

# Proposed Determination of the U.S. Environmental Protection Agency Region 10 Pursuant to Section 404(c) of the Clean Water Act Pebble Deposit Area, Southwest Alaska



July 2014

**PROPOSED DETERMINATION OF THE  
U.S. ENVIRONMENTAL PROTECTION AGENCY REGION 10  
PURSUANT TO SECTION 404(C) OF THE CLEAN WATER ACT  
PEBBLE DEPOSIT AREA, SOUTHWEST ALASKA**

U.S. Environmental Protection Agency  
Region 10  
Seattle, WA

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Main photo: Upper Talarik Creek (Joe Ebersole, EPA)

Thumbnail 1: Fishing boats at Naknek, Alaska (EPA)

Thumbnail 2: Sockeye salmon in the Wood River (Thomas Quinn, University of Washington)

Thumbnail 3: Salmon drying at Koliganek (Alan Boraas, Kenai Peninsula College)

Thumbnail 4: Age-0 coho salmon in the Chignik watershed (Jonny Armstrong)

**Preferred citation:** EPA (U.S. Environmental Protection Agency). 2014. Proposed Determination of the U.S. Environmental Protection Agency Region 10 Pursuant to Section 404(c) of the Clean Water Act, Pebble Deposit Area, Southwest Alaska. Region 10, Seattle, WA.

## EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) Region 10 is requesting public comment on a proposed determination to restrict the use of certain waters in the Bristol Bay watershed for disposal of dredged or fill material associated with mining the Pebble deposit, a large ore body in southwest Alaska. EPA Region 10 is taking this step because of the high ecological and economic value of the Bristol Bay watershed and the assessed unacceptable environmental effects that would result from such mining. This proposed determination relies on clear EPA authorities under the Clean Water Act (CWA), and is based on peer-reviewed scientific and technical information. Its scope is geographically narrow and it does not affect other deposits or mine claim holders outside of those affiliated with the Pebble deposit. EPA Region 10 is taking this step pursuant to Section 404(c) of the CWA and its implementing regulations at 40 Code of Federal Regulations (CFR) Part 231.

Alaska's Bristol Bay watershed (Figure ES-1) is an area of unparalleled ecological value, boasting salmon diversity and productivity unrivaled anywhere in North America. As a result, the region is a globally significant resource with outstanding value. The Bristol Bay watershed provides intact, connected habitats—from headwaters to ocean—that support abundant, genetically diverse wild Pacific salmon populations. These salmon populations, in turn, maintain the productivity of the entire ecosystem, including numerous other fish and wildlife species.

The Bristol Bay watershed's streams, wetlands, and other aquatic resources support world-class, economically important commercial and sport fisheries for salmon and other fishes, as well as a more than 4,000-year-old subsistence-based way of life for Alaska Natives. Each year Bristol Bay supports the world's largest runs of sockeye salmon, producing approximately half of the world's sockeye salmon. These sockeye salmon represent the most abundant and diverse populations of this species remaining in the United States. Bristol Bay's Chinook salmon runs are frequently at or near the world's largest, and the region also supports significant coho, chum, and pink salmon populations. Because no hatchery fish are raised or released in the watershed, Bristol Bay's salmon populations are entirely wild. Bristol Bay is remarkable as one of the last places on Earth with such bountiful and sustainable harvests of wild salmon. One of the main factors leading to the success of this fishery is the fact that its aquatic habitats are untouched and pristine, unlike the waters that support many other fisheries.

Nearly 70% of the sockeye and large numbers of the coho, Chinook, pink, and chum salmon are harvested in commercial, subsistence, and recreational fisheries before they can return to their natal lakes and streams to spawn. Thus, these salmon resources have significant economic, nutritional, cultural, and recreational value, both within and beyond the Bristol Bay region. The Bristol Bay watershed's ecological resources generated nearly \$480 million in direct economic expenditures and sales and provided employment for over 14,000 full- and part-time workers in 2009. The Bristol Bay commercial salmon fishery generates the largest component of this economic activity, with an estimated

value of \$300 million (sales from fishers to processors) and employment for over 11,000 full- and part-time workers (EPA 2014: Chapter 5).

