the state of Alaska and beyond. As world salmon resources decline the value of Bristol Bay's salmon resources continues to grow. As early as the 1970's the state recognized the importance of the fishery and the watershed that supports it and determined it was in the best interest of the state to provide heightened protection for the Bristol Bay area, its wild salmon and the superb existing recreational, subsistence, commercial and ecological values within and connected to the area. In 1972 the Bristol Bay Fisheries Reserve was created - the Koktuli River lies in the heart of this Reserve Area..[13] These reasons for protection continue to be relevant and support the need for additional protective measures in the Bristol Bay region, especially in the Koktuli watershed.

There is wide-ranging support from a diverse stake-holder group that the Koktuli River system is extremely important to Alaskans and special recognition and protection of the Koktuli river system re-emerged as a priority amongst fisheries stakeholders over two years ago, when the Board of Fisheries (BOF) reviewed Proposal 121 which would provide additional protections for the watersheds in the region. The proposal received the most public testimony recorded in the history of the BOF in favor of a proposal. As a result of the meetings, the Board of Fisheries acknowledged the Koktuli River and the larger Bristol Bay watershed as outstanding fisheries resources by establishing a Habitat Committee to further address the potential need for additional protective measures. Testimonies of support for these waters to be protected as a Fisheries Refuge came from local Natives, commercial and sport fisherman, as well as attorneys and scientists. **(See Section on *Community Support and Testimony* on pg. 48)**

During the following legislative session, two bills, Senate Bill 67 and House Bill 134, were introduced to offer higher standards of protection for the Koktuli River and other key systems in Bristol Bay. Senate Bill 134, the *Wild Salmon Protection Act*, aimed for protection of water used by salmon or for human consumption.[14] The Bill passed out of the Fisheries Committee of the 25th legislature. As introduced, it provided that subject to exceptions for most current uses of water, a person would not be able to "withdraw, obstruct, divert, inject, pollute or pump" surface or ground water or "alter, destroy, displace, relocate, channel, damn [or] convert to dry land" any water body in the Nushagak River drainage and other rivers which flow into Bristol Bay.[15] The Bill received the most hearings held in one committee in

[13] This determination prohibited the issuance of a surface entry permit or an exploration license to develop an oil and gas lease until the legislature found that the entry would not constitute a danger to the fishery. However, this provision did not include provision on mining, which now stands at the greatest potential risk to these waters. **(See Section on *Potential Risks to the Reduction of Water Quality and Existing Values* at pg. 35)**

[14] H.B. 134, 25th Leg. (Feb. 2007), *available at* http://www.legis.state.ak.us/PDF/25/Bills/HB0134A.PDF (last checked Mar. 24, 2008). While S.B. 67 primarily seeks to protect fish, game, habitat, and public uses of these resources, and would be implemented by ADF&G and DNR, H.B. 134 would add a new section to the Alaska Code, Alaska Stat. § 16.10.015, and would be implemented by the Alaska Department of Environmental Conservation (DEC).

[15] See H.B. 134, 2007 Leg., 25th Sess. § (Alaska 2007).

Alaskan history and had an astounding level of public support, however it didn't get passed into law. In essence, the Bill would have offered many of the same antidegradation policies that the designation of as an Outstanding National Resource Water would enact. Recognizing the time required and the political process of passing a such a Bill in the State legislature, the immediate threats to the Koktuli River, the mission of the Water Department of Alaska's Department of Environmental Conservation to improve and protect the State's water resources, and the intent of the federal law governing Outstanding National Resource Waters, the petitioners believe ONRW designation best ensures continuation of the pristine water quality of the Koktuli River system.

B. Exceptional Ecological Value

The Koktuli River watershed is one of the most intact watersheds left on the planet. Characterized by healthy meandering rivers, clean clear cold water and a haven for fish and wildlife alike – it deserves special protection for its pristine, intact ecological conditions.

As previously discussed, the federal Clean Water Act and accompanying federal regulations require States to develop water quality standards[16], which must include an antidegradation policy.[17] Ultimately, the state must develop policy consistent with the federal antidegradation policy. Clearly under federal antidegradation regulations, "exceptional recreational or ecological significance" is a central criterion for designating ONRWs, as well as formal recognition that the water body is of high quality, in this case, recognition previously granted by the Alaska State Legislature (as discussed in above Previous/Existing Special Designations Section).

Supporting Scientific Evidence Demonstrating ONRW Criteria

1. Healthy fish populations

The pristine water, intact river beds, and relatively untouched uplands of the Koktuli River sustain one of the most productive trout and salmon fisheries in the world. These fish support other aquatic life in the system as well as many terrestrial species.

The rivers and streams of the Koktuli watershed provide some of the best coldwater fish habitat in the region. The Koktuli salmon are of particular importance because they significantly contribute to the genetic diversity of Bristol Bay's salmon fisheries. Escapement[18] into the Koktuli's North and South forks is historically strong for coho, sockeye, and Chinook salmon. Historic aerial escapement index counts of Chinook salmon, conducted by the Department of Fish and Game between 1967 to 1999, show the Koktuli River to have the highest mean of

[16] 33 U.S.C. s. 1313(a); 40 C.F.R. s.131
[17] 40 C.F.R. s.131.12
[18] It must be noted that any measure of escapement is probably an underestimate of the actual and that escapement estimates are made after harvests; and, therefore, are a very poor representation of the production.

streams selected by salmon (out of the Stuyahok River, Nushagak River, Mulchatna River, King Salmon River, Klutuspak River, Kokwok River, Iowithla River, and Koktuli River, all within the Nushagak and Mulchatna drainages).[19] The South Fork is particularly important for Chinook salmon. An estimated 13,900 Chinook salmon escaped into the South Fork Koktuli in 2005.[20] State biologists estimate that on average, nearly ¼ of the king salmon that return to the Nushagak drainage each year spawn within the Koktuli river system (Dye and Schwanke, *In Prep)*. Despite the limitation that escapement numbers give when compared to actual production numbers, the Koktuli River system remains comparatively high, emphasizing the exceptional importance of this system to fisheries production within the larger Bristol Bay watershed.

In addition to the many salmon that use the drainage, the Koktuli River system lies within an area specially managed for its exceptional rainbow trout fishery resources. Designed to protect the biological integrity of the region's world famous wild rainbow trout stocks as well as to ensure recreational benefit to all users, the regulations for the Southwest Alaska Rainbow Trout Management Plan (SWARTMP) were adopted by the Alaska BOF in 1990. The BOF established eight catch and release areas, six fly-fishing catch and release only areas, and eleven single-bait artificial lure areas (including the Koktuli River system) to protect rainbow trout stocks.[21]

The outstanding qualities of the rainbow trout fisheries of the Koktuli River system are further emphasized by field research conducted by the Department of Fish and Game during the 1970's. Demonstrating the remarkable size of many of the fish found within the Koktuli river system, the length frequencies documented for rainbow trout were highest for the Koktuli with a mean[22] of 399 millimeters (rivers surveyed include the Koktuli, Chilikildrotna, Chilchitna, and Stuyahok).[23] In addition to rainbow trout, researchers captured grayling, dolly varden, northern pike, as well as round whitefish during their surveys. The mean length for grayling within the Koktuli River system was also higher than in the Stuyahok, Chilchitna, and Chilikadrotna Rivers.

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[19] Dunaway, Dan and Sonnichsen, Sandra, *Area Management Report for the Recreational Fisheries of Southwest Alaska Sport Fish Management Area*, Fishery Management Report No. 01-06, 1999, http://www.sf.adfg.state.ak.us/sfPubsComplete/Fmr01-06.pdf.

[20] Northern Dynasty Mines, Inc. 2006d. Pebble Project. Baseline Environmental Team Agency Meetings. November 28 to December 1, 2006. Anchorage, Alaska.

[21] Alaska Dept. of Fish & Game, Division of Sport Fish, *Southwest Alaska Alaska Rainbow Trout Management Plan*, Alaska Board of Fisheries, Feb. 1990, at pages 1, 5, 8-9, http://www.sf.adfg.state.ak.us/region1/trout/wildtrout/rbtmgt1990bof.pdf

[22] Range of fork length for rainbow trout was between 262-519 mm; 203-436mm for grayling; 37-495 for dolly varden; 559- for Northern Pike; and 115- for round whitefish.

[23] Russell, Richard, and Gwartney, Louis A., Annual Report for Inventory and Catologing of Sport Fish and Sport Fish Waters of the Bristol Bay Area, Alaska Department of Fish and Game, 1978. Available online at http://www.sf.adfg.state.ak.us/FedAidPDFs/fredF-9-10(19)G-I-E.pdf.

Although there is a lot of evidence supports the outstanding ecological significance of the Koktuli river, there is a lot left to be learned. Stream surveys conducted by The Nature Conservancy in 2008, indicated that data regarding presence and absence of anadromous fish in the Koktuli River system still remains understudied. Working in partnership with the Department of Fish and Game, 27 streams were studied to determine the presence or absence of anadromous fish - anadromous rearing Chinook and/or coho salmon were documented in 20 streams, 13 of which were tributaries to the Koktuli totaling over 17 miles .[24] Recent research conducted by the Alaska Department of Fish and Game further updates historic studies and documents fish distribution, resident fish size composition, as well as water quality in the Koktuli River. The report *Koktuli River Fish Distribution Assessment* is included in full in Appendix III. However, excerpts from the discussion are selected below to further detail the outstanding fishery resources and water quality in this section of the nomination.

> The float trips provided documentation of the size distribution, presence, and distribution fish species in the lower 52 miles of the river. Size distributions of fish captured with hook and line can be used for future comparisons of samples collected in a similar manner. The similarity of rainbow trout length distributions during the 3 months of the project provides evidence that there may be a resident population in the river during the summer… The length distributions of Arctic grayling were significantly different due to slightly larger fish captured in June. With Arctic grayling present upstream of the float survey area, the difference in length distributions may be explained by the larger grayling being located father upriver later in the summer…
>
> Although not an index of abundance, the CPUE of resident species does provide a means of documenting fish distribution in the survey area. Rainbow trout were most common in the lower half of the survey area and Arctic grayling were more common in the upper half of the survey area and are common above the survey area…The distribution of rainbow trout throughout the river did not appear to be change significantly over the course of the three float trips. Dolly Varden appeared in the lower half of the river between June and July and exhibited an upstream movement between July and August. This is likely an anadromous population, similar to those observed in the Togiak River drainage west of the Nushagak River, that enter the system to feed on salmon spawn during late summer and to spawn in the fall. Although spawning locations are unknown, some of the Dolly Varden sampled in August were developing sexual characteristics such as spawning colors…
>
> Adult salmon were present throughout the survey area seasonally and appeared abundant. Spawning was observed by Chinook, chum, and sockeye salmon beginning in the upper section of the float, and aerial surveys indicate that spawning occurs above this location as well. Juvenile and Chinook and coho salmon were captured at three of the four water quality sampling sites and salmon fry were commonly observed throughout the area.[25]

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[24] Johnson, J., and Klein, Kimberly, Special Publication No. 09-05 Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes – Southwestern Region, Effective June 1, 2009Available online at http://www.sf.adfg.state.ak.us/SARR/AWC/index.cfm/FA/data.AWCData

[25] Craig J. Schwanke, *Koktuli River Fish Distribution Assessment,* Alaska Department of Fish and Game, Fishery Data Series No. 07-78, December 2007, 14 at http://www.sf.adfg.state.ak.us/FedAidPDFs/fds07-78.pdf.

Each year more data is collected and more is learned about the importance of the Koktuli river to healthy trout and salmon populations.

2. Koktuli River salmon support regional populations.

The Koktuli River system makes significant contributions to the sustainability of salmon populations in the larger river systems within the Bristol Bay watershed by providing critical spawning habitat and genetic diversity to our world's salmon populations.

