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## Mitigation of Wetland Impacts from Large-Scale Hardrock Mining in Bristol Bay Watersheds

Thomas G. Yocom<sup>†</sup> & Rebecca L. Bernard<sup>‡</sup>

*The U.S. Environmental Protection Agency (EPA) has evaluated the potential impacts and risks of large-scale hardrock mining projects in a portion of the Bristol Bay region of Alaska drained by the Nushagak and Kvichak River systems. The EPA's draft Bristol Bay Watershed Assessment (BBWA) did not assess the likelihood that impacts, such as those to streams, open-water habitats, and adjacent wetlands, might be offset by mining project sponsors, thereby reducing net project impacts. The purpose of this article is to evaluate the likelihood that practicable compensatory mitigation measures exist to offset the impacts of such a mining project – in particular the proposed Pebble Mine – enough to satisfy the permitting requirements under Section 404 of the Clean Water Act (CWA).*

*This article focuses exclusively on compensatory mitigation for impacts to wetland and aquatic sites and does not evaluate other potential mining project impacts, such as those to water quality and stream flows. Accordingly, it assesses only the likelihood that the sponsor of a large-scale hardrock mine in the Bristol Bay region could sufficiently offset project losses of wetland and aquatic habitats to qualify for a permit pursuant to Section 404.*

*This article concludes that the size, unique nature, and permanence of habitat losses associated with large-scale hardrock mining in Bristol Bay watersheds are unlikely to be offset adequately through compensatory mitigation. Therefore, the impacts would be unacceptable and not permissible under Section 404 of the CWA.*

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## I. INTRODUCTION

Compensatory mitigation measures are commonly used during the Clean Water Act (CWA) Section 404 permitting process to reduce or offset losses of aquatic resources and functions resulting from the permitted discharges. Offsetting large-scale impacts in ecologically intact environments, however, may be neither feasible nor effective in replacing lost functions due to the lack of opportunities for aquatic resource restoration, enhancement, or preservation of similar resources. This article assesses the potential options for compensatory mitigation for losses of anadromous fish streams, their tributaries, open-water habitats, and adjacent wetlands from one or more large-scale hardrock mines in the Bristol Bay region of Alaska and evaluates the likelihood that any of these options could offset impacts of the magnitude that would likely result from such a mine, as required under the CWA.

In a sense, this article attempts to fill a gap in the draft Bristol Bay Watershed Assessment (BBWA) released by the U.S. Environmental Protection Agency (EPA) in July 2012.<sup>1</sup> The draft BBWA assessed the potential impacts of one or more large-scale hardrock mines in the Nushagak and Kvichak drainages within the Bristol Bay region but did

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1. See U.S. ENVTL. PROT. AGENCY, EPA 910-R-12-004D, AN ASSESSMENT OF POTENTIAL MINING IMPACTS ON SALMON ECOSYSTEMS OF BRISTOL BAY, ALASKA (2012), available at <http://yosemite.epa.gov/R10/ECOCOMM.NSF/bristol+bay/bristolbayreport>.

not address the potential for offsetting those impacts through compensatory mitigation measures.<sup>2</sup>

The specific focus of this article is the proposed Pebble Mine, a project of the Pebble Limited Partnership (PLP). PLP has not yet submitted formal permit applications for the mine, but if it secures approval, the mine will be built in the virtually pristine headwaters of the Koktuli River and Talarik Creek watersheds within the broader Nushagak-Kvichak watershed in the Bristol Bay region of Alaska. The potential mine poses particular challenges with respect to compensatory mitigation because of the sheer size of the impact (thousands of acres of streams and wetlands), the largely undisturbed environment, and the special ecological functions of the headwater streams and wetlands that would be filled.<sup>3</sup> Nonetheless, the analysis should have relevance to other potential large-scale hardrock mines in other Bristol Bay drainages, given the significance of the entire Bristol Bay basin as highly productive and sustainable salmon habitat.<sup>4</sup>

This article does not address the likelihood that large-scale hardrock mining could comply with other Section 404 restrictions concerning less damaging alternatives, water quality standards, endangered species, or significant degradation, but these restrictions are another potential stumbling block for proposed new mines.<sup>5</sup> We also do not address the likelihood that impacts to water quality or stream flows could be mitigated to permitted levels, but we recognize that these mitigation challenges could be even greater than those we assess here.

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2. *Id.* Indeed, in the Final Peer Review Report for the Draft BBWA, released by EPA on November 9, 2012, one peer reviewer noted that the Draft BBWA identifies mitigation measures to minimize impact but no compensatory mitigation measures: “This is a concern, for I wonder if compensatory mitigation for the example mine is even possible in the watershed.” See VERSAR, INC, Contract No. EP-C-07-025, Task Order 155, FINAL PEER REVIEW REPORT, EXTERNAL PEER REVIEW OF EPA’S DRAFT DOCUMENT, AN ASSESSMENT OF POTENTIAL MINING IMPACTS ON SALMON ECOSYSTEMS OF BRISTOL BAY, ALASKA 49-50 (2012) (comment by Paul Whitney, Ph.D.), available at <http://www.epa.gov/ncea/pdfs/bristolbay/Final-Peer-Review-Report-Bristol-Bay.pdf>.

3. For a lyrical description of the largely untouched nature of the Bristol Bay region, see Edwin Dobb, *Alaska’s Choice: Salmon or Gold*, NAT’L GEOGRAPHIC, Dec. 2010, available at <http://ngm.nationalgeographic.com/2010/12/bristol-bay/dobb-text>.