In February 2011, Northern Dynasty Minerals Ltd. (NDM) formally submitted information to the U.S. Securities and Exchange Commission (SEC) that put forth plans for the development of a large-scale mine at the headwaters of this pristine ecosystem (Figure ES-2). Their proposal outlines several stages of mine development, the smallest being a 2.0-billion-ton mine<sup>1</sup> and the largest being a 6.5-billion-ton mine<sup>2</sup> (Ghaffari et al. 2011, SEC 2011), both of which are larger than 90% of the known ore deposits of this type in the world (EPA 2014: Chapter 4).

The Pebble deposit is a large, low-grade, porphyry copper deposit (containing copper-, gold-, and molybdenum-bearing minerals) that underlies portions of the South Fork Koktuli River (SFK), North Fork Koktuli River (NFK), and Upper Talarik Creek (UTC) watersheds. Based on information provided by NDM to the SEC (Ghaffari et al. 2011, SEC 2011), mining the Pebble deposit is likely to involve excavation of the largest open pit ever constructed in North America, covering up to 6.9 square miles (17.8 km<sup>2</sup>) and reaching a depth of as much as 0.77 mile (1.24 km) (EPA 2014: Chapter 6); for reference, the maximum depth of the Grand Canyon is approximately 1 mile. Disposal of resulting waste material would require construction of up to three mine tailings impoundments covering an additional 18.8 square miles (48.6 km<sup>2</sup>) and waste rock piles covering up to 8.7 square miles (22.6 km<sup>2</sup>) (EPA 2014: Chapter 6) in an area that contains highly productive streams and wetlands. The volume of mine tailings and waste rock produced from the smallest mine proposed by NDM to the SEC (Ghaffari et al. 2011, SEC 2011) would be enough to fill a professional football stadium more than 880 times, whereas the largest mine would do so more than 3,900 times.

In total, these three mine components (mine pit, tailings impoundments, and waste rock piles) would cover an area larger than Manhattan. Mine construction and operation would also require the construction of support facilities, including a major transportation corridor, pipelines, a power-generating station, wastewater treatment plants, housing and support services for workers, administrative offices, and other infrastructure. Such facilities would greatly expand the “footprint” of the mine and affect additional aquatic resources beyond the scope of this proposed determination. Although NDM’s preliminary plans (Ghaffari et al. 2011, SEC 2011) could change, any mining of this deposit would, by necessity, require similar mine components, support facilities, and operational features.

Given the extent of streams, wetlands, lakes, and ponds both overlying the Pebble deposit and within adjacent watersheds, excavation of a massive mine pit and construction of large tailings impoundments and waste rock piles would result in discharge of dredged or fill material into these waters. This discharge would result in complete loss of fish habitat due to elimination, dewatering, and

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<sup>1</sup> Ghaffari et al. (2011) call the 2.0 stage mine the “Investment Decision Case,” which describes an initial 25-year open pit mine life upon which a decision to initiate permitting, construction, and operations may be based.

<sup>2</sup> Ghaffari et al. (2011) call the 6.5 stage mine the “Resource Case,” which is based on 78 years of open pit production and seeks to assess the long-term value of the project in current dollars.

fragmentation of streams, wetlands, and other aquatic resources. In addition, water withdrawal and capture, storage, treatment, and release of wastewater associated with the mine would significantly impair the fish habitat functions of other streams, wetlands, and aquatic resources. All of these losses would be irreversible.

Based upon information known to EPA about the proposed mine at the Pebble deposit and its potential impacts on fishery resources, and as a result of multiple inquiries, concerns, and petitions to EPA to use its authorities to protect these fishery resources, EPA decided to conduct an ecological risk assessment before considering any additional steps. After three years of study, two rounds of public comment, and independent, external peer review, EPA released its *Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska*<sup>3</sup> (Bristol Bay Assessment) (EPA 2014) in January 2014. The Bristol Bay Assessment established that the extraction, storage, treatment, and transportation activities associated with building, operating, and maintaining one of the largest mines ever built would pose significant risks to the unparalleled ecosystem that produces one of the greatest wild salmon fisheries left in the world. In simple terms, the infrastructure necessary to mine the Pebble deposit jeopardizes the long-term health and sustainability of the Bristol Bay ecosystem.