In 2004, estimates of more than 14,000 Chinook and 12,000 sockeye spawned in the Koktuli drainage (McLarnon 2006). The Koktuli River drainage supports a variety of important fish species and serves as a fish passage corridor between portions of the watershed used for fish production. Chinook salmon (*Oncorhynchus tshawytscha*), chum salmon (*Oncorhynchus keta*), coho salmon (*Oncorhynchus kisutch*), sockeye salmon (*Onchorhynchus nerka*), round whitefish (*Prosopium cylindraceum*), Pygmy whitefish (*Prosopium coulteri*), Arctic grayling (*Thymallus arcticus*), Dolly Varden (*Salvelinus malma*), Arctic char (Salvelinus alpinus), rainbow trout (*Osmerus mordax*), slimy sculpin (*Cottus cognatus*), and Alaskan brook lamprey rely on the Koktuli system for a portion of, or all of their spawning, incubation, rearing, and passage life phases. These species contribute to sport, commercial, and subsistence fishing in the area (Wiedmer, 2006) (Table 3). The calendar of when many of these species use the Koktuli River system is available in the periodicity charts in Appendix IV.

In her written testimony to the Alaska Board of Fisheries in favor of Proposal 121, Dr. Carol Ann Woody, fisheries biologist and regional expert, spoke on the importance of preserving the Koktuli River system because of the critical role it plays in maintaining the biodiversity which sustain the world-renowned fisheries of Bristol Bay. She explained the complexity of one system in the context of the larger watershed and the global relevance for salmon conservation and habitat management:

> Throughout the world, once productive commercial fishery stocks are no longer viable, (e.g., Atlantic salmon and cod, Pacific sardine, Peruvian anchoveta etc.). In contrast, the Bristol Bay salmon fishery is extraordinary because it is considered a rare example of a sustainable fishery. This is due primarily to unaltered habitat, good management, and unparalleled stock biodiversity - several hundred smaller spawning populations, comprise the whole, or the metapopulation (Hilborn et al. 2003). This salmon biodiversity tempers effects of unpredictable environmental change because different stocks perform better under different environmental conditions. Because future environmental variation is unpredictable, and because development can adversely affect fish production, it is important to understand and conserve biodiversity… Bristol Bay provides the world with a rare and valuable natural laboratory, annually revealing how salmon naturally colonize, adapt and flourish in a relatively unaltered state. Because Bristol Bay contains the greatest sockeye salmon genetic and habitat diversity documented to date (Habicht et al. 2004, Ramstad et al. 2004, Ramstad et al. 2006), studies here provide a valuable template for

> rehabilitation of the more than 300 endangered salmonid stocks in the Pacific Northwest (Nehlsen et al. 1991, Allendorf et al. 1997).[26]

Dr. Woody's assertions are further supported by the research of Dr. Daniel Schindler, H. Mason Keeler Professor of Aquatic and Fishery Sciences at University of Washington and Dr. Jack Stanford, Professor of Ecology, at the University of Montana. Their testimony on the ecological significance of the Koktuli River system is included in Appendix V to provide scientific support for this nomination. In addition Jack Williams, Trout Unlimited's Senior Scientist and leader in the fisheries ecology field, recently testified on behalf of salmon before the House Subcommittee on Insular Affairs, Oceans, and Wildlife, in his testimony he emphasized the importance of protecting salmon strongholds, such as those that exist in the Koktuli river drainage:

> Protecting the best remaining stronghold populations has long been recognized as the First Principle of conservation biology. The concept of protecting salmon strongholds has been promoted as a scientifically sound and cost effective approach to anchor wild salmon populations (Rahr and Augerot 2006). Additionally, scientists have argued for a large, watershed scale approach to fisheries conservation that would protect entire healthy watersheds and the native fish communities contained therein (Moyle and Yoshiyama 1992). [27]

The Koktuli river is a salmon stronghold not only for the Bristol Bay region but for the entire West coast. By protecting the Koktuli spawning populations of salmon we can help ensure that the Bristol Bay fishery continues as a world leader and can strengthen the existing model of sustainable salmon management.

3. Koktuli salmon as a keystone species

The return of anadromous fish maintains stream productivity as decomposing carcasses release nutrients to the food chain to provide food for rearing salmon, resident species, terrestrial animals and vegetation. Salmon are considered a "keystone" species because of the myrid of species that depend on them for survival. Salmon runs function as huge conveyor belts that transport life-supporting marine nutrients into upstream habitats. As salmon move upstream, spawn and die their decaying carcasses are the primary food source for aquatic invertebrates and fish. They also are eaten by birds and terrestrial mammals which transfer some of those nutrients to nearby marshes and upland plant communities. For example sockeye salmon runs in southwest Alaska add up to 170 tons of phosphorous per year to Lake Illiamna[28], and the number of salmon carcasses carried by brown bears to within 100 meters of

[26] Dr. Carol Ann Woody, Written Testimony Submitted to the Alaska Board of Fisheries, December 2006.
[27] Dr. Jack Williams, Written Testimony Submitted to the US House Subcommittee on Insular Affairs, Oceans, and Wildlife, June 2009
[28]Hartman and Burggner 1972 in Mary F. Willson, Scott M. Gende, and Brian H. Marston. 1998. Fishes and the Forest. *Bioscience*. 48(6):455-462).

streams adds phosphorous to terrestrial systems at a rate of 6.77 kg/ha -- the equivalent application rate of commercial fertilizers for evergreen trees[29],[30].

Many terrestrial wildlife species found in the region use the Koktuli drainage and often take advantage of the abundant salmon resources there. Marten may be present in low numbers restricted to areas of extensive mature forest. Moose populate forested and riparian areas of the drainage. Caribou of the Mulchatna Caribou Herd frequently travel through the Koktuli Drainage. Upper portions of the Koktuli river drainage are important Caribou calving habitat and other areas see heavy use during the post-calving aggregation period in late June and early July.[31] Large numbers of caribou periodically winter throughout the drainage, but population counts are highly variable. Brown bears, wolves, and coyotes roam throughout the drainage. Beaver, mink, muskrat, and river otters use the wetland and riparian areas. Waterfowl, water birds, and ptarmigan use the areas of the drainage that provide habitat needs of specific species (Woolington, 2006).

4. Water quality throughout the watershed is consistently pristine[32] [33]

The Koktuli River watershed, including the mainstem, the North and South forks and their respective watershed areas, are currently roadless, which further protects the system from

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[29] Mary F. Willson, Scott M. Gende, and Brian H. Marston. 1998. Fishes and the Forest. *Bioscience*. 48(6): 455-462).

[30] http://www.wildsalmoncenter.org/about/whySalmon.php

[31] Alaska Department of Natural Resources, Division of Mining, Land and Water, *Nushagak & Mulchatna Rivers Recreation Management Plan (2005 Revision)*, Adopted April 2005.

[32] This section was compiled by Kendra Zanzow of the Center for Science in Public Participation.

[33] Summary of data collection. Data from a current study of discharge and water quality on the mainstem Koktuli River has been ongoing since 2005, conducted by hydrologist Cathy Flanagan with support from the Bristol Bay Native Association (BBNA). Data on stream water and sediment have also been collected by the Environmental Natural Resources Institute (ENRI) of the University of Alaska, Anchorage on the mainstem and North and South Fork Koktuli Rivers (2008) and by the Nature Conservancy along the North and South Forks and its tributaries (2009). Additionally, Northern Dynasty Minerals, Ltd. Released a report with data collected in 2004 (NDM 2005, available at: http://dnr.alaska.gov/mlw/mining/largemine/pebble/2005_plans/sp_ch06.pdf). This baseline data is supplemented by research conducted by Craig Schwanke under the Department of Fish and Game and data collected by Dr. Carol Ann Woody, cataloging many new miles of stream in the Anadromous Waters Catalog. It is believed that these data provide an adequate baseline for the proposed Koktuli River ONRW, however many studies are currently in progress and we hope that new scientific info that becomes available can further supplement existing data.

Cathy Flanagan's data details water quality (temperature, specific conductivity, dissolved oxygen, pH, turbidity, water color), and water chemistry (nutrients, major elements, and trace elements) at a station on the Koktuli River below the confluence with the Swan River. These are included on Page 13 of the *Koktuli River Fish Distribution Assessment, 2007* in the Appendix III. Data from ENRI and The Nature Conservancy of water quality sampling on the North and South Fork Koktuli's and associated tributaries have not been released to the public. Both field data (pH, specific conductivity, dissolved oxygen, temperature) and analytical data (nutrients, major metals, trace metals, anions, cations) were collected. More preliminary data NOT USED in this assessment is available at : http://www.pebblepartnership.com/pages/environment/environment-pre-permitting.php#Report_Series_F. Cathy Flanagan's water quality data collection protocols are available in Appendix VI.

eroded sediment and damaging hydrograph changes that roads often contribute. Access in the upper areas of the Koktuli drainage is limited to a few small lakes suitable for the landing of small float planes. Most travel is by raft or on foot. Although there have been mineral exploration activities within the headwater drainages of the Koktuli River in recent years, consisting of drilling activity and temporary water use, which the Department of Natural Resources asserts to be "negligible," we can assume that the riparian ecology and stream habitat is currently largely intact.

Continued research, including data in the recently released Environmental Baseline Docuemtns (EBD) by the Pebble Limited Partnership, underscore that waters of the Koktuli Rivers are exceptionally high quality. (PLP, 2012, Chapter 9, Appendix 9.1).[34] It qualifies under the most stringent water quality criteria supporting drinking water and aquatic life uses, and supports the healthy diversity of fish species and genetic diversity of salmon stocks. Temperatures were generally low, [35] reflecting groundwater inputs, while dissolved oxygen was high. Specific conductivity, hardness, and alkalinity were low, although generally somewhat higher in Upper Talarik Creek. Dissolved organic carbon (DOC) was also low, with the highest concentrations (in wetlands at the headwaters of the North Fork Kotuli) below 8 mg/L. Most trace metals were rarely, if ever, detected. Metal concentrations increased briefly during spring snow melt, and appeared to correlate with the depth of snow and rapidity of melting. Metal concentrations may increase with fall rains, although generally to less extent than during snow melt and generally as particulate-associated. Water has little ability to buffer or mitigate potential toxicity of metals to aquatic life, based on the low alkalinity, hardness, and DOC.

Recent research and data continues to confirm that the chemical and physical water quality of natural riverine systems is affected by changes in seasonal discharge (Doyle et al., 2005). Thus it will change when break-up arrives. Dirt and dust entrain in snow and ice. As snow and ice melt, metals bound within dirt particles are released in drips and freshets. As the new fresh water sinks into the ground, it replenishes groundwater. Groundwater travels under streams and pushes up through the streambed sediments, flushing out metals that have sequestered in sediment pore water and sorbed to sediment surfaces. Between snow melt releasing dust particles and pushing dirt and rock along with it, and the groundwater pulsing from beneath streams, the metals entering the stream water column increase in a sharp pulse. This starts as melting begins, and continues until discharge – the volume of fresh water rushing into the streams – dilutes the incoming metals. As melting slows and trickles to a stop, the concentration of minerals dissolved in the water column stabilizes, with only occasional, localized spikes as rainstorms erode rock and push sediment into streams, increasing the concentrations of metals commonly found in surface geology, such as iron, aluminum, and

[34] Chapter 9.0, 9.1, and 9.2, including Appendices 9.1B, 9.1D, 9.2B, 9.2C, and 9.2D. In addition, EBD Appendix A (Quality Assurance/Quality Control, QA/QC), Appendix E (Consolidated Study Plan), Appendix F (Field Sampling Plans) and Appendix G (Quality Assurance Project Plans, QAPP) were reviewed where relevant to analysis of water quality data. Data available at www.pebbleresearch.com.

[35] For example, median temperatures at South Fork Koktuli main stem sites were 2°C, 3°C, 7°C, 5°C, 2°C, 3°C from downstream to upstream; temperatures could reach over 15 °C in July, and reached 20 °C at SK100F below Frying Pan Lake twice, in July 2004 and July 2005. In the Upper Talarik main stem, individual measurements were all below 12 °C except one sample at UT100B at 15°C in August 2005 and two samples at UT100D near 13°C.

manganese. Conversely, cations such as calcium, magnesium, and sodium are transported by groundwater to streams, and are in highest concentration when discharges are very low and groundwater makes up a significant part of the stream base flow. A large body of research has shown that a range of flow levels is important for different ecological processes (Poff, 1997) and that certain discharges are more important for the maintenance of nutrient transport rates, nutrient retention levels, and temperature regime maintenance (Doyle et al., 2005, Doyle, 2005, Emmett et al., 2001).