4. For a discussion of the productivity of the Bristol Bay fishery, see, e.g., Daniel E. Schindler et al., *Population Diversity and the Portfolio Effect in an Exploited Species*, 465 NATURE 609 (2010), available at <http://www.nature.com/nature/journal/v465/n7298/full/nature09060.html>.

5. See WILLIAM M. RILEY & THOMAS G. YOCOM, REPORT PREPARED FOR BRISTOL BAY NATIVE CORPORATION AND TROUT UNLIMITED, MINING THE PEBBLE DEPOSIT: ISSUES OF 404 COMPLIANCE AND UNACCEPTABLE ENVIRONMENTAL IMPACTS (2011). The Corps or EPA could determine, for example, that there are less-damaging alternative sites including alternative ore deposits, or that a large-scale hardrock mine in this area could result in unacceptable risks to water quality.

This article begins with an explanation of the regulatory framework (Part II), followed by a brief discussion of the unique ecological functions of the headwater streams and wetlands in the region of the Pebble Deposit (Part III). The article then discusses potential compensatory mitigation measures, including mitigation banks (Part IV.A), in-lieu fee programs (Part IV.B), and various potential permittee-responsible compensatory mitigation projects (Part IV.C). In brief, we conclude that there are few, if any, reasonable and practicable measures within the relevant watersheds that could offset the enormous losses of headwater wetland and aquatic habitats associated with the proposed Pebble Mine.

## II. REGULATORY BACKGROUND

The federal CWA aims to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters”; to achieve this objective, it declares several national goals, including “that the discharge of pollutants into the navigable waters be eliminated by 1985.”<sup>6</sup> The Act pursues these goals by, among other measures, prohibiting the discharge of pollutants into the “waters of the United States” except as specifically permitted by the Act.<sup>7</sup> Section 404 of the CWA authorizes the Corps to issue permits for the discharge of dredged or fill material,<sup>8</sup> which is defined as a pollutant under the CWA regulations.<sup>9</sup> In determining whether to issue such permits, the Corps applies CWA regulations promulgated jointly by the Corps and the EPA (the 404(b)(1) Guidelines).<sup>10</sup> Mirroring the Act, the 404(b)(1) Guidelines seek to “restore and maintain the chemical, physical, and biological integrity of the Nation’s waters” through the control of discharges of dredged or fill material.<sup>11</sup> The primary mechanism of the Guidelines for achieving this purpose is avoidance of impact to waters of the U.S., including wetlands:

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6. 33 U.S.C. § 1251(a) (2006).

7. *See id.* §§ 1311(a) (discharge prohibition), 1362(12) (defining “discharge” to make the prohibition specific to “navigable waters”), 1362(7) (defining “navigable waters” to mean “the waters of the United States”).

8. *See* 33 U.S.C. § 1344(a).

9. *See* 40 C.F.R. § 122.2 (2011) (for purposes of the Clean Water Act, “pollutant” means “dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended) . . . , heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal, and agricultural waste discharged into water.”).

10. 404(b)(1) Guidelines, 40 C.F.R. part 230 (2012).

11. 40 C.F.R. § 230.1(a).

Fundamental to these Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern.<sup>12</sup>

Where a discharge of dredged or fill material into waters of the U.S. is unavoidable, the impacts of the discharge to the physical, chemical, and biological integrity of those waters must be minimized and offset.

The regulations that govern discharges of dredged or fill material follow this hierarchy in determining if the discharges can be authorized. The 404(b)(1) Guidelines prohibit the authorization of discharges where:

1. There is a practicable alternative that would have less adverse impact on the aquatic environment (LEDPA);
2. The discharges would violate an applicable State water quality standard or toxic effluent standard, would jeopardize the continued existence of an endangered or threatened species or destroy or adversely modify its designated critical habitat, or would violate any requirement imposed to protect a marine sanctuary;
3. The discharges would cause or contribute to significant degradation of waters of the U.S.; or
4. Appropriate and practicable measures have not been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.<sup>13</sup>

The Corps must deny authorization of any proposed discharge that does not comply with all of these restrictions.<sup>14</sup> For example, even where appropriate and practicable measures have been taken to minimize potential adverse impacts of the discharge, the Corps must deny the permit if the discharge would cause or contribute to significant degradation of waters of the U.S. In addition, the Corps must deny a permit where “there does not exist sufficient information to make a reasonable judgment as to whether the proposed discharge will comply

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12. 40 C.F.R. § 230.1(c).

13. 40 C.F.R. § 230.10(a)-(d).

14. *See* Corps Section 404 Regulations, 33 C.F.R. § 323.6(a) (2012) (“Subject to consideration of any economic impact on navigation and anchorage pursuant to section 404(b)(2), a permit will be denied if the discharge that would be authorized by such a permit would not comply with the 404(b)(1) guidelines. If the district engineer determines that the proposed discharge would comply with the 404(b)(1) guidelines, he will grant the permit unless issuance would be contrary to the public interest.”) (emphasis added).

with these Guidelines.”<sup>15</sup> In other words, the regulations direct the Corps to deny the permit application if a District Engineer cannot determine if the proposed discharge represents the LEDPA or whether, after considering proposed compensatory mitigation measures, the proposed discharge would or would not cause or contribute to significant degradation of the waters of the U.S.