The Bristol Bay Assessment characterizes the significant ecological resources of the region and describes potential impacts on salmon and other fish from large-scale porphyry copper mining at the Pebble deposit. The Bristol Bay Assessment evaluated these impacts using three mine scenarios that represent different stages of mining at the Pebble deposit, based on the amount of ore processed.

- Pebble 0.25 stage mine (approximately 0.25 billion tons of ore over 20 years)
- Pebble 2.0 stage mine (approximately 2.0 billion tons of ore over 25 years)
- Pebble 6.5 stage mine (approximately 6.5 billion tons of ore over 78 years)

Ghaffari et al. (2011) indicate that the total mineral resources at the Pebble deposit are now believed to be approximately 12 billion tons of ore. Thus, it is expected that development of a mine at the Pebble deposit would ultimately be much larger than the 0.25 stage mine and could exceed the 6.5 stage mine. NDM has stated to the public that “the Pebble deposit supports open pit mining utilizing conventional drill, blast and truck-haul methods, with an initial mine life of 25 years and potential for mine extensions to 78 years and beyond” (NDM 2011). This statement, along with others to investors, indicates that NDM is actively considering a mine size between 2.0 and 6.5 billion tons.

Nevertheless, EPA also assessed the impacts of a much smaller mine footprint in the Bristol Bay Assessment. The 0.25 stage mine is based on the worldwide median size porphyry copper deposit (Singer et al. 2008). Although this smaller size is dwarfed by the mine sizes that NDM put forward to the SEC (Ghaffari et al. 2011, SEC 2011), its impacts would still be significant.

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<sup>3</sup> For more information about EPA’s efforts in Bristol Bay or copies of the Bristol Bay Assessment, see <http://www.epa.gov/bristolbay>.

In total, the Bristol Bay Assessment estimates that habitat losses associated with the 0.25 stage mine would include nearly 24 miles (38 km) of streams, representing approximately 5 miles (8 km) of streams with documented anadromous fish occurrence and 19 miles (30 km) of tributaries of those streams (EPA 2014: Chapter 7). Total habitat losses would also include more than 1,200 acres (4.9 km<sup>2</sup>) of wetlands, lakes, and ponds, of which approximately 1,100 acres (4.4 km<sup>2</sup>) are contiguous with either streams with documented anadromous fish occurrence or tributaries of those streams. For the largest mine that NDM put forward to the SEC (the 6.5 stage mine), stream losses would expand to 94 miles (151 km), representing over 22 miles (36 km) of streams with documented anadromous fish occurrence and 72 miles (115 km) of tributaries of those streams (EPA 2014: Chapter 7). Total habitat losses for the 6.5 stage mine would also include more than 4,900 acres (19.8 km<sup>2</sup>) of wetlands, lakes, and ponds, of which approximately 4,100 acres (16.6 km<sup>2</sup>) are contiguous with either streams with documented anadromous fish occurrence or tributaries of those streams.

To put these numbers in perspective, stream losses for just the 0.25 stage mine would equal a length of more than 350 football fields and the 0.25 stage mine wetland losses would equal an area of more than 900 football fields. Although Alaska has many streams and wetlands that support salmon, individual streams, stream reaches, wetlands, lakes, and ponds play a critical role in protecting the genetic diversity of Bristol Bay's salmon populations. Individual waters can support local, unique populations (Quinn et al. 2001, Olsen et al. 2003, Ramstad et al. 2010, Quinn et al. 2012). Thus, losing these populations would erode the genetic diversity that is crucial to the stability of the overall Bristol Bay salmon fisheries (Hilborn et al. 2003, Schindler et al. 2010, EPA 2014: Appendix A).

These stream, wetland, and other aquatic resource losses also would reverberate downstream, depriving downstream fish habitats of nutrients, groundwater inputs, and other subsidies from lost upstream aquatic resources. In addition, water withdrawal, capture, storage, treatment, and release at even the 0.25 stage mine would result in streamflow alterations in excess of 20% in more than 9 miles (nearly 15 km) of streams with documented anadromous fish occurrence. These streamflow changes would result in major changes in ecosystem structure and function and would reduce both the extent and quality of fish habitat downstream of the mine to a significant degree. The impacts from the larger mine sizes NDM has forecasted would be significantly higher. The 2.0 and 6.5 stage mines would result in streamflow alterations in excess of 20% in more than 17 miles (27 km) and 33 miles (53 km), respectively, of streams with documented anadromous fish occurrence (EPA 2014: Chapter 7).