Therefore, we can expect the median water quality to be consistent, but with occasional spikes in erosional material and cations consistent with seasonal events such as melting, rains, and fluctuating stream discharge volumes. When the full data is graphed as a box plot, occasional unusually high concentrations observed are shown as outliers.

Based on the available data, all trace and major elements, as well as ammonia, pH, and other parameters set out in the State of Alaska Water Quality Criteria Manual for Toxic and Other Deleterious Organic and Inorganic Substances[36] meet or exceed State of Alaska water quality criteria for drinking water or aquatic life criteria, whichever is the most stringent for the parameter, when based on the median of surface water chemistry to date, with the exception of iron and copper at two sites very close to the mineral ore body at the headwaters of the South Fork Koktuli. Graphs representing examples of ranges and medians for common minerals are found in Appendix VII.

The streams of the Koktuli watershed are generally below the state-recommended alkalinity standard and therefore have little buffering capacity, and are susceptible to changes in pH – these streams will find it harder to recover from introduction of acid in the water than streams that have higher alkalinity and higher buffering capacity. The median alkalinity reaches the State of Alaska recommendation on the main stem of the Koktuli River.

The maintenance of the nutrients, water chemistry, and temperature regimes of a system become extremely important when we begin to consider the effects that changes in these parameters could have on the health of the resident and anadromous fish species that use Koktuli River system and the outstanding habitat that ultimately supports outstanding commercial, recreational, and subsistence benefits. By preventing degradation to the Koktuli's pristine water quality, ONRW designation would preserve and protect fish habitat and the recreational and ecosystem function dependent on them. Altering the functions of a natural riverine system so that the optimal conditions are not attained or do not coincide with the needs of different periods of species life cycles, may cause adverse effect on aquatic species.[37]

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[36] Draft, as amended December 12 2008

[37] Example of natural riverine system functions that might cause adverse effects on aquatic species if altered:

- altering optimal water temperature, pH, dissolved oxygen, and chemical composition;
- altering optimal water velocity and depth;
- altering optimal stream morphology;
- increasing suspended organic or mineral material;
- altering chemical/physical character of bottom sediments;

C. Exceptional Recreational and Social Values

The pristine, free flowing waters of the Koktuli drainage contribute to the extraordinary sport, and subsistence fishing opportunities in the region and also play a significant role in the success and sustainability of the regional commercial fishing industry, the primary source of employment and income in the region.

1. Recreation: Value of current use and potential impacts

The Koktuli River is well known across the state, the nation, and the world, for the outstanding recreational capacity of its water quality, ecology, and perhaps above all, fishery resources. The very fact that this river system resides in such a remote region, with very little public access and infrastructure development, makes recreation on the Koktuli River an unparalleled experience. Recreation and tourism spending in Bristol Bay brings $90 million to the state in the form of taxes and licenses each year. In addition, it is estimated that anglers that come to the Bristol Bay area spend about $117 million within the local economy.

The Koktuli River offers world-renowned sport-fishing opportunities for anglers visiting from around the globe. While other areas in the Bristol Bay watershed may receive more pressure due to easier access, the remoteness and pristine nature of this system offers an unparalleled fishing experience within the Bristol Bay Fisheries Reserve. For example, the South Fork flowing into the mainstem of the Koktuli River is a popular float for anglers seeking a multi-day, remote wilderness experience in the larger Bristol Bay watershed. As part of the *Economics of Wild Salmon Watersheds: Bristol Bay, Alaska* report, anglers coming to the Bristol Bay region were surveyed and 70% of those surveyed said the most important attribute of the recreational experience was "[f]ishing in a remote, off-the-road locations." It was also noted in the survey that if a road were built that provided easier access to the area, 45.5% of non-residents and 30.4% of residents felt that they would stop fishing in this area and potentially stop coming to Alaska to fish entirely."[38] (Duffield et al, 2006, p. 45-63).

- increasing sedimentation and reduction in permeability of substrate;
- reducing food supply; and
- reducing protective cover (e.g., overhanging stream banks or vegetation).

[38] John Duffield and Chris Neher et al, Duffield, *The Economics of Wild Salmon Watersheds: Bristol Bay, Alaska*, 2007 at 45-63.

Angler on the Koktuli River. Photograph by Ben Knight.

Although specific economic studies haven't been done for the Koktuli River, by taking a look at the the role recreation plays in the regional economy we can see that salmon and the waters that support them are critical to maintaining this exemplary recreation area. Sport fishermen spend some $60 million a year to experience the Bristol Bay watershed. Over 65,000 people visit the Bristol Bay region each year to fish and recreate. Near the major communities, local roads provide sport fishermen with limited access. Clients of remote lodges pay up to $8000/week to fish in the pristine waters of the Bristol Bay watershed. Whether it is fishing for a giant 30 inch rainbow, Chinook or sockeye salmon, or grayling, sport-fishing opportunities in Bristol Bay are currently endless. The Alaska Department of Fish and Game recently published a study examining the impact and contributions of sport fishing in Alaska, which also breaks down the regional significance of the Bristol Bay watershed. Anglers fishing in Alaska spent nearly $1.4 billion on fishing trips, equipment, and development and maintenance of land use primarily for the pursuit of sport fishing in Alaska. Resident spending was $733 million and nonresident spending was $652 million. A total number of 15,879 full and part-time jobs were supported by money spent on sport fishing in 2007 and accounted for $545 million in total wages and benefits paid to employees and proprietors. South central Alaska, including Bristol Bay, was by far the most popular angling region in Alaska.[39] While the actual use of the Koktuli River contributes only a fraction to this

[39] Alaska Department of Fish and Game, *Economic Impacts and Contributions of Sportfishing in Alaska*, 2009, at http://www.sf.adfg.state.ak.us/statewide/economics.

economy, its outstanding ecological significance sustaining the biocomplexity needed to maintain the world renowned fisheries of the Bristol Bay watershed is a vital component to Alaska's sport fishing tourism industry.

John Duffield, one of the nation's top natural resource economists, has studied the region extensively. In a recent economic study, he concluded: "It is apparent that the private sector basic employment [harvesting, processing, recreation, government and health] in this economy is essentially 100% dependent on Bristol Bay's wild salmon ecosystems…The only other basic driver is government employment including hospitals, which are publicly funded. As a share of basic employment, the salmon ecosystem dependent sectors account for 63.6 % of all the basic employment that essential drives the Bristol Bay economy."[40] (Duffield et al, 2006, p. 16). Duffield's research further documents concern for maintaining the Bristol Bay sport fishing industry at its current level if there were larger infrastructure changes to the region, such as road development. Survey results of non-resident and resident anglers fishing in Bristol Bay show that 45.4% of non-residents and 30.5% of residents who had fished in the watershed felt that increased road access would cause them to stop fishing in the region.[41]

Although the Department of Fish and Game asserts that the sport-fish log books significantly underestimate actual use, the logs from 2005-2007 document usage patterns in the Koktuli River System. Regional Sport-Fish Biologist Craig J. Schwanke details usage of the system, as well as concerns of impacts from future mining development:

> The Nushagak/Mulchatna River drainage is a popular drainage for sport fishing in the BBMA [Bristol Bay Management Area] with 18,420 angler-days from 1999-2003 (Howe et al. 2001; Jennings et al. 2004, 2006a, b; Walker et al. 2003). The average effort for the Koktuli River during the same 5-year period was 519 angler-days (Howe et al. 2001; Jennings et al. 2004, 2006a, b; Walker et al. 2003). Potential mineral resource development at the headwaters of the Koktuli River may increase access and angling pressure on the river. Increased use and mineral development may also have the potential to negatively affect the river's water quality to the detriment of fish populations.[42]

It is evident, through both data on the use of the Koktuli River, as well as testimony in support of the fishing experience, that these waters support an exceptional fishery that greatly contributes to the larger tourism industry in the Bristol Bay watershed.

2. Subsistence: Value of current use and potential impacts.

[40] John Duffield and Chris Neher et al, Duffield, *The Economics of Wild Salmon Watersheds: Bristol Bay, Alaska*, 2007 at 16.
[41] John Duffield, *Supra* note 52 at 58.
[42] Craig J. Schwanke, *Koktuli River Fish Distribution Assessment,* Alaska Department of Fish and Game, Fishery Data Series No. 07-78, December 2007, 1 at http://www.sf.adfg.state.ak.us/FedAidPDFs/fds07-78.pdf.

The Koktuli River's renewable resources also contribute to the subsistence lifestyles of Alaska Natives in the area. Locals rely heavily upon these pristine waters and the fishery resources they sustain, to feed their families throughout the year. The Koktuli River system makes significant contributions to the sustainability of the salmon populations in the larger river systems within Bristol Bay, by providing critical spawning habitat. In 2004, estimates of more than 14,000 Chinook and 12,000 sockeye spawned in the Koktuli drainage (McLarnon 2006).

Residents of native allotments along the Koktuli, as well as residents of Ekwok, New Stuyahok, Dillingham, and adjacent inland areas of the Nushagak and Mulchatna River drainages have relied on the Koktuli River area as a place of subsistence harvest. Residents of these areas hunt for both moose and caribou and trap fur bearers from this area, the Koktuli River provides riparian habitat zones for movement corridors, cover and forage. Salmon harvest occurs more intensively near communities, although the Koktuli River and its tributaries are known to be important spawning and rearing habitat for the species previously listed in the periodicity tables (Appendix IV).

While there is certainly individual value of the Koktuli watershed for subsistence use, as previously discussed, the health of these waters directly contribute to the larger Bristol Bay watershed and related subsistence use. There are 25 communities in the region with a resident population of about 8000. Major communities located within the region include Naknek, King Salmon, Dillingham, Togiak, Nondalton, Newhalen, and Iliamna. In addition, the smaller communities of Ekwok, New Stuyahok and Koliganek are the primary users of the subsistence resources in the Nushagak drainage. About 70% of the population is Alaska Native, relatively high compared to the rest of the state which is estimated at about 16%. Alaska Natives likely followed salmon runs after the last ice age ended (~10,000 – 15,000 years ago) and settled in regions with abundant dependable food resources. In Bristol Bay more than 50% of the subsistence resource is from salmon dependant upon clean water and healthy habitat. Approximately one third of the subsistence harvest comes from land mammals (31%); and non-salmon fish comprise another 10% of the subsistence harvest. Alaskans in Bristol Bay harvest some 2.4 million pounds of salmon (or ~315 lbs per person) for subsistence each year from tributaries of Bristol Bay.[43]

Specific subsistence use of the Koktuli watershed was recently documented in a study conducted by The Nature Conservancy. The primary product of the ecoregional assessment was to term a portfolio of areas of biological significance as well as collect traditional ecological knowledge of use patterns. Figures 4-6 show documented subsistence use of the Koktuli watershed for harvesting moose, sockeye, Chinook, coho, chum, and pink salmon. The study identifies the Nushagak drainage as one of the richest areas in the state in terms of its abundance of natural resources.

[43] John Duffied, *Supre* note 52 at 11.

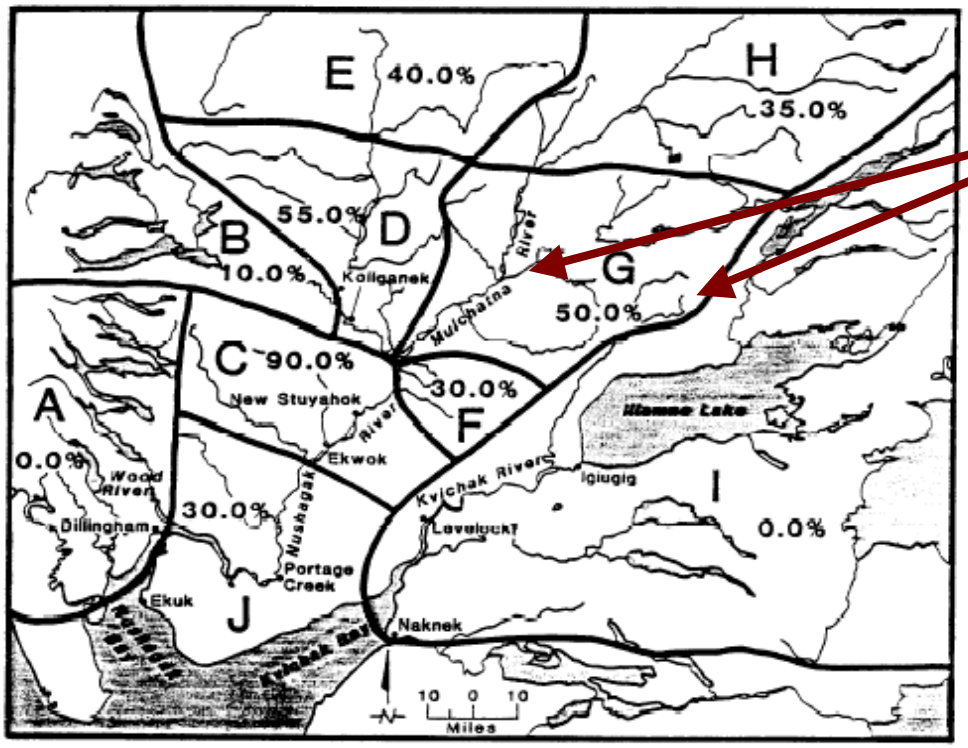

Figure 4: Illustrates 30% of Ekwok households which used the Koktuli River watershed for Moose Hunting.