Compliance with these regulations has been required for all permitted discharges since 1986. In 1990, the Department of the Army and the EPA entered into a Memorandum of Agreement (MOA) on mitigation, which further confirmed the mitigation sequence of avoiding, minimizing, and offsetting (mitigating) impacts.<sup>16</sup>

In 2001, the National Academy of Sciences produced a report that concluded compensatory mitigation measures under the Section 404 program were generally insufficient, unsuccessful, and in some cases not implemented as required under Army Corps permits.<sup>17</sup> The report made several recommendations to improve the success of compensatory mitigation under the Section 404 regulatory program.<sup>18</sup> This study and others led the Corps and the EPA to promulgate new regulations in 2008 to govern the implementation of Section 404 compensatory mitigation.<sup>19</sup> The goal of the new regulations, known as the 2008 Mitigation Rule, is to “promote no net loss of wetlands by improving wetland restoration and protection policies, increasing the effective use of wetland mitigation banks and strengthening the requirements for the use of in-lieu fee mitigation.”<sup>20</sup>

The 2008 Mitigation Rule confirmed the “avoid, minimize, and offset” sequence for mitigation and emphasized that a permit may not be issued where there is a “lack of appropriate and practicable

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15. 40 C.F.R. § 230.12(a)(3)(iv).

16. See Memorandum of Agreement between the Environmental Protection Agency and the Department of the Army concerning the determination of mitigation under the Clean Water Act Section 404(b)(1) Guidelines (Feb. 6, 1990), available at <http://water.epa.gov/lawsregs/guidance/wetlands/mitigate.cfm>. Importantly, this MOA states that compensatory mitigation “may not be used as a method to reduce environmental impacts in the evaluation of the least environmentally damaging practicable alternatives for the purposes of requirements under Section 230.10(a).” In other words, impacts must be avoided and/or minimized first, regardless of the compensatory mitigation measures that may be proposed by a permit applicant. *Id.*

17. COMM. ON MITIGATING WETLAND LOSSES, BD. ON ENVTL. STUDIES AND TOXICOLOGY, WATER SCI. AND TECH. BD., DIV. ON EARTH AND LIFE STUDIES & NAT’L RESEARCH COUNCIL, COMPENSATING FOR WETLAND LOSSES UNDER THE CLEAN WATER ACT (NATIONAL ACADEMY PRESS) (2001).

18. *Id.*

19. See 40 C.F.R. §§ 230.91-230.98 (EPA) and 33 C.F.R. §§ 332.1-332.8 (Corps).

20. See *Compensatory Mitigation Rule Factsheet*, U.S. ENVTL. PROT. AGENCY, <http://water.epa.gov/lawsregs/guidance/wetlands/upload/MitigationRule.pdf> (last visited Mar. 6, 2013).

compensatory mitigation options.”<sup>21</sup> Under the 2008 Mitigation Rule, “[t]he fundamental objective of compensatory mitigation is to offset environmental losses resulting from unavoidable impacts to waters of the United States authorized by [Section 404] permits.”<sup>22</sup> Compensatory mitigation must be determined “based on what is practicable and capable of compensating for the aquatic resource functions that will be lost as a result of the permitted activity.”<sup>23</sup> Furthermore, “[c]ompensatory mitigation requirements must be commensurate with the amount and type of impact that is associated with a particular [Section 404] permit.”<sup>24</sup>

Methods of available compensatory mitigation that may be considered are restoration, enhancement, establishment, and, under certain narrow circumstances, preservation with an expressed preference in the regulations for restoration.<sup>25</sup> Preservation is an acceptable form of compensatory mitigation only where all of the following criteria are met:

- (i) The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
- (ii) The resources to be preserved contribute significantly to the ecological sustainability of the watershed. In determining the contribution of those resources to the ecological sustainability of the watershed, the district engineer must use appropriate quantitative assessment tools, where available;
- (iii) Preservation is determined by the district engineer to be appropriate and practicable;
- (iv) The resources are under threat of destruction or adverse modifications; and
- (v) The preserved site will be permanently protected through an appropriate real estate or other legal instrument (*e.g.*, easement, title transfer to state resource agency or land trust).<sup>26</sup>

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21. 40 C.F.R. § 230.91(c)(3). “Practicable means available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes.” *Id.* § 230.91(c)(2).

22. *Id.* § 230.93(a)(1).

23. *Id.* In determining what compensatory mitigation will be “environmentally preferable,” the Corps “must assess the likelihood for ecological success and sustainability, the location of the compensation site relative to the impact site and their significance within the watershed, and the costs of the compensatory mitigation project.” *Id.*

24. *Id.*

25. *Id.* § 230.93(a)(2).

26. *Id.* § 230.93(h).



The order in which the Corps is to consider types and locations of mitigation options is as follows: (1) mitigation bank credits, where available; (2) in-lieu fee program credits, where available; (3) permittee-responsible mitigation under a watershed approach; (4) permittee-responsible mitigation through on-site and in-kind mitigation; and (5) permittee-responsible mitigation through off-site and/or out-of-kind mitigation.<sup>27</sup>