The CWA is a law essential for EPA's mission, which is to protect and restore the environment and public health for current and future generations. Section 404(c) of the CWA authorizes EPA to prohibit, restrict, or deny the use of any defined area in waters of the United States for specification as a disposal site whenever it determines, after notice and opportunity for public hearing, that the discharge of dredged or fill material into the area will have an unacceptable adverse effect on fishery areas (including spawning and breeding areas). EPA has used its Section 404(c) authority judiciously and sparingly, having completed only 13 Section 404(c) actions in the 42-year history of the CWA.

As a first step in the regulatory process pursuant to Section 404(c), EPA Region 10 coordinated with NDM, the Pebble Limited Partnership (PLP),<sup>4</sup> and the State of Alaska to provide them an opportunity to submit information that demonstrated either that no unacceptable adverse effects would result from discharges associated with mining the Pebble deposit or that actions could be taken to prevent unacceptable adverse effects on fishery areas. EPA Region 10 met with both NDM/PLP and the State of Alaska and extended the time period for both to submit this information.

Both NDM/PLP and the State of Alaska submitted information that raised scientific and technical issues, most of which had been previously raised in public comments on the Bristol Bay Assessment. However, this information did not demonstrate to the satisfaction of EPA Region 10 that no unacceptable adverse effects on fishery areas will occur should the disposal of dredged or fill material associated with mining the Pebble deposit proceed.

Therefore, EPA Region 10 has decided to take the next step in the Section 404(c) review process, publication of this proposed determination. As part of a Section 404(c) proposed determination, the EPA Regional Administrator must identify a defined area, known as the disposal site, where its prohibitions or restrictions would apply. In this case, the proposed geographic boundaries of the potential disposal site are the waters within the mine claims held by NDM subsidiaries, including PLP, that fall within the SFK, NFK, and UTC watersheds (Figure ES-3). EPA Region 10 focused on this area because it determined that it best represents the smallest geographical area where the discharge of dredged or fill material associated with mining the Pebble deposit is most likely to occur.

To protect important fishery areas in the SFK, NFK, and UTC watersheds from unacceptable adverse effects, EPA Region 10 recognizes that losses of streams, wetlands, lakes, and ponds and alterations of streamflow each provide a basis to issue this Section 404(c) proposed determination.

Given the proposals made by NDM to develop 2.0- and 6.5-billion-ton mines at the Pebble deposit (Ghaffari et al. 2011, SEC 2011) and EPA's evaluation of the 0.25-billion-ton mine (EPA 2014), the Regional Administrator has reason to believe that mining of the Pebble deposit at any of these sizes, even the smallest, could result in significant and unacceptable adverse effects on ecologically important streams, wetlands, lakes, and ponds and the fishery areas they support.

Accordingly, the Regional Administrator proposes that EPA restrict the discharge of dredged or fill material related to mining the Pebble deposit into waters of the United States within the potential disposal site that would, individually or collectively, result in any of the following.

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<sup>4</sup> PLP was created in 2007 by co-owners NDM and Anglo American PLC to design, permit, construct, and operate a long-life mine at the Pebble deposit (Ghaffari et al. 2011). Anglo American PLC withdrew from the partnership in late 2013; since 2013, NDM has been the sole partner in PLP.



1. **Loss of streams**
  - a. The loss of 5 or more linear miles of streams with documented anadromous fish<sup>5</sup> occurrence; **or**
  - b. The loss of 19 or more linear miles of streams where anadromous fish are not currently documented, but that are tributaries of streams with documented anadromous fish occurrence; **or**
2. **Loss of wetlands, lakes, and ponds.** The loss of 1,100 or more acres of wetlands, lakes, and ponds contiguous with either streams with documented anadromous fish occurrence or tributaries of those streams; **or**
3. **Streamflow alterations.** Streamflow alterations greater than 20% of daily flow in 9 or more linear miles of streams with documented anadromous fish occurrence.