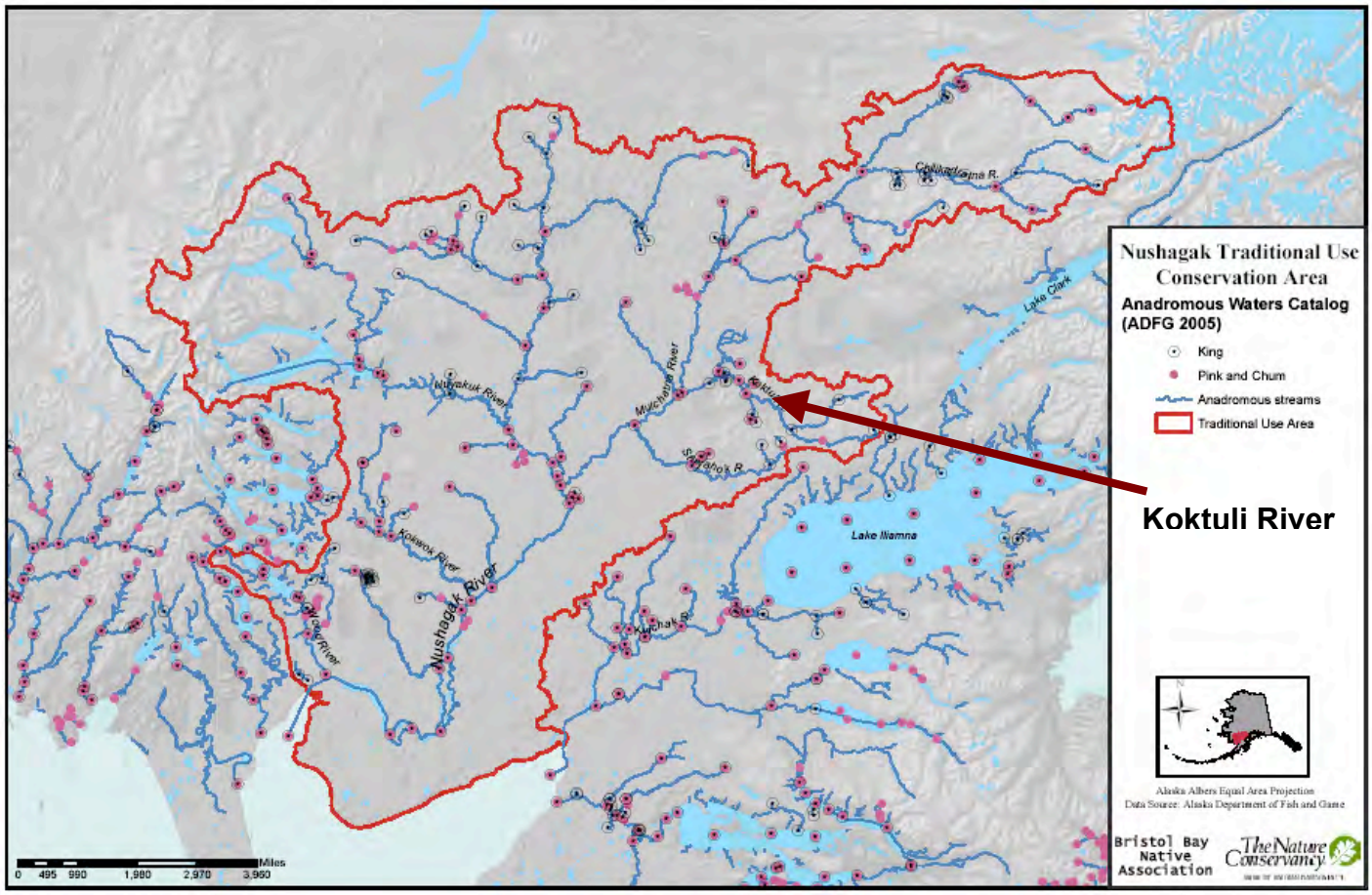

Figure 5: The map illustrates traditional ecological use within the Nushagak drainage. Data shows subsistence use for harvesting coho, pink and chum within the Koktuli River watershed (mainstem, North and South Forks.)

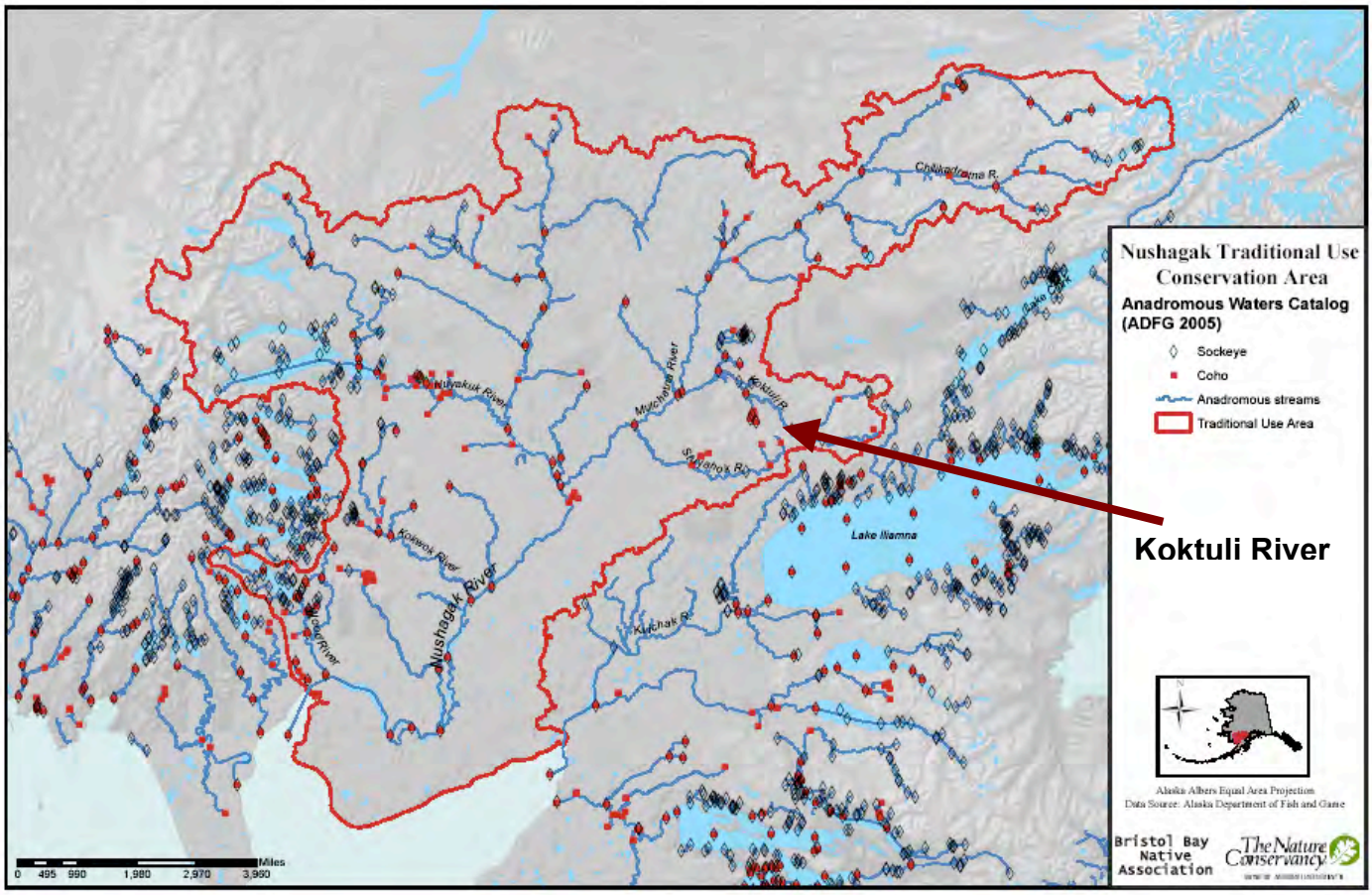

Figure 6: The map illustrates traditional ecological use within the Nushagak River drainage. Data shows subsistence use for harvesting sockeye and coho within the Koktuli River (mainstem, North and South Forks.

3. Commercial Fishing: Value of current use and potential impacts.

While no commercial fishing occurs directly within the Koktuli River system, the scientific arguments presented in this report support the fact that Koktuli waters serve a vital role in the health of the larger watershed and its associated commercial fishing industry. A report recently completed by Northern Economics details the role of commercial fisheries in Alaska's economy. The report determined that if Alaska were a nation, it would place 9th among seafood producing countries. Alaska's seafood industry has played a major role in the state's history, and it remains a major part of the economy today, with more jobs that any other private sector. The Bristol Bay fishery plays a large role in Alaska's seafood industry and

provides a substantial number of jobs year after year. In 2008, the salmon fishing industry in Bristol Bay employed nearly 11,500 people.[44]

The Bristol Bay commercial fisheries management area includes eight major river systems: Naknek, Kvichak, Egegig, Ugashik, Wood, Nushagak, Igushik, and Togiak, with the Kvichak and Nushagak (of which the Koktuli is part of) as the largest producers. Bristol Bay's commercial salmon harvest accounts for nearly 33% of Alaska's total harvest earnings each year. Harvest and processing of Bristol Bay fish generates nearly $320 million a year. Annual commercial catches between 1984 and 2003 averaged nearly 24 million sockeye salmon, 69,000 Chinook, 971,000 chum, 133,000 coho, and 593,000 pink salmon.[45]

Bristol Bay accounted for a significant portion of Alaska's seafood harvesting jobs due to the large salmon fisheries occurring in the region. Bristol Bay has about 13 percent of Alaska's total seafood processing jobs, 26.1 percent of the state's total seafood harvesting jobs, and about 19.9 percent of the state's workforce in seafood harvesting and seafood processing combined. [46]

The Bristol Bay salmon fishery is considered well managed and categorized as one of the only sustainable commercial fisheries in the world. The salmon that return to the Bristol Bay region offer an invaluable renewable resource for Alaska if current, relatively pristine habitat is maintained through the Koktuli River watershed, as well as the larger Bristol Bay watershed. By designating the Koktuli River as an ONRW it will be protecting a large portion of the headwaters of the largest sockeye salmon run on earth – a stronghold for the species and a way of life.

Through these recreation, economic and social arguments, it is evident that nearly the entire private economy of the Bristol Bay region is dependent on a healthy functioning ecosystem: local, Alaskan, and non-Alaskan commercial fishers, processors, sport anglers, sport hunters and wildlife viewers sustain the private economy when fish and game are available. However, the value of these renewable resources extends far beyond any year-by-year economical analysis of jobs, industry income and subsistence harvest. Maintaining the pristine habitat of the Koktuli River through designation as an ONRW will undoubtedly help sustain the truly exceptional ecological value of this watershed, the way of life for many Alaskans, and the outstanding recreational opportunities in perpetuity.

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[44] Northern Economics, Inc. *The Seafood Industry in Alaska's Economy,* January, 2009, 9, at http://www.marineconservationalliance.org/docs/SIAE_Jan09.pdf.
[45] John Duffield, *Supra* note 52 at 13.
[46] Northern Economics, Inc., *Supra* note 56 at 50.