The 2008 Mitigation Rule emphasizes a watershed approach: “[i]n general, the required compensatory mitigation should be located within the same watershed as the impact site, and should be located where it is most likely to successfully replace lost functions and services . . . .”<sup>28</sup> The goal of this approach is to “maintain and improve the quality and quantity of aquatic resources within watersheds . . . .”<sup>29</sup> Watershed is defined as “a land area that drains to a common waterway, such as a stream, lake, estuary, wetland, or ultimately the ocean.”<sup>30</sup> Among other factors, the watershed approach must consider “how the types and locations of compensatory mitigation projects will provide the desired aquatic resource functions . . . .”<sup>31</sup> This means selecting mitigation projects that will provide not just a single function, but “where practicable, the suite of functions typically provided by the affected aquatic resource.”<sup>32</sup> Although the Corps has flexibility to define the scale of the “watershed,” the scale must “not be larger than is appropriate to ensure that the aquatic resources provided through compensation activities will effectively compensate for adverse environmental impacts resulting from activities authorized by [Section 404] permits.”<sup>33</sup> Selection of the mitigation site focuses on replacing lost function,<sup>34</sup> and in-kind mitigation is preferred over out-of-kind mitigation because it is most likely to compensate for lost function.<sup>35</sup> In-kind “rehabilitation, enhancement, or preservation” is particularly emphasized for difficult-to-replace resources like streams (and, though not expressly stated, presumably headwater wetlands that provide unique functions and services).<sup>36</sup>

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27. *Id.* § 230.93(b).

28. *Id.* § 230.93(b)(1); *see also id.* § 230.93(c)(1) (Corps must use a watershed approach to compensatory mitigation where appropriate and practicable).

29. *Id.* § 230.93(c)(1).

30. *Id.* § 230.92.

31. *Id.* § 230.93(c)(2).

32. *Id.*

33. *Id.* § 230.93(c)(4).

34. *Id.* § 230.93(d)(1).

35. *Id.* § 230.93(e)(1).

36. *Id.* § 230.93(e)(3).

The amount of compensatory mitigation required must be, “to the extent practicable, sufficient to replace lost aquatic resource functions.”<sup>37</sup> A functional or conditional assessment should be used to determine the proper amount. If one is not available, “a minimum one-to-one acreage or linear foot compensation ratio must be used.”<sup>38</sup> A compensation ratio greater than one-to-one is required where, among other things, the mitigation method is preservation, the likelihood of success is at issue, the aquatic resources lost and replaced are different, the mitigation site is distant from the impact site, or the lost functions are difficult to restore.<sup>39</sup>

The 2008 Mitigation Rule also requires that compensatory mitigation occur, to the extent practicable, in advance of or concurrent with the permitted impacts, and that the permittee provide financial assurances.<sup>40</sup> The Rule requires that each compensatory mitigation project have a mitigation plan containing: objectives; site selection criteria; site protection instruments (such as conservation easements); baseline data (for impact and compensation sites); a valid methodology for determining mitigation credit; a work plan; a maintenance plan; ecologically based performance standards; monitoring requirements; a long-term management plan; an adaptive management plan to deal with unforeseen problems; and financial assurances to ensure that the compensatory mitigation plan continues to be successful in the future.<sup>41</sup> The plan must also contain ecological performance standards designed to ensure the mitigation project achieves its objectives.<sup>42</sup> Additionally, the Rule addresses monitoring and management of mitigation projects<sup>43</sup> and provides detailed rules governing mitigation banks and in-lieu fee programs.<sup>44</sup>

The preamble to the 2008 Mitigation Rule explicitly recognizes the continuing applicability of the May 13, 1994, guidance titled “Statements on the Mitigation Sequence and No Net Loss of Wetlands in Alaska,” issued by the EPA and the Department of the Army as part of the Alaska Wetlands Initiative Final Summary Report.<sup>45</sup> This guidance

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37. *Id.* § 230.93(f)(1).

38. *Id.*

39. *Id.* § 230.93(f)(2).

40. *Id.* §§ 230.93(m), (n).

41. *Id.* § 230.94(c).

42. *Id.* § 230.95(a).

43. *Id.* §§ 230.96, 230.97.

44. *Id.* § 230.98.

45. Compensatory Mitigation for Losses of Aquatic Resources, 73 Fed. Reg. 19,594, 19,619 (Apr. 10, 2008) (citing Memorandum from Robert H. Wayland, III, to Alvin L. Ewing, Alaska Operations Office, U.S. Env'tl. Prot. Agency Region X: Statements on the Mitigation Sequence and No Net Loss of Wetlands in Alaska (May 13, 1994) (on file with journal)).

memorializes an interagency policy understanding that compensatory mitigation is not always warranted or practicable within Alaska, even though this policy seems contrary to 1) the goal of the CWA to restore and maintain the physical integrity (reach and extent) of the nation's waters, including wetlands, and 2) the national no-net-loss-of-wetlands policy with which it attempts to find harmony.

It seems clear, however, that the EPA and the federal agency team that participated in the 1994 Alaska Wetlands Initiative intended that this initiative apply primarily to small projects with minimal impacts. In its background discussion developing this policy, the EPA notes that 251 individual permits and 654 general permits<sup>46</sup> were issued by the Corps, Alaska District in 1993, 11 of which were required to provide compensatory mitigation.<sup>47</sup> The 11 projects where compensatory mitigation was required provided 226 acres of wetlands mitigation (an average of approximately 20 acres per project). For the remaining 240 individual and 654 general permitted activities for which compensatory mitigation was not required, the average net loss per authorization was approximately one acre.