These restrictions derive from the estimated impacts resulting from the discharge of dredged or fill material associated with construction and routine operation of a 0.25 stage mine at the Pebble deposit, as evaluated in the Bristol Bay Assessment (EPA 2014).

EPA Region 10's evaluation of relevant portions of the Section 404(b)(1) Guidelines (40 CFR Part 230) further demonstrates that discharge of dredged or fill material resulting in the level of adverse effects identified in the proposed restrictions could result in unacceptable adverse effects on fishery areas. Degradation of these aquatic resources would be even more pronounced given extensive cumulative impacts at successive stages of mine expansion (i.e., 2.0 and 6.5 stage mines or larger) at the Pebble deposit, including elevated instream copper concentrations sufficient to cause direct toxicity to fish. Toxic effects on fish would include fish kills; reduced survival, growth, and/or reproduction; and reduced sensory acuity, which is important to salmon for locating natal streams, finding food, and avoiding predators.

EPA Region 10 recognizes it has underestimated potential adverse effects on resources within the SFK, NFK, and UTC watersheds from mining the Pebble deposit for several reasons. This evaluation does not include footprint impacts associated with all of the components necessary to construct and operate such a mine (e.g., a major transportation corridor, pipelines, a power-generating station, wastewater treatment plants, housing and support services for workers, administrative offices, and other infrastructure). It also does not rely upon impacts resulting from potential accidents and failures as a basis for its findings. There is a high likelihood that wastewater treatment plant failures would occur, given the long management horizon expected for the mine (i.e., decades). There is also real uncertainty as to whether severe accidents or failures, such as a complete wastewater treatment plant failure or a tailings dam failure, could be adequately prevented over a management horizon of centuries, or even in perpetuity, particularly in such a geographically remote area subject to climate extremes. If such events

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<sup>5</sup> Anadromous fish are those that hatch in freshwater habitats, migrate to sea for a period of relatively rapid growth, and then return to freshwater habitats to spawn. For the purposes of these restrictions, anadromous fish refers to coho or silver salmon (*Oncorhynchus kisutch*), Chinook or king salmon (*O. tshawytscha*), sockeye or red salmon (*O. nerka*), chum or dog salmon (*O. keta*), and pink or humpback salmon (*O. gorbuscha*).

were to occur, they would have profound ecological ramifications. By not relying on potential accidents and failures, EPA Region 10 has employed a conservative analysis of adverse effects.

Known compensatory mitigation techniques are unlikely to offset impacts of the nature and magnitude described in the proposed restrictions. Compensatory mitigation is the concept of improving stream or wetland health in other parts of the watershed to compensate for stream or wetland destruction or degradation in a separate area. Compensatory mitigation efforts typically involve restoration and enhancement of waters that have potential for improvement in ecological services. However, the waters of the Bristol Bay watershed are already among the most productive in the world. EPA Region 10 sees little likelihood that human activity could improve upon the high-quality natural environment in the Bristol Bay watershed that nature has created and that has thus far been preserved. Compensation methods proposed by PLP, including placement of instream structures, stream fertilization, and construction of spawning channels, have typically had only variable, local, or temporary effects, were designed for use in degraded watersheds, or resulted in adverse, unintended consequences (EPA 2014: Appendix J).

Mine alternatives with lower environmental impacts at the Pebble deposit are not evaluated in either the Bristol Bay Assessment or this Section 404(c) proposed determination. If these proposed restrictions are finalized, proposals to mine the Pebble deposit that have impacts below each of these restrictions would proceed to the Section 404 permitting process with the U.S. Army Corps of Engineers. Any such proposals would have to meet the statutory and regulatory requirements for permitting under Section 404.

After evaluating available information, EPA Region 10 has reason to believe that unacceptable adverse effects on fishery areas (including spawning and breeding areas) could result from the discharge of dredge or fill material associated with mining the Pebble deposit. Further, it has not been demonstrated to the satisfaction of EPA Region 10 that no unacceptable adverse effect(s) will occur.