III. Potential Risks[47] to the Reduction of Water Quantity, Quality and Existing Values

The petitioners believe that avoiding certain activities that have historically proven high risk to water quality and pristine fish habitat is necessary to protecting these outstanding national resources for the best, long-term ecological and recreational public interest.

At the time of filing this application, the reasonably foreseeable threats to the water quantity and quality of the Koktuli River are extractive water use as well as potential contamination from proposed hard-rock mining activities; mainly development of the Pebble Mine and associated human-caused impacts. Metal mines throughout the world have degraded water quality and require enormous volumes of water. According to the Environmental Protection Agency (EPA), the hard-rock mining industry is the single largest source of toxic releases in the US. This industry has already caused enormous damage to rivers and fisheries around the world. More than 70% of mines in the United States have exceeded the water quality standards which they promised to upkeep during their permitting process (Kuipers and Maest, 2006).

Under the proposed plans of the Pebble Partnership, the Pebble project will create two tailings dams, one at the headwaters of the South Fork of the Koktuli River.[48]Given the

[47] The petitioners interpret this section of the nomination packet to refer to *reasonably foreseeable human activities* which could cause reduction in existing water quality or habitat – or cause *increased* pollution, above the existing baseline, which the ONRW is intended to prevent.

[48] Geoffrey Y. Parker and Frances M. Raskin, et al, *Pebble Mine: Fish, Minerals, and Testing the Limits of Alaska's "Large Mine Permitting Process."*Alaska Law Review Vol XXV, 17, (June 2008).
The Pebble Mine likely would include most of the following facilities:

1. An open pit mine at Pebble West that may be about 2000 feet deep and cover about two square miles and an underground mine at Pebble East that may be of comparable size and 5000 feet deep.
2. Various stream diversion channels, wells and devices to: (a) prevent water from filling the open pit, (b) extract water that would be used for processing the ore, (c) transport ore concentrate in a slurry via pipelines, and (d) transport wastes in a slurry via pipelines.
3. A mill to crush, process, and concentrate the ore extracted from the open pit and underground mines.
4. Five dams or embankments composed of waste rock and earthen-fill material that together would span about nine linear miles. The three largest dams would be 740 feet high and 3 miles long, 700 feet high and 2.9 miles long, and 710 feet high and 1.3 miles long.70 These dams and embankments would create and contain ponds that would cover at least 10 square miles and store chemically reactive, ore-processing wastes known as "tailings."
5. A deep-water port in marine waters on the west side of Cook Inlet (about 200 miles southwest of Anchorage) to load the ore concentrate on ocean freighters.
6. A 104-mile road to provide a transportation corridor from the mine facilities to the port.
7. Two 100-mile-long, fifteen inch-diameter pipelines that would run parallel to the road. One pipeline would be used to transport a slurry of copper ore concentrate from the mill to the port, where the slurry would be de-watered. The other pipeline would return the slurry water to the mine area.
8. Four 54-inch-diameter pipelines. Three of the pipelines, totaling 70,000 feet (13.25 miles), would transport mine wastes from the mill to the waste storage facilities. The fourth pipeline, totaling 17,000 feet (3.2 miles), would reclaim water from the waste facilities and transport it to the mill.

immediate threats to the waters of the Koktuli River system, the main goals of protections offered by ONRW designation would ensure that the development of any large-scale metallic sulfide mine would not directly, indirectly, or cumulatively have any adverse effect on: wild salmon and other fish; wildlife; commercial, subsistence, and sport-fishing; and guiding and tourism activities, within this watershed that is already part of the Bristol Bay Fisheries Reserve.

The breadth of political leaders concerned about the future of the Koktuli river system in the face of mining development extends to the very memorable words of the late Jay Hammond, the popular Republican governor of Alaska from 1976 to 1982. He made his home on the shores of Lake Clark in the Bristol Bay drainages, just 30 miles from the Koktuli River and the Proposed Pebble Mine.[49] On July 11, 2005, two weeks before his death, he expressed his views:

> When I was first asked about the Pebble Mine… I expressed this concern: that if I were asked where in Alaska would I least rather see the largest open-pit mine in the world, I can think of no more less appropriate spot than the headwaters of the Talarik Creek and Koktuli River, the drainages of two of the finest trout streams and salmon spawning in Alaska. But I have since modified that to where if asked that question again, I'd say there is one place I'd even less rather see it, and that's in my living room here at Lake Clark.[50]

The following sections explain how mining affects water quantity and quality as well as critical fish habitat, and ways in which the Koktuli River system may be vulnerable should the Pebble Mine, or any other large-scale metallic sulfide mine, be developed.

A. Water Quantity[51]

A key reason the Koktuli River supports such a robust population of fish and therefore outstanding recreational opportunities is that the river's natural hydrology remains largely intact. Water flows are sufficient to maintain cool water temperatures, flush silt, and support other ecological functions. They also allow for exceptional backcountry floating and fishing opportunities.

Modern hard-rock metallic sulfide mining requires massive volumes of water, which are typically diverted from fisheries, domestic, recreational, and agricultural uses, thus

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9. A 300-megawatt power plant that would be located on the Kenai Peninsula, across Cook Inlet.
10. More than 100 miles of transmission lines and undersea cables to transmit electricity from the power plant on the Kenai Peninsula to the mine site.

[49] Jay S. Hammond, Tales of Alaska's Bush Rat Governor: The Extraordinary Biography of Jay S. Hammond, 294 (1994).
[50] Interview by Lance Holter with Jay S. Hammond, former Governor of Alaska, in Port Alsworth, Alaska (July 11, 2005) available upon request by Geoffrey Y. Parker and Frances M. Raskin.
[51] Sections on water quality and quantity compiled by Robert Moran, hydrogeologist and international mining consultant. (Moran, R. 2007. Pebble hydrogeology and geochemistry issues.)

increasing competition for water .Water use in metals mining ranges between 100 and 8,000 liters of water per ton of ore extracted. In 2000, mines in the US alone withdrew about 518,000 m^3 per day.[52] The *EPA and Hardrock Mining: A Source book for industry in the Northwest and Alaska* describes some of the effects from mining water withdrawal from a watershed:

> A proposed mining project can impact the quantity and velocity of surface water flow by altering natural drainage patterns and the infiltration/runoff relationships in a watershed; discharging storm water and wastewater; impounding water; changing the character of gaining and losing stream reaches through mine dewatering; mining through stream channels and flood plains; and by diverting, re-routing, and channelizing streams. Importantly, many mining activities have the potential to alter the equilibrium balance between flow and sediment transport in streams (Johnson, 1997). Altering this equilibrium causes stream gradients, channel geometries, channel patterns, and stream banks to adjust to new equilibrium conditions that reflect new erosion and sediment transport characteristics (Johnson, 1997). Such changes can disrupt aquatic habitats both upstream and downstream of a mine. The creation of waste dumps, tailings impoundments, mine pits and other facilities that become permanent features of the post-mining landscape can cause fundamental changes in the physical characteristics of a watershed (O'Hearn, 1997).[53]

Developing and operating the Pebble Mine would require billions of gallons of water each year of mine operation. Northern Dynasty Mines, Inc. (NDM) applied to the State of Alaska in July of 2006 for water rights in the following amounts, in gallons per year (Table 1):

Location	Surface Water (GPY)	Groundwater (GPY)
South Fork Koktuli	12.03 billion	2.8 billion
North Fork Koktuli	8.02 billion	0.2 billion
Upper Talarik Creek	6.84 billion	1.7 billion

Table 1: Water requested by Northern Dynasty Mines, Inc. (NDM) in water rights applications to the Department of Natural Resources, 6/2006. (GPY = gallons per year)

This amount of proposed water use by the Pebble Mine developers is nearly 35 billion gallons of water a year, more than annual water consumption rates in Anchorage.[54]

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[52] Global Equity Research, Watching water: A guide to evaluating corporate risks in a thirsty world. March 2008 at http://www.pebblescience.org/pdfs/jpmorgan_watching_water.pdf

[53] U.S. Environmental Protection Agency, Region 10. 2003. *EPA and Hardrock Mining: A Source book for industry in the Northwest and Alaska.* Found at pg 46 at http://yosemite.epa.gov/R10/WATER.NSF/840a5de5d0a8d1418825650f00715a27/e4ba15715e97ef2188256d2c00783a8e/$FILE/Maintext.pdf

54 USGS. 2006. Anchorage Water Use. Fact Sheet 2006-3148. USGS Anchorage, AK

1. Water quantity and impacts on fish

Water quantity is an extremely critical component of healthy salmon populations at all portions of their life cycle. The chemical and physical water quality of natural riverine systems is affected by changes in seasonal discharge (Doyle et al., 2005). Because the greatest natural mortality of salmonids occurs during early life stages while they are still in fresh water, the aquatic environment greatly influences rates of natural mortality. Sufficient water velocity and depth are also needed to allow the movement of water over, within and through gravel that transports dissolved oxygen to eggs and newly hatched salmon, and removes metabolic wastes. Stream velocity is particularly important to distribute aquatic invertebrates – a primary food source that juveniles depend upon for growth.

A large body of research has shown that a range of flow levels is important for different ecological processes (Poff, 1997) and that certain discharges are more important for the maintenance of nutrient transport rates, nutrient retention levels, and temperature regime maintenance (Doyle et al., 2005, Doyle, 2005, Emmett et al., 2001). The maintenance of the nutrients, water chemistry, and temperature regimes of a system becomes extremely important when we begin to consider the effects that changes in these parameters could have on the health of resident and anadromous fish species that use the system and provide commercial, recreational, and subsistence benefits to the Bristol Bay Region. Altering the natural stream flow patterns that could cause extended periods of low discharge can lead to the desiccation of eggs, low oxygen levels, high temperatures during warm weather, freezing during low temperatures, and high embryo mortality. Artificially low flows and shallow water depth can ultimately block upstream migration of adults (ADF&G 1985a, Reiser and Bjornn 1979). Any of these changes could have significant impacts on the salmon that depend on the Koktuli River to complete their life cycle.

B. Water Quality

Hard rock mining has a poor track record when it comes to water contamination – especially in areas where the mine site is close to ground or surface water. A study that provided in-depth comparison of predictions of water pollution vs. actual water pollution found that 85% of the mines near surface water with elevated potential for acid drainage or contaminant leaching exceeded water quality standards; 93% of the mines near groundwater with elevated potential for acid drainage or contaminant leaching exceeded water quality standards, and of the sites that did develop acid drainage, 89% predicted

that they would not.[55] The 2007 EPA Toxins Release Inventory (TRI) showed that the hardrock mining industry was again the leader in the release of toxins into the environment producing over 1.1 billion pounds. The below graph is from the EPA TRI website:[56]

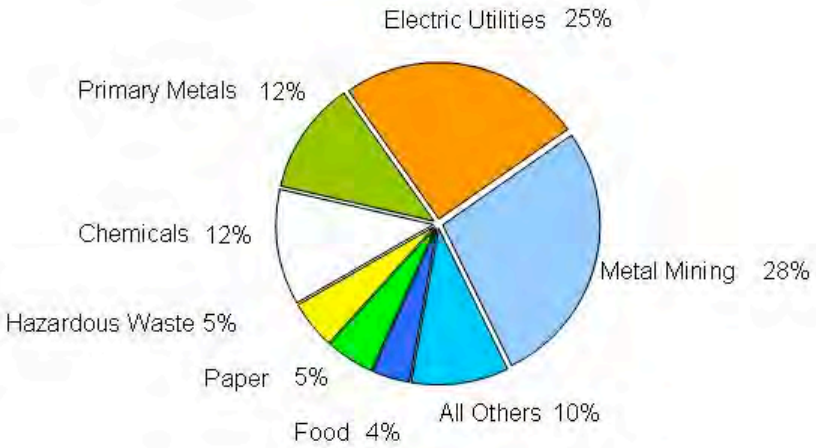

Figure 7: TRI Total Disposal or Other Releases 4.09 billion pounds (Source: http://www.epa.gov/tri/tridata/tri07/brochure/brochure.htm)

The EPA estimates in a 2004 report that the hardrock mining industry (including gold) is responsible for polluting 3,400 miles of streams and 440,000 acres of land.[57] Similarly, the U.S. Forest Service (USFS) estimates that approximately 10,000 miles of rivers and streams may have been contaminated by acid mine drainage from the metal mining industry.[58] The National Academy of Science, in their review of hardrock mines on federal lands found that at individual facilities, hardrock mining operations may disturb thousands of acres of land and impact watersheds including, to varying degrees, effects on groundwater, surface water, aquatic biota, aquatic and terrestrial vegetation, wetlands, wildlife, soils, air, cultural resources, and humans that use these resources recreationally or for subsistence. [59]

For example, like the proposed Pebble Mine, the Bingham Canyon Mine is a copper/gold/molybdenum mine, currently the largest in North America with an ore body roughly half the size of Pebble. Pollution from the mine has contaminated 60 square miles of

[55] Kuipers, J.R., Maest, A.S., MacHardy, K.A., and Lawson, G. 2006. Comparison of Predicted and Actual Water Quality at Hardrock Mines: The reliability of predictions in Environmental Impact Statements.
[56] http://www.epa.gov/tri/tridata/tri07/brochure/brochure.htm
[57] U.S. EPA. 2004. "Cleaning Up the Nation's Waste Sites: Markets and Technology Trends." EPA 542-R-04-015. Accessed at http://www.epa.gov/tio/pubisd.htm
[58] U.S. EPA 2004. "Nationwide Identification of Hardrock Mining Sites." Office of Inspector General. Report No. 2004-P-00005. Accessed at: http://epa.gov/oig/reports/2004/20040331-2004-p-00005.pdf
[59] National Research Council. 1999. *Hardrock Mining on Federal Lands*. National Academies Press. Washington, DC.

groundwater near Salt Lake City, making water unusable for at least 4,300 households. Kennecott Utah Copper Corp., a subsidiary of Rio Tinto, built a multi-million dollar water treatment facility, the largest of its kind in the United States, to treat an estimated 2.7 billion gallons of polluted water annually for at least the next 40 years.