In subsequent guidance specifically applicable to Alaska, the Corps, Alaska District clarified what project impacts will require compensatory mitigation pursuant to Section 404 of the CWA under the 2008 Mitigation Rule. The Corps' 2009 Regulatory Guidance Letter (RGL) lists types of projects that always require compensatory mitigation, including those requiring "fill placed in anadromous fish streams and wetlands adjacent to anadromous fish streams."<sup>48</sup> The RGL also identifies compensatory mitigation ratios that apply in Alaska. For waters in the "high" compensation category, as those in the Koktuli River and Upper Talarik Creek headwaters region would likely be, the required ratio is at least 2:1 for restoration and/or enhancement and at least 3:1 for preservation.<sup>49</sup>

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46. General permits, such as Nationwide General Permits, are authorizations issued by the Corps for minor activities that the Corps has determined would have minimal impacts individually and cumulatively. These general permits have strict acreage limitations, and are typically well under one acre.

47. U.S. Envtl. Prot. Agency, Dep't. of the Army, U.S. Fish and Wildlife Serv. & Nat'l Marine Fisheries Serv., Alaska Wetlands Initiative Summary Report, Table 1 (1994), *available at* [http://water.epa.gov/grants\\_funding/wetlands/facts/upload/alaska.pdf](http://water.epa.gov/grants_funding/wetlands/facts/upload/alaska.pdf).

48. U.S. ARMY CORPS OF ENG'RS ALASKA DIST., RGL ID NO. 09-01, ALASKA DISTRICT REGULATORY GUIDANCE LETTER 8 (2009), *available at* <http://southeastalaskalandtrust.org/pdf/2009/AK%20District%20Mitigation%20RGL.pdf> [hereinafter ALASKA RGL].

49. *Id.* app. B. "High functioning wetlands" include those that "are undisturbed and contain ecological attributes that are difficult or impossible to replace within a human lifetime, if at all. . . . The position of the wetland in the landscape plays an integral role in overall watershed health." *Id.* app. A at 3. They also include those where "[s]pawning areas are present (aquatic vegetation and/or

Accordingly, our assessment of potential compensatory mitigation measures within the Bristol Bay basin is based on the understanding that such measures would be required for hardrock mining projects that would impact anadromous fish streams and adjacent wetlands, such as the streams and wetlands that are documented by PLP in its Environmental Baseline Document (EBD).

### III. THE IMPORTANCE AND UNIQUE ECOLOGICAL FUNCTIONS OF HEADWATER STREAMS

Because compensatory mitigation focuses on replacing lost aquatic functions, it is important to understand the specific functions that are performed by the headwater streams and wetlands that would be lost if the Pebble Mine were permitted.

Headwater streams, which dominate the region surrounding the Pebble deposit, are defined as low-order and intermittent streams at the fringes of watershed boundaries.<sup>50</sup> Although they may compose almost 80 percent of total stream length in many drainage networks,<sup>51</sup> they are often unmapped and overlooked due to their small size and sometimes intermittent flow.<sup>52</sup> In the North Fork and South Fork Kaktuli Rivers and Upper Talarik Creek watersheds, headwater streams comprise more than twice the stream kilometers of mainstem habitat.<sup>53</sup> Because headwater and intermittent streams vary widely in physical, chemical, and biological characteristics, they provide varied and abundant habitats crucial to maintaining a diverse aquatic ecosystem function downstream.<sup>54</sup> Headwaters may be influenced by groundwater or

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gravel beds)." *Id.* app. A at 6. The headwaters wetlands in the Kaktuli and Upper Talarik watersheds fit these descriptions, as the subsequent section indicates.

50. Judy L. Meyer, David L. Strayer, J. Bruce Wallace, Sue L. Eggert, Gene S. Helfman & Norman E. Leonard, *The Contribution of Headwater Streams to Biodiversity in River Networks*, 43 J. AM. WATER RESOURCES ASS'N 86 (2007); J. DAVID ALLAN & MARIA M. CASTILLO, *STREAM ECOLOGY: STRUCTURE AND FUNCTION OF RUNNING WATERS* 436 (2d ed. 2007).

51. John S. Richardson & Robert J. Danehy, *A Synthesis of the Ecology of Headwater Streams and their Riparian Zones in Temperate Forests*, 53(2) *FOREST SCI.* 131 (2007).

52. J. L. Meyer & J.B. Wallace, *Lost Linkages and Lotic Ecology: Rediscovering Small Streams*, in *ECOLOGY: ACHIEVEMENT AND CHALLENGE* 295-317 (Malcolm C. Press, Nancy J. Huntly & Simon Levin eds., 2001).

53. 746 headwater km and 306 mainstream km. Personal communication with Marcus Geist, formerly Spatial Data Manager, The Nature Conservancy (Mar. 15, 2012). Calculations based on U.S. Geological Survey National Hydrographic Dataset.

54. MEYER ET AL., *supra* note 52; Mark S. Wipfli, John S. Richardson & Robert J. Naiman, *Ecological Linkages Between Headwaters and Downstream Ecosystems: Transport of Organic Matter, Invertebrates, and Wood Down Headwater Channels*, 43 J. AM. WATER RESOURCES ASS'N 72 (2007); Robin L. Vannote, G. Wayne Minshall, Kenneth W. Cummins, James R. Sedell &

subsurface (hyporheic) flow and/or variable shade conditions which produce variable water temperatures and often provide both warm refuges during winter and cool refuges during summer.<sup>55</sup> Inasmuch as organic matter is carried by headwater streams to the mainstems, headwater streams determine downstream nutrient dynamics.<sup>56</sup> Many primary and secondary producers (e.g., algae and aquatic macroinvertebrates) are unique to headwater ecosystems<sup>57</sup> and may be adapted to freezing and intermittent flow conditions.<sup>58</sup> The diversity and abundance of headwater species additionally provide source populations for colonization of downstream habitat as well as prey for downstream invertebrates and fish species.<sup>59</sup>