EPA Region 10 is soliciting public comment on all issues discussed in this proposed determination, including likely adverse impacts on fishery resources, mitigation measures to potentially address these impacts, and other options to restrict or prohibit potentially harmful discharges of dredged or fill material associated with mining the Pebble deposit. All comments will be fully considered as EPA Region 10 decides whether to withdraw the proposed determination or forward to EPA Headquarters a recommended determination to restrict the use of certain waters in the SFK, NFK, and UTC watersheds in southwest Alaska as disposal sites for the discharge of dredged or fill material associated with mining the Pebble deposit. Should EPA Region 10 make a recommended determination, EPA Headquarters will then determine, based on the recommended determination, public comments received on the proposed determination, and all other available, relevant information, whether to issue a final determination under Section 404(c).

**Figure ES-1. The Bristol Bay watershed, composed of the Togiak, Nushagak, Kvichak, Naknek, Egegik, and Ugashik River watersheds and the North Alaska Peninsula. Only selected towns and villages are shown on this map.**

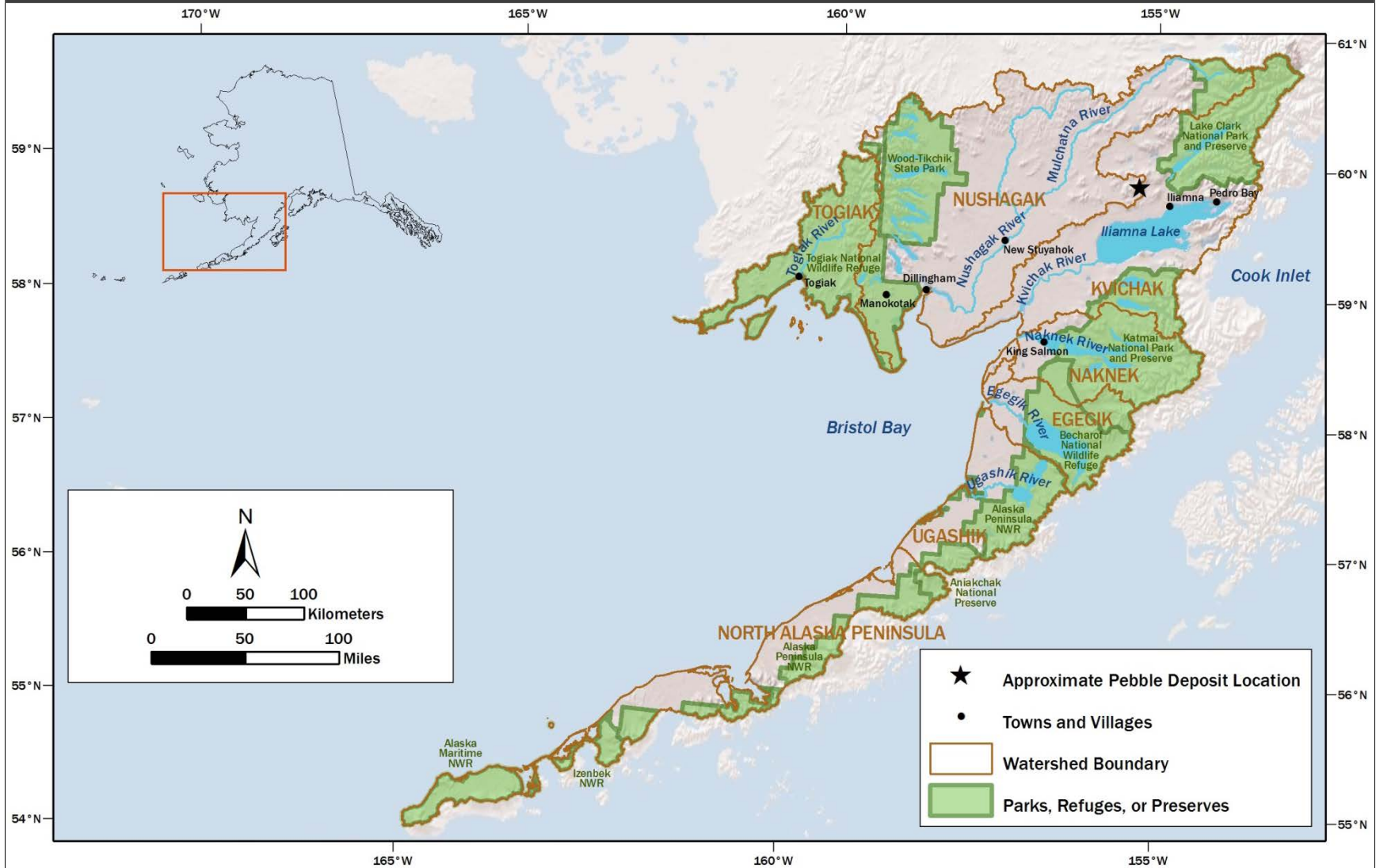


Figure ES-2. The Nushagak and Kvichak River watersheds.