Figure 8. Kennecott Bingham Canyon Mine in Utah. (Left) Tailings impoundment (roughly 9,000 acres) with the Great Salt Lake at the top left. The pit is 0.75 miles deep, 2.5 miles wide, and covers 1,900 acres. (Right) Tailings are shown in the foreground (grey) with Salt Lake City in the background. Operations produced a 60 square-mile groundwater plume under valley to right, mostly from waste rock seepage. As of 2006, Kennecott had spent $370 million on cleanup and source control, and will be required to pump and treat aquifer water for at least the next 40 years. By 2009, 2.7 billion gallons of water will be treated annually to supply homes unable to use the aquifer.

Byproducts are created throughout the various stages of mining. Some of these can be relatively non-toxic, others must be carefully taken care of to prevent damage to human health or the ecosystem. Pollution at mine sites can primarily happen through the mishandling of site operation chemicals, tailings creation and storage, acid mine drainage, and metals leaching all of which could have downstream effects on the Koktuli River's fish and ecosystem functions.

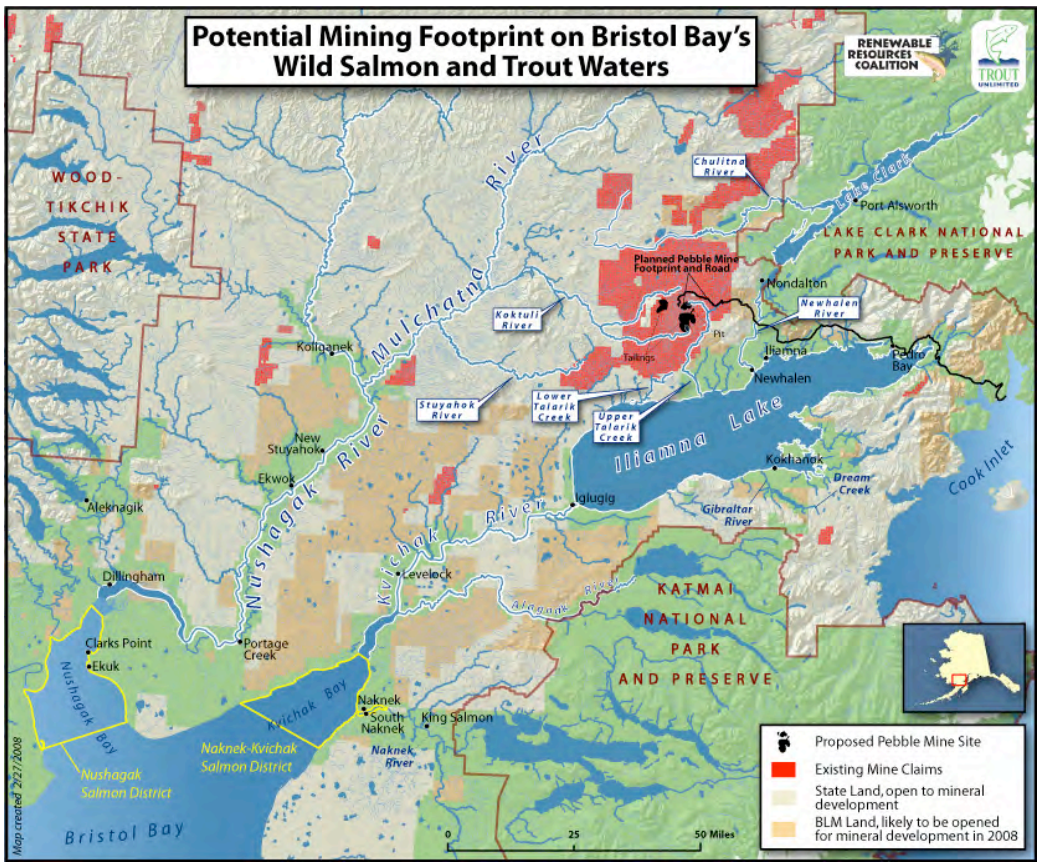

Figure 9: Existing mining claims and the proposed Pebble Mine shown in relation to the Koktuli River system. The mine site lies directly in between the North and South Fork of the Koktuli River, which feeds the Mainstem, all nominated as Alaska's first Outstanding National Resource Waters.

1. Site operation chemicals

Mine operations use tremendous amounts of chemicals– explosives, fuels, oils, greases, antifreeze, water treatment chemicals, herbicides, pesticides, and road de-icing compounds – that may be released into local surface and groundwater and can be toxic to fish and wildlife. A large part of the Pebble mining activities would take place within the Koktuli River watershed using ground and surface water.

One of the most common chemicals used in mining to separate the gold from the other minerals and rocks removed from the site is cyanide. About 1.4 million tons of hydrogen cyanide is produced throughout the world, about 13% of this goes towards the production of cyanide related chemicals used to process gold. Cyanide is typically transferred and stored at mining sites in one of two ways: 1) in liquid form, transported by tanker truck or railcar and then offloaded to an onsite storage tank; 2) in briquette or flake form, transported via truck or

railcar in drums, plastic bags, bins, boxes or ISO-containers. The cyanide is then mixed with the ore to remove the gold via leaching. When the recoverable gold is removed the cyanide laced ore is either dewatered to recover the solution, treated to neutralize or recover cyanide, or is sent to the tailing storage facility. [60]

Although cyanide in minute amounts occurs naturally and is produced by some plants, a small amount can be highly toxic to humans and wildlife. A teaspoon full of two-percent solution of cyanide can kill a human adult.[61] Fish and aquatic invertebrates are extremely sensitive to cyanide, just 5.0 to 7.2 micrograms per liter of free cyanide in aquatic systems can effect a fish's movement and prevent successful reproduction. Higher amounts can cause additional physical effects and death.[62]

Cyanide is just one of the many chemicals that will be used at the proposed Pebble Mine site that has a chance to contaminate the currently pristine, life-supporting waters of the Koktuli River.

2. Tailings

During mining operations ore is removed from the ground and mixed with water and chemicals separate copper, gold and other metals from the rock. More than 99 percent of processed ore becomes a solid-water-chemical waste called tailings that are usually permanently stored within large impoundments. Tailings contain process chemicals and elements from natural rock that can harm humans and wildlife. For example, 2 parts per billion concentrations of copper above background may negatively affect the ability of salmon to locate their spawning grounds.[63] Other natural rock elements may include aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, zinc, sulfides, and natural radioactive constituents (uranium, thorium, potassium-40).

Process chemicals in tailings may include lime, sodium isopropyl xanthate (e.g. SF-113), dithiophosphate and thionocarbamate (e.g. Aeropromotor AC 6682), methyl isobutylcarbinol (MIBC), and polypropylene glycol methyl ether (Dowfroth 250). Some of these chemicals are recycled but most are discharged with the tailings.

Copper mines frequently operate for 50 years or more. Tailings impoundments must hold the waste forever and are vulnerable to natural forces such as erosion, landslides and earthquakes. Seepage is collected and returned to the impoundment during operations, but this

[60] From the International Cyanide Management Institute website: http://www.cyanidecode.org/cyanide_use.php
[61] http://montanakids.com/agriculture_and_business/mining/Future_of_Mining.htm
[62] From the International Cyanide Management Institute website: http://www.cyanidecode.org/cyanide_environmental.php
[63] Hecht, S.A. and 5 coauthors. 2007. An overview of sensory effects on juvenile salmonids exposed to dissolved copper. Technical White Paper. NMFS, Seattle, WA.

process usually stops when mining ceases. Inevitably, some of the "chemical soup" seeps out into the surrounding ground and surface waters.

If developed the proposed Pebble Mine would be the largest open pit mine in North America. The pit would stretch to 2 miles wide, and be dug as much as 2,000 feet deep. The 8 billion tons of waste rock removed from the mine would require two giant tailings ponds enclosed by four earthen dams, the largest measuring 4.3 miles long and 740 feet high (far bigger than Grand Coulee Dam). The other dams would be 700, 400 and 175 feet tall. Each of these dams would put two valleys under water, one of which is in the Koktuli river watershed. The area is also an active earthquake zone which leads to an elevated risk of structure damage and pollution.[64]

3. Risk of Acid Mine Drainage and Metals Leaching [65]

The reasonably foreseeable human activities of mining development in the Koktuli River watershed, makes Acid Mine Drainage (AMD) another potential risk that would degrade water quality. Acid drainage and metal leaching occur because the metals developers want from mines commonly exist as complex chemical compounds in the rock. The entire mineral makeup of the rock, not just the copper or gold, determines how excavating and storing rock affects the environment.

Three processes can lead to contamination. First, rain and snow falling on crushed or broken rock can turn the water acidic (low pH) or alkaline (high pH). Second, rain or snow on rock may leach metal salts (readily dissolved compounds) into water. Third, processing chemicals can leak or spill.

Iron sulfide is a major contributor to AMD. Iron sulfide often occurs with gold and other valuable minerals. Rain, snowmelt, or water moving over iron sulfide forms sulfuric acid. The acid dissolves metals in the rock like copper, zinc, nickel, and lead. Acid and metals are washed downstream into clean watersheds where aquatic plants and animals are exposed. It can occur in tunnels, open pits, waste rock piles, and mill waste (tailings) (Figure 10).

[64] http://ourbristolbay.com/the-risk-factsheet.html
[65] This section compiled by Dr. Kendra Zamzow of CSP2, http://www.csp2.org. References are included at the bottom of: http://ourbristolbay.com/acid-rock-drainage.html

Figure 10: Acid Drainage photo. Acid drainage is red or orange because of the iron in it. Dissolved oxidized iron gives acid drainage its distinctive red color. These processes occur naturally, but are more extreme when rock is crushed and more rock surface is exposed. Acid on tunnel walls at Kensington gold mine (Southeast Alaska). Photo - D. Chambers.

While sulfide makes acid, carbonate in rock buffers acid. The ratio of sulfides to neutralizing rock like carbonate influences the overall acidity of mine drainage. With enough buffering minerals, drainage may not be acid; however, neutralizing minerals often break down more quickly than sulfides, so even if there is plenty of neutralization initially, acid drainage may develop in the future. Acid mine drainage may take decades to develop.

Acid mine drainage may contain copper, zinc, cadmium and other minerals to which salmon are very sensitive. For example, Copper can destroy or impair the ability of salmon to smell, making it harder to avoid predators, find mates and return to spawning grounds. An increase of just 2.3 to 3.0 ug Cu/L of dissolved Cu above background levels can interfere with behaviors tied to smell in juvenile coho salmon (Woody 2007).