Because they provide refuge from predators and competitors, rich feeding grounds, and thermal refuge, fish species often exploit low-order and ephemeral streams as either residents (e.g., sculpin) or migrants (e.g., salmonids).<sup>60</sup> Salmonids may use headwater streams as rearing (e.g., coho, Chinook),<sup>61</sup> and spawning (e.g., chum) habitat.<sup>62</sup> In a survey of 105 low-gradient headwater streams in the Nushagak and Kvichak drainages, 96 percent of streams supported resident fish, and 75 percent of streams supported anadromous salmon species.<sup>63</sup> In addition to supporting diverse fish populations, headwater streams can also be important habitat for amphibians, birds, mammals, and other biota.<sup>64</sup> As such, headwater

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Colbert E. Cushing, *The River Continuum Concept*, 37 CAN. J. FISHERIES & AQUATIC SCI. 130 (1980).

55. G. Power, R. S. Brown & J. G. Imhof, *Groundwater and Fish—Insights from Northern North America*, 13 HYDROLOGICAL PROCESSES 401, 409 (1999).

56. John S. Richardson, Robert E. Bilby & Carin A. Bondar, *Organic Matter Dynamics in Small Streams of the Pacific Northwest*, 41 J. AM. WATER RESOURCES ASS'N 921 (2005).

57. R.A. Progar & A. R. Moldenke, *Insect Production from Temporary and Perennially Flowing Headwater Streams in Western Oregon*, 17 J. FRESHWATER ECOLOGY 391 (2002).

58. John G. Irons III, Keith Miller & Mark W. Oswood, *Ecological Adaptations of Aquatic Macroinvertebrates to Overwintering in Interior Alaska (U.S.A.) Subarctic Streams*, 71 CAN. J. ZOOLOGY 98, 104-08 (1993).

59. Mark S. Wipfli & David P. Gregovich, *Export of Invertebrates and Detritus From Fishless Headwater Streams in Southeastern Alaska: Implications for Downstream Salmonid Production*, 47 FRESHWATER BIOLOGY 957, 957-58 (2002).

60. MEYER ET AL., *supra* note 52.

61. Thomas G. Brown & Gordon F. Hartman, *Contribution of Seasonally Flooded Lands and Minor Tributaries to the Production of Coho Salmon in Carnation Creek, British Columbia*, 117 TRANSACTIONS AM. FISHERIES SOC'Y 546 (1988); P.J. Wigington, Jr., et al., *Coho Salmon Dependence on Intermittent Streams*, 4 FRONTIERS ECOLOGY & ENV'T 513 (2006).

62. MEYER ET AL., *supra* note 52.

63. Carol Ann Woody & Sarah Louise O'Neal, *Fish Surveys in Headwater Streams of the Nushagak and Kvichak river Drainages, Bristol Bay, Alaska 2008-2010*, Prepared for the Nature Conservancy 48 (2010), available at [http://www.nature.org/media/alaska/aw\\_c\\_dec\\_2010.pdf](http://www.nature.org/media/alaska/aw_c_dec_2010.pdf).

64. MEYER ET AL., *supra* note 52.

and intermittent streams are sites of enormous biological diversity, hosting hundreds to thousands of species.<sup>65</sup>

#### IV. MITIGATING IMPACTS OF LARGE-SCALE HARDROCK MINING IN BRISTOL BAY WATERSHEDS

##### *A. Delineating the Watershed*

The Corps has some flexibility in defining the scale of the watershed for compensatory mitigation purposes, but that scale must “not be larger than is appropriate to ensure that the aquatic resources provided through compensation activities will effectively compensate for adverse environmental impacts resulting from activities authorized by [Corps] permits.”<sup>66</sup> For example, compensatory mitigation projects “should be located where [they are] most likely to successfully replace lost functions and services . . . .”<sup>67</sup>

Based on the language of the statute and its policy goals, the most appropriate watershed scale for purposes of compensating for unavoidable project impacts resulting from permitted discharges within the North Fork and South Fork Koktuli Rivers and/or Upper Talarik Creek drainages would be those same drainages (roughly 100 square miles each).<sup>68</sup> This scale is most appropriate because it would offer the greatest likelihood that compensatory mitigation measures would replace the specific suite of aquatic resource functions lost due to permitted discharges in those drainages. Mitigation projects within these specific drainages would also offer the only opportunity to protect habitat for the particular salmon stocks that originate in these drainages. This is important in light of the documented importance of the diversity of salmon stocks to the stability of the overall Bristol Bay salmon fishery—the so-called “portfolio effect.”<sup>69</sup>

If there are no reasonable or practicable measures that could be undertaken in these watersheds, it would be appropriate for the Corps and/or the EPA to require compensatory mitigation within the closest

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65. *Id.*

66. 40 C.F.R. § 230.93(c)(4) (2012).