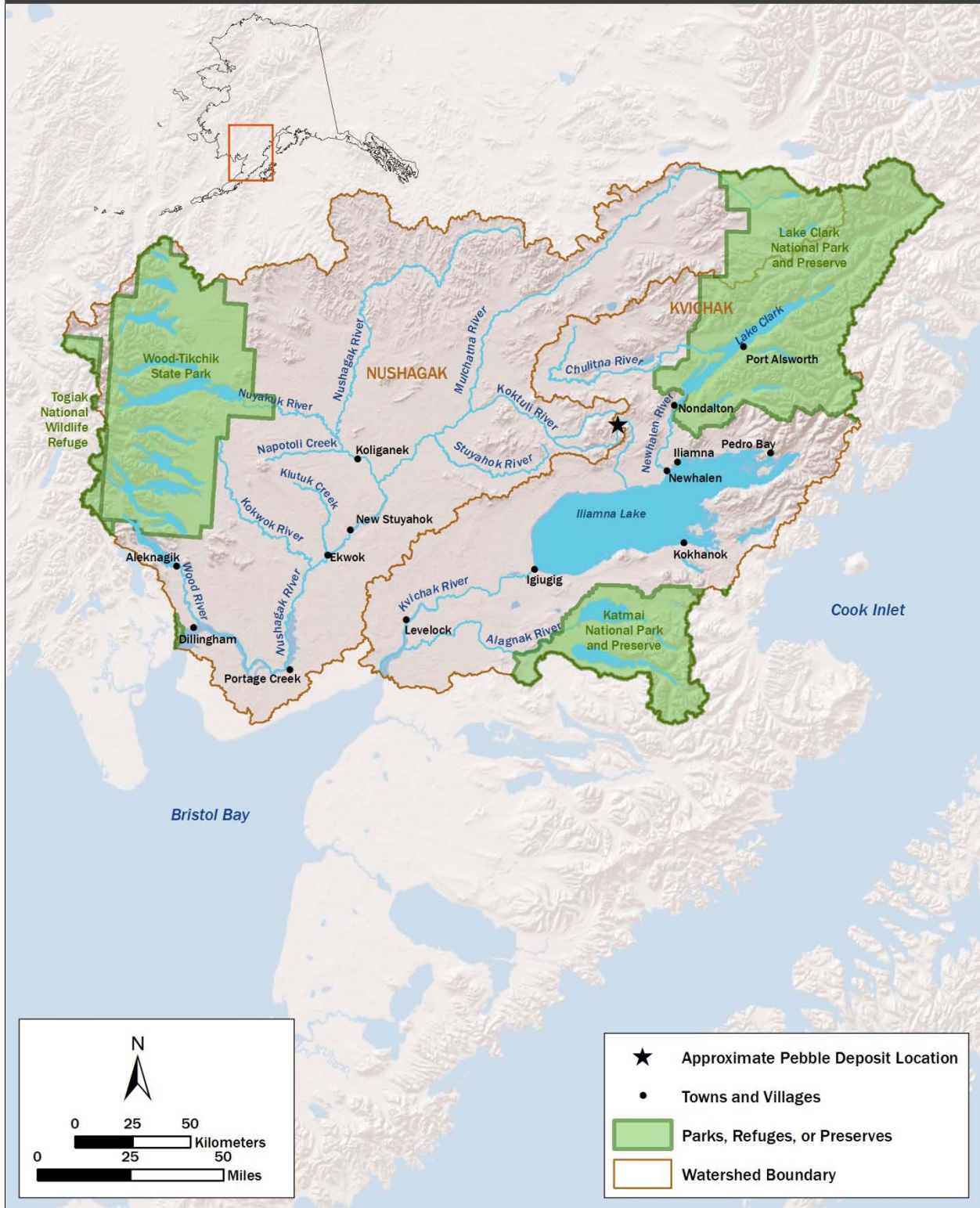
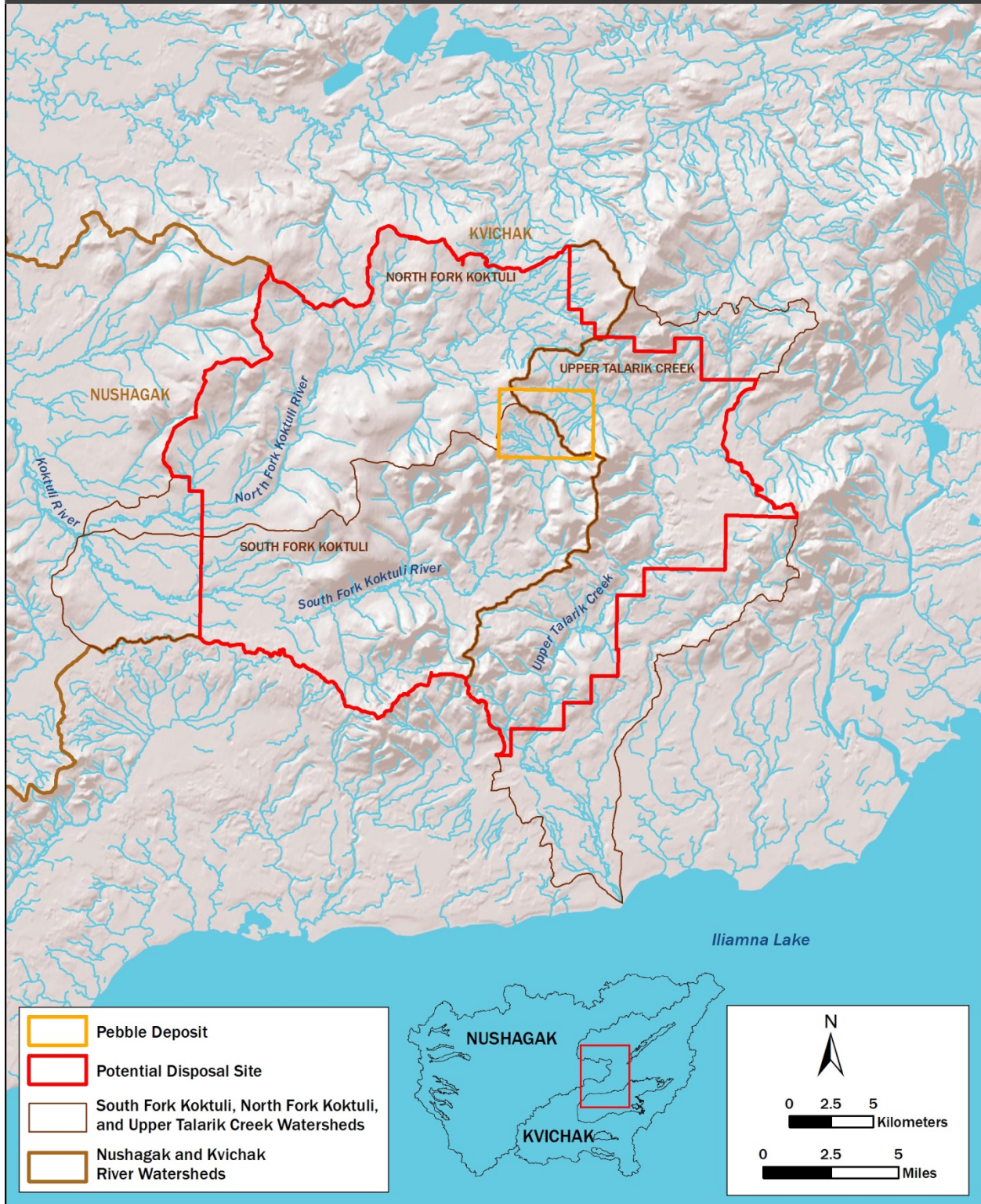


Figure ES-3. The potential disposal site delineated in the proposed determination.



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