When acid drainage enters clean streams, the acid is diluted, but "yellowboy" forms as red dissolved iron becomes solid. Yellowboy is a classic orange color (Figure 11) and acts like cement, smothering species that live on stream bottoms.

Figure 11: Red dissolved iron and yellowboy. The red iron (top) and yellowboy (bottom) near the closed Leviathan copper mine in California. Top photo G. Miller. Bottom photo Lahontan Regional Water Quality Board.

Dissolved aluminum also becomes solid in natural waters, forming mucus-like streamers that clog fish gills and cause fish to suffocate.

Acid drainage is irreversible. Placing sulfide rock underwater or burying it can slow acid formation by removing oxygen, but it won't stop completely if certain forms of iron are present. Since it cannot be stopped, the contaminated water must be treated in perpetuity, for hundreds or thousands of years. [66]

Preliminary geochemical data indicates significant acid mine drainage potential at the Pebble Mine site. If water treatment is required, expensive lime treatment may be necessary, possibly

[66] Mining companies post bonds to pay for water treatment, but regulators often underestimate the cost, leaving taxpayers to pay. For example, when Montana and the US Environmental Protection Agency (EPA) requested Pegasus Gold to clean up water pollution in 1998, Pegasus filed for bankruptcy and left Montana with millions of dollars in water treatment costs.

in perpetuity. Lime products form sludge that will require on site disposal. Treated discharge has low metals but high total dissolved solids (tds).

Authorizing a mine where it is known that water treatment in perpetuity will be required poses significant long term financial and/or environmental risks to the public.

In addition to acid mine drainage, other mining byproducts can have effects on the watershed. Metals and metal-like elements don't need acid to dissolve – they can dissolve at neutral or alkaline pH. This is called "metal leaching". Alkaline pH can occur in two ways: if the rock contains a lot of carbonate, or if ore processing requires the pH of process water to be very high. For instance, when cyanide is used to extract gold, the pH must be kept high to avoid forming cyanide gas that can kill people. Alkaline water causes arsenic, cadmium and selenium to dissolve. These toxins can reduce growth, cause physical deformities and kill fish.

4. Impacts to Fish

Given the location of the deposit (See Figure 9) the proposed Pebble Mine has potential to contaminate surface water of the Koktuli River system, a direct threat to the characteristics of an Outstanding National Resource Water. In addition to surface water contamination, the extensive glacial gravel deposits of the Koktuli area are highly permeable; a characteristic that contributes to salmon productivity but also provides pathways for water and potentially for mine wastes to move between surface and groundwater and between river basins.

Salmon have adapted to the local surface water, naturally pure with extremely low concentrations of dissolved minerals; even minute amounts of contaminants beyond what these salmon have adapted can potentially cause harm. Salmon and organisms comprising freshwater food chains are very sensitive to heavy metals, trace elements, and other contaminants found in mine wastes.[67] Pollution from mines can degrade habitat and other ecosystem functions including[68]:

> *Acid Mine Drainage* - Acid mine drainage harms respiratory function of fish, and low PH can impact reproduction rates and rearing success. Low PH can also kill aquatic plants and macroinvertebrates, thereby diminishing important food sources and disrupting the natural food chain.
>
> *Heavy metals contamination* - Dissolve heavy metals can bioaccumulate in trout and salmon and collect on their gills, causing respiratory problems. Some metals have been shown to severely impact the juvenile salmon life cycle and limit growth rates. High metal concentrations in water can be toxic to plants and wildlife. They can also

[67] Elsa M. Sorensen, *Metal Poisoning In Fish*, 235-84 (1991); A. Dennis Lemly, *Mining in Northern Canada: Expanding the Industry While Protecting Arctic Fishes – A Review,* 29 Ecotoxicology and Envtl. Safety 229, 230-34 (1994); Ronald Eisler, *Handbook of Chemical Risk Assessment: Hazards to Humans, Plants, and Animals: Metals, 144-73 (2000).*

[68] http://www.tu.org/conservation/abandoned-mines-western-us

bioaccumulate in fish tissues and can be passed on to humans and other animals through the food chain. Open-pit mines, tunnels, and other mine workings can also be a direct threat to groundwater contamination when they extend below the water table. When these areas fill up with water, they can lower the water table and contribute to dewatered streams, springs, and wells.

- *Sedimentation* - . As soil particles are washed into a stream, sedimentation occurs as they drop to the streambed and cover rocks and vegetation Sediment from waste rock and tailings piles can cover spawning beds, impair the growth of other aquatic organisms and smother juvenile trout. Sediment can also raise the water temperature, decrease oxygen supplies, fill pools, destroy stream channels, and lead to greater risks of flooding.

Some examples:

- In Colorado, there are 20,299 abandoned mine sites and 1,300 miles of adversely affected streams! As one example, mining waste has killed 20 miles of the Animas River fishery in southwest Colorado from the nearby molybdenum mine.
- In New Mexico, at least eight miles of the Red River's aquatic life (including its trout) have been decimated by heavy metal waste associated with the nearby molybdenum mine.
- In Montana, a tailings dam in the headwaters of the Blackfoot River breached in 1975 and sent sever thousand tons of mine waste into the river. The toxic material has been traced as far as 16 miles downstream and killed all aquatic life in the first ten miles of the river.

Of particular concern to the outstanding natural waters of the Koktuli River system is potential contamination from: low pH or an unusually high pH; metals/metalloids (elevated concentrations of many potentially toxic constituents such as: aluminum, antimony, arsenic, barium, cadmium, copper, chromium, cobalt, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, vanadium, zinc); together with elevated concentrations of the major metals (calcium, magnesium, sodium and potassium); of nonmetals (sulfate, nitrate, ammonia, boron, phosphorus, fluoride, chloride); and of natural radioactive constituents (uranium, thorium, potassium-40, gross alpha and beta, in general), all of which are associated with natural rock in place. Two recent papers document the presence of these constituents in the Red Dog mine rocks (Kotzebue area), and it is of similar concern in the Bristol Bay watershed (Slack et al., 2004a and b). Moreover, interactions among metals, can produce more than additive effects. Mixtures of metals can cause higher rates of mortality in fish than would be expected by simply adding the effects of each element alone.[69] Once inside an organism, metallic elements exist in a specific form and ratio to other elements and will interact directly

[69] J.B. Sprague & B.A. Ramsay, *Lethal Levels of Mixed Copper-Zinc Solutions for Juvenile Salmon,* 22 J. of the Fisheries Red. Bd. Of Can. 425 (1965); Sorenson, *Supra* note 26, 335-39; Eisler, *supra* note 26 at 335.

or indirectly based on a multitude of parameters.[70] For example, survival from egg to hatch of catfish (*Ictalurus* spp.) treated with a 1:1 ratio of Cu:Zn declined predictably under an additive model up to a concentration of ~1 ppm. With increasing concentrations, mortality rates increased synergistically at higher that predicted rates.[71] However, relatively few studies of synergistic effects exist, and the scientific understanding of such effects is still developing.[72]

Short-term fluctuations in water quality are caused by diurnal variation in natural conditions, especially light exposure. For example, this has been documented in a small system in Colorado that receives acid mine drainage; photoreduction of ferric iron results in a well-defined increase in dissolved ferrous iron during the day. There is greater variability in dissolved iron concentrations during the day, indicative of photoreduction. (McKnight, 1988). To understand the chemical and physical nature of this system, baseline water quality data collected at specific time intervals is needed, as is long-term monitoring for diel cycle variations. A full understanding of natural systems requires that we understand complex ways in which seemingly unrelated processes such as photosynthesis and sorption are coupled. (Fuller, 1989). Diurnal fluctuations in concentrations of metals such as cadmium and zinc also have documented impacts on trout survival. (Nimick et al., 2007). Seasonal fluctuations can bring much larger changes in concentration than diurnal changes - particularly during break up when snow is melting. This causes metals sequestered in sediment and sediment pore-water to flush up into the water column and sharply increase metal concentrations in water.

There are potential effects on fish of from copper concentration increases [2-10 ppb (µg/L)] over natural levels in the aquatic environment.[73] Minute increases of dissolved copper above natural water levels can impair a salmon's sense of smell, and thus survival, as salmon use smell to find spawning grounds and to distinguish among predators, prey, kin, and mates (Woody, 2007; Hecht et al. 2007). Increased levels of copper can stress salmon and impair their ability to fight disease, breathe, or maintain cell fluid and electrolyte balance (osmoregulation), and can impair brain function (Eisler 2001; Woody, 2007). Additionally, increased levels of copper may delay or accelerate natural hatch rates, which can reduce salmon survival rates and kill or harm salmon food sources, including algae, zooplankton, aquatic insects and fish (Woody, 2007). The following excerpt from the Alaska Law Review[74] further explains these potential threats to the Koktuli River system and its fisheries habitat:

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[70] H.H. Sanstead, *Effects and Does-Response Relationships of Toxic Metals* (1976); SORENSEN, *supra* note 26, at 335.

[71] Wesley J. Birge & Jeffrey A. Black, *Effects of Copper on Embryonic and Juvenile Stages of Aquatic Animals*, *in* Jerome O. Nriagu, ed., *Copper in the Environment: Health Effects Part II*, 373 and 386–88.

[72] Geoffrey Y. Parker and Frances M. Raskin et al, *Pebble Mine: Fish, Minerals, and Testing the Limits of Alaska's "Large Mine Permitting Process,* Alaska Law Review, Volume XXV, No. 1, June 2008, 19.

[73] The proposed Pebble Mine would be a large-scale (2007 Northern Dynasty Mines plans show ~2.6 mi long X 1.6 mi wide X 1 – 5 thousand ft deep copper-gold-molybdenum) mine similar to mines (e.g. Butte, MT) that increased copper and other pollutants harmful to fish in the surrounding environment (USEPA 1994; Woody, 2007). The exact Pebble Mine plan is undefined at present. It is expected to include both open-pit and underground operations.

[74] Geoffrey Y. Parker and Frances M. Raskin, et al, *Pebble Mine: Fish, Minerals, and Testing the Limits of Alaska's "Large Mine PermittingProcess."*Alaska Law Review Vol XXV, 17, (June 2008).

Both lethal and sublethal effects of copper (Cu) on salmon and their food chains have been demonstrated[75] at concentrations below the Alaska state water quality criterion for protection of freshwater species (9 micrograms Cu per liter (µg Cu/L) calculated on 100 mg/L hardness (CaCO3)), and well below the human drinking water criterion of 1,300 µg Cu/L.[76] Copper has sublethal effects on salmon that can reduce the viability of populations.[77] Concentrations below the accepted criterion for aquatic life in Alaska (< 9 µg Cu/L) have produced the following documented effects on fish:

1. impairment of sense of smell (olfaction);[78]
2. interference with normal migration;[79]
3. impairment of their ability to fight disease (immune response);[80]
4. difficulties in breathing;[81]
5. disruption of osmoregulation (ability to control internal salinity of body fluids);[82]
6. impairment of ability to sense vibrations via their lateral line canals (a sensory system that helps fish avoid predators);[83]
7. impairment of brain function;[84]
8. changes in enzyme activity, blood chemistry and metabolism;[85] and
9. delay or acceleration of natural hatch rates;[86]

Many metals toxic to aquatic life are commonly released at hard rock mining sites, and interactive effects on salmon and aquatic systems are not well studied.[87] Few studies exist on the "cocktail" effects that multiple metals have on fish and aquatic food chains. Combined effects can be more toxic than any single element.[88]

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[75] Eisler, *supra* note 21, at 144–173, TABLE 3.5 144–161.

[76] Alaska Admin. Code tit. 18 § 70.020(b) (2007) incorporates by reference the *Alaska Water Quality Criteria for Toxic and Other Deleterious Substances, available at* http://dec.alaska.gov/water/wqsar/wqs/pdfs/70wqsmanual.pdf (stating copper criteria for freshwater aquatic life and for human health).

[77] David H. Baldwin et al., *Sublethal Effects of Copper on Coho Salmon: Impacts on Nonoverlapping Receptor Pathways in the Peripheral Olfactory Nervous System*, 22 Envt'l Toxicology and Chemistry 2273 (2003); Eisler, *supra* note 21, at 163–166. SORENSEN, *supra* note 19, at 269–276.