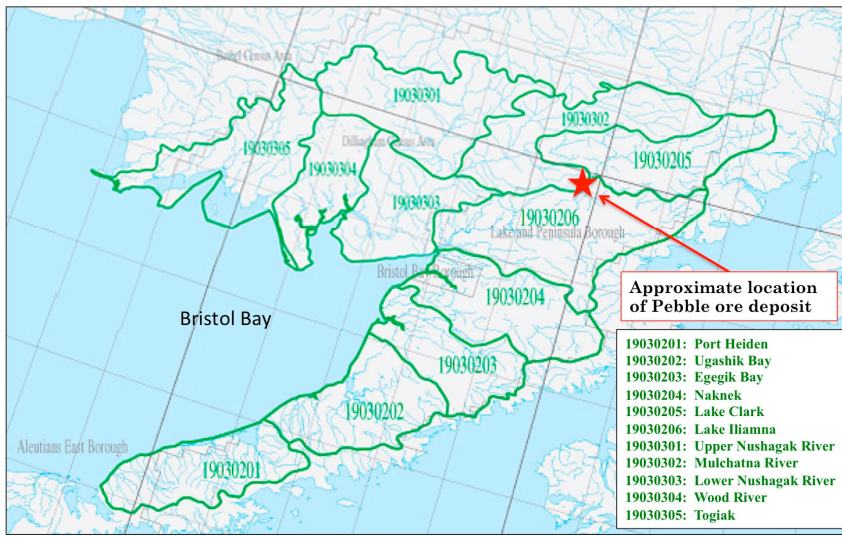
67. *Id.* § 230.93(b)(1); *see also id.* § 230.93(c)(1) (Corps must use a watershed approach to compensatory mitigation where appropriate and practicable).

68. See USGS 15300250 Upper Talarik Creek, National Water Information System: Web Interface, USGS, [http://waterdata.usgs.gov/nwis/inventory/?site\\_no=15300250&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/inventory/?site_no=15300250&agency_cd=USGS) (last visited Mar. 19, 2013); *see also* USGS 15302250 North Fork Koktuli River, National Water Information System: Web Interface, USGS, [http://waterdata.usgs.gov/nwis/inventory/?site\\_no=15302250&agency\\_cd=USGS](http://waterdata.usgs.gov/nwis/inventory/?site_no=15302250&agency_cd=USGS) (last visited Mar. 19, 2013).

69. *See, e.g.,* Schindler et al., *supra* note 4.

“hydrologic units” as defined by the U.S. Geological Survey. In this case, those hydrologic units are the Mulchatna River and Lake Iliamna watersheds (Figure 1).<sup>70</sup>

**Figure 1. USGS 8-digit HUC watersheds that drain to Bristol Bay, Alaska**



70. See *Surf Your Watershed: Mulchatna River Watershed*, U.S. ENVTL. PROT. AGENCY, [http://cfpub.epa.gov/surf/huc.cfm?huc\\_code=19030302](http://cfpub.epa.gov/surf/huc.cfm?huc_code=19030302) (last visited Mar. 6, 2013); see also *Surf Your Watershed, Lake Iliamna Watershed*, U.S. ENVTL. PROT. AGENCY, [http://cfpub.epa.gov/surf/huc.cfm?huc\\_code=19030206](http://cfpub.epa.gov/surf/huc.cfm?huc_code=19030206) (last visited Mar. 6, 2013). The USGS hydrologic units are identified in the 2008 Mitigation Rule as an appropriate basis for determining the service area of a mitigation bank or in-lieu fee provider. 40 C.F.R. §§ 230.98(d)(6)(ii)(A), 230.98(d)(8). The Mitigation Rule contemplates that such service areas may be defined based on smaller, 8-digit USGS hydrologic units (subbasins or watersheds) or much larger, 6-digit USGS hydrologic units (basins), at the discretion of the Army Corps district engineer. *Id.* Figure 1 shows the 8-digit units surrounding the Pebble deposit, including the Mulchatna River and Lake Iliamna units. These units are, in turn, encompassed within two 6-digit units – one containing all the 8-digit units beginning “190302” and one containing all the 8-digit units beginning “190303.” The Mulchatna River and Lake Iliamna watersheds are smaller, 8-digit watersheds (see Figure 1), which are most appropriate in this context due to the large size of the proposed mine and its impacts, as well as the importance of preserving the genetic diversity of the Bristol Bay salmon stocks. See *supra* note 69 and accompanying text. Further, due to scaling differences in mapping Alaska watersheds, these two 8-digit Alaska watersheds are six and ten times larger respectively than the average 8-digit hydrologic basin in the Lower 48. See U.S. GEOLOGICAL SURVEY & NATURAL RES. CONSERVATION SERVICE, FEDERAL STANDARDS AND PROCEDURES FOR THE NATIONAL WATERSHED BOUNDARY DATASET (WBD): TECHNIQUES AND METHODS 11–A3 (3d ed. 2012), available at [http://www.nrcs.usda.gov/Internet/FSE\\_DOCUMENTS/nrcs143\\_021581.pdf](http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs143_021581.pdf). Furthermore, use of very large, 6-digit hydrologic basins in Alaska (twice the size of the national average) would allow the consideration of compensatory mitigation projects hundreds of miles from the impact site, effectively eluding the goal of successfully replacing lost ecological functions and services. Even if the larger, 6-digit hydrologic basins in the region of the Pebble deposit were considered an appropriate watershed scale for mitigation purposes, this broader area does not likely offer compensatory mitigation opportunities involving the restoration or even preservation of thousands of acres of functionally similar habitat.

The South Fork and North Fork Koktuli Rivers flow into the Mulchatna River, and Upper Talarik Creek flows into Lake Iliamna; thus, these two watersheds would offer a somewhat broader geographic area for identifying mitigation sites while remaining close to the site of impact.