[78] J. Raloff, *Aquatic Non-Scents: Repercussions Of Water Pollutants That Mute Smell*, SCIENCE NEWS, Jan. 27, 2007, at 59.

[79] J.N. Goldstein, D. F. Woodward and A. M. Farag, *Movements of Adult Chinook Salmon During Spawning Migration in a Metals-Contaminated System*, *Coeur d'Alene River, Idaho*, TRANSACTIONS OF THE AMERICAN FISHERIES SOCIETY 128, 121–129 (1999); D.F. Woodward et al., *Brown Trout Avoidance of Metals in Water Characteristic of the Clark Fork River, Montana*, CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES 52:2031–2037 (1995); SORENSEN, *supra* note 105, at 264.

[80] R.J. Baker, M.D. Knittel , and J.L. Fryer, *Susceptibility of Chinook Salmon*, Oncorhynchus tshawytscha (*Walbaum*), *and Rainbow Trout*, Salmo gairdneri, *Richardson*, *to Infection with* Vibrio anguillarum *Following Sublethal Copper Exposure*, Journal of Fish Diseases 3:267–275 (1983).

[81] Sorensen, *supra* 27 at 266–269.

[82] *Id.* at 256–262; Eisler, *supra* note 21, at 180.

[83] Sorensen, *supra* note 27, at 253.

[84] Eisler, *supra* note 27, at 163.

[85] Sorensen, *supra* note 27, at 256–262. EISLER, *supra* note 104, at 180.

[86] Sorensen, *supra* note 27, at 271.

[87] Eisler, *supra* note 27, at 102–105.

[88] Carol Ann Woody, *Copper: Effects on Freshwater Food Chains and Salmon: A Review*, 14 *at* http://fish4thefuture.com/pdfs/Woody_Copper_Effects_to_Fish%20-%20FINAL2007.pdf. (Sept. 21, 2007).

The Pebble Partnership asserts that about ninety-five percent of the metal that the mine would produce is copper.[89] Given the location of the deposit, the type of deposit and mine proposed, increased levels of copper are reasonable and foreseeable changes from human activities that would cause reduction in existing water quality within the Koktuli River watershed and have a significant effect on its trout and salmon populations.

Of additional concern are contaminants generated in the processing of ore, and these are of toxic concern to fish and fish habitat. The following chemical agents are some of the potentially-toxic processing compounds generally added in mineral processing: methyl isobutyl carbinol, potassium ethyl xanthate, sodium ethyl ether, potassium amyl xanthate, sodium isobutyl xanthate, sodium metabisulfite, zinc sulfate, copper sulfate, sodium cyanide, sodium sulfide, lime, sodium hydroxide, organic antiscalents and flocculents (Personal Communication between Robert Moran and Lauren Oakes, 11/2007). Moreover, interactions among metals, such as copper and zinc, can produce more than additive affects. Mixtures of metals cause higher rates of mortality in fish than would be expected by simply adding the effects of each element alone.[90]

[89] Elizabeth Bluemink, *Jewelers Announce Opposition to Pebble Prospect's 'Dirty Gold:' Companies Call for Protection of River Drainages*, Anchorage Daily News, Feb. 13, 2008, at A1, *available at* http://www.adn.com/money/industries/mining/story/313462.html.
[89] Eisler, *supra* note 27, at 163–166 at 138.
[90] J. B. Sprague and B.A. Ramsay, *Lethal Levels of Mixed Copper-Zinc Solutions for Juvenile Salmon, 22* J. of the Fisheries Red. Bd. Of Can. 425 (1965); Sorenson, *supra* note 105, 335-39; Eisler *supra* note 104, at 104.

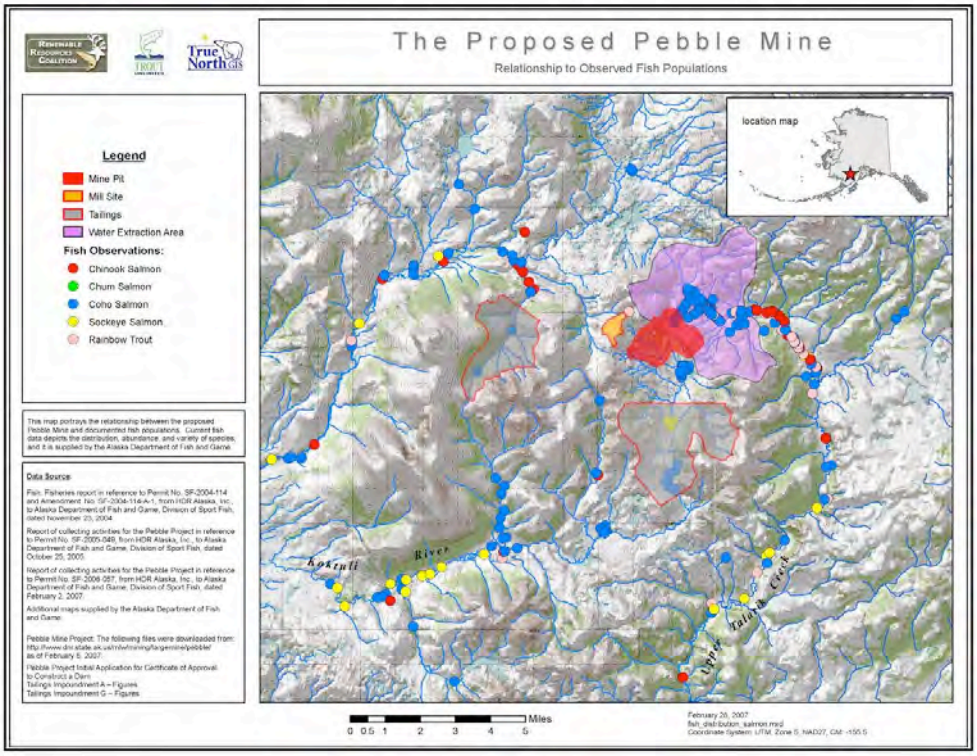

Figure 12: illustrates the proposed Pebble Mine in proximity to the Koktuli Rivers and details observed anadromous fish populations.

Once copper and other heavy metals enter a system, they generally remain and are constantly recycled due to floods, lake turnover, and benthic feeding organisms (e.g., snails, clams, whitefish). Such effects on salmon and aquatic food chains of the Koktuli River system could cause significant declines in salmon populations, and the cumulative long term effects of copper and other pollution on salmon warrant the protection and maintenance of existing water quality of the Koktuli River system.

IV. Community Support and Testimony

Local Support, Testimony, and Additional Evidence to Substantiate ONRW Designation

Anglers, recreationists, scientists, and local Natives, recognize the Koktuli River system is well known as one of the most beautiful and outstanding waters in the state, supporting a larger ecosystem like none other on the planet.

Flyfishing lodge owner Chuck Ash is a native Alaskan who has guided wilderness and fly fishing trips since 1975. As owner of Brightwater Alaska, a guided fishing company, he has floated, hiked, and fished the Koktuli River and surrounding area since 1985.

> Over the years I have watched as rivers diminish in wilderness value due to greatly increased human use, especially by float planes and river boats. The Koktuli however has remained by and large unaffected. It has no headwaters lake from which it can be easily accessed by plane and the river is too small and too interdicted by natural logjams and sweepers to be easily navigated by river boats.
>
> There are a number of rivers in Bristol Bay where I can float and find good fishing. The Koktuli is one of the last two remaining rivers where I can take customers to find true wilderness and real solitude. All of Alaska was once this way.
>
> The ecosystem over the length of the river is unique and defines the experience. The upper third of the river is through upland tundra, which abruptly changes to a riparian spruce-birch forest at the confluence of the north and main forks. This forest continues in a narrow but widening band, closely contained by the tundra on the uplands surrounding it, and descends into the broader floodplain of the Mulchatna River.
>
> Because of the wide variety of habitat along its entirety, the Koktuli is unusual in the mix of species it contains. Vegetation, birds and mammals on the upper end are those that require the open and more arid conditions of tundra. Further downriver are found the species that require the coolness and shelter of the forest. All the species present on the Koktuli require fresh and clean water for their existence.
>
> Moose, wolves, wolverines and foxes are the resident large mammal species here, but many of the other mammalian, avian and piscine species are migratory. Birds migrate from North America, South America, Asia and the Pacific islands to nest here or on their way to nesting grounds further north. Caribou migrate through the Koktuli valley on their annual peregrinations. The migrating salmon, however, are the linchpin to the strength and diversity of this ecosystem.
>
> Salmon come annually from the sea to spawn, transferring energy and minerals from the ocean to the waters and land of the Koktuli in the process. Rainbow trout and Dolly Varden migrate upstream to feed on the roe and decaying flesh of these spawning salmon, returning to the larger waters of the Mulchatna in the late summer. Grayling descend from their own spawn in the upper river to take advantage of the salmon spawn, as well. Bears migrate seasonally both to and through the Koktuli in search of spawning salmon. The people who reside in the

Bristol Bay area are also economically and culturally dependent on these returning salmon. Without the salmon the fabric of life here is weakened and the richness of this ecosystem and all it supports wanes.

My concern for the protection of the Koktuli River sysytem is not personal, but rather for the sanctity of what was once both unique and common, and is now scarce and precious.

Chuck Ash
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Nature writers and photographers, Erin McKittrick and Bretwood Higman (Hig) have walked over 7000 miles all over Alaska. They have studied the wilderness of Alaska not only as fuel for their writing and photography but to gain awareness about these last remaining wilderness locations. Hig and Erin visited the Koktuli and Iliamna region in the summer of 2006, upon completion of there epic 3000 mile journey, this was said,

> When I visited the Koktuli River in 2006 along with my wife and a friend, we had been living in Washington. In many ways this framed our impressions. In Washington, there are beautiful mountains, but if you visit the rivers, they are crowded by development, framed by young forests, and sport a fraction of the fish that once crowded their waters. In contrast, the Koktuli wanders free across a broad wild valley.
>
> We passed a USGS river gage, but no other evidence that humankind existed. Starting at the headwaters in Frying Pan Lake, we walked and floated first through tundra speckled with spring flowers and roaming bears. At lower elevations willow and cottonwood forests crowded the river, providing browse for moose. We caught rainbow trout and arctic grayling. Even after a winter, the signs of last season's salmon runs were apparent—bear scat filled with fish bones. On the lower river we passed into spruce forests. These gallery forests are confined to the floodplain, and are bounded by broad plains of rich tundra feeding caribou and providing nesting for migratory birds such as the arctic tern and sandhill crane.

> Everywhere in salmon country rivers are the biological center of the universe. It is only on the river banks that you see the animals and plants at their full diversity and density. Along the Koktuli, that ecosystem is particularly broad and diverse. Because the valley is broad and low, and because the river crosses through transitions between tundra and forest, there is diverse habitat to support plants and animals. When the salmon come, providing a huge boost in nutrients, the ecosystem benefits for miles to either side of the river.
>
> The Koktuli is alive. In Washington, most large animal tracks are rare—there we would react with excitement at even one bear print. The banks of the Koktuli are crisscrossed with tracks of bear, caribou, moose, beaver, porcupine, ground squirrel, wolverine, river otter, and innumerable birds. My wife and I moved to Alaska a little over a year ago, in part because of the Koktuli Valley and places like it.

In a recent poll, which is the most in-depth survey of local Alaska Natives' opinion, determined that only 8 percent of survey respondents supported the Pebble mine project. The survey also found that 79 percent of respondents believe the Pebble Mine, located in the headwaters of two of the region's largest salmon-spawning rivers, would damage Bristol Bay's wild salmon fishery – a key resource that many residents depend on for income and food.

Designate the Koktuli River as Alaska's First ONRW

The Koktuli River is a gem even amongst Alaska's most stunning landscapes and deserves the protection that Outstanding National Resource Water status awards. Its trout and salmon populations have sustained decades of anglers and other recreationists in their quest to experience some of the best backcountry travel left in the country. In addition, healthy runs of salmon have supported a vibrant and well-functioning ecosystem for centuries, which in turn has shaped a subsistence way of life for Alaska Natives and other residents who depend on the land for their survival and way of life. We, the petitioners of this nomination, can think of no watershed more worthy of becoming Alaska's first Outstanding National Resource Water than the Koktuli River system.

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