The EPA assessed a broader geographic area in its draft BBWA—the Nushagak and Kvichak River watersheds, including navigable and non-navigable tributaries—because that is where large-scale hardrock mining projects are most likely to occur. However, the geographic scope of the draft BBWA, focusing on known locations of large-scale mineral deposits, is not the appropriate watershed scale for compensatory mitigation for discharges from the proposed Pebble Mine, or any other permitted discharge in one of the several drainages that flow into Bristol Bay. The Nushagak and Kvichak River systems drain a large area, approximately the size of the State of West Virginia. Defining the watershed scale this broadly, or even more broadly as the entire Bristol Bay basin, would likely fail to effectively compensate for the adverse environmental impacts of the permitted discharge—the fundamental requirement of the Mitigation Rule. The genetic differences between individual salmon stocks in various drainages, and the importance of this genetic diversity to the overall stability of the Bristol Bay salmon fishery, undermine the value of mitigation measures designed to protect aquatic resources in a drainage far from the site of impact.<sup>71</sup>

An analogous situation is the California Central Valley, which is also approximately the size of the State of West Virginia and is also drained by two major rivers: the Sacramento and the San Joaquin, which both flow into San Francisco Bay. Like the portion of the larger Bristol

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71. An even more expansive view of the relevant watershed is cited in a white paper (policy analysis) prepared by HDR Inc. for PLP, which endorses a proposal by The Conservation Fund to divide its in-lieu fee provider service area, which is the entire State of Alaska, into five large geographic service areas: “Under that program, the Bristol Bay watershed, the Kuskokwim River watershed, Kodiak Island, and the Alaska Peninsula are grouped into one service area called Southwest Alaska. The regional scale of this ‘watershed’ makes sense because development projects are scattered across an extensive and sparsely populated area, the ecological resources are similar, and mitigation opportunities can be clustered for greater ecological benefit.” CHRISTOPHER WROBEL, JOHN MORTON, MIKE WITTER & JODIE ANDERSON, *OFFSETTING POTENTIAL IMPACTS THROUGH THE ENVIRONMENTAL PERMITTING PROCESS* (2012), available at <http://www.pebblepartnership.com/perch/resources/plp-white-paper-series1.pdf>. This justification for a broad watershed definition may be reasonable in the context of small development projects scattered across an extensive area, which is how in-lieu fee programs are generally used in Alaska (for a discussion of in-lieu fee programs, see *infra* Part IV.C.2), but it is not reasonable in the context of a very large project like the proposed Pebble Mine with enormous impacts on unique aquatic resources at a specific site. A mitigation project in the Kuskokwim River watershed or on Kodiak Island clearly would not be capable of replacing the particular ecological functions provided by the headwaters of the Koktuli River and Upper Talarik Creek drainages.



Bay basin where the EPA focused its assessment, the California Central Valley is not a single watershed, nor is it made up of simply the Sacramento and San Joaquin River drainages. Instead, the U.S. National Marine Fisheries Service identifies twenty-eight major watersheds in the Central Valley, as well as geologic and genetic differences among anadromous fish in these watersheds that would contraindicate allowing a permittee to compensate for anadromous fishery impacts in one of these watersheds with measures in another Central Valley watershed.<sup>72</sup>

Accordingly, because the regulations require a more precise focus, this article assesses the potential for mitigation to be implemented within the specific watersheds where the impacts would occur, or within the closest USGS hydrologic units.

*B. Estimating the Magnitude of Impacts for Which Compensatory Mitigation Would be Required*

We estimate that a Section 404 permit for the Pebble Mine would require at least 6,000 acres of compensatory mitigation if restoration or enhancement is the selected mitigation method and at least 9,000 acres if preservation is the selected method. In making this estimate, we begin with a preliminary mine plan published by PLP partner Northern Dynasty Minerals (NDM) in a 2011 report prepared in compliance with Canadian public disclosure regulations.<sup>73</sup> The report and plan are based on environmental and engineering studies that Pebble Mine proponents have conducted since at least 2004.<sup>74</sup>

The EPA has been criticized for using this plan as the basis for the “hypothetical mine scenario” that it assesses in its Draft BBWA.<sup>75</sup> This criticism is unfounded. The preliminary plan is a proper basis for both

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72. Nat'l Marine Fisheries Serv., SW. Reg'l Office, Public Draft Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-Run Chinook Salmon and Central Valley Spring-Run Chinook Salmon and the Distinct Population Segment of Central Valley Steelhead app. A (2009).

73. HASSAN GHAFARI ET AL., DOCUMENT NO. 1056140100-REP-R0001-00, PRELIMINARY ASSESSMENT OF THE PEBBLE PROJECT, SOUTHWEST ALASKA, PREPARED FOR NORTHERN DYNASTY MINERALS LTD. (2011), available at [http://www.hdgold.com/i/pdf/ndm/Pebble\\_Project\\_Preliminary%20Assessment%20Technical%20Report\\_February%2017%202011.pdf](http://www.hdgold.com/i/pdf/ndm/Pebble_Project_Preliminary%20Assessment%20Technical%20Report_February%2017%202011.pdf); see also RILEY & YOCOM, *supra* note 5 (discussing Wardrop report). The Canadian regulation is National Instrument 43-101 (Standards of Disclosure for Mineral Projects), promulgated by the British Columbia Securities Commission. See National Instrument 43-101 *Standards of Disclosure for Mineral Projects* British Columbia Sec. Comm'n, <http://www.bsc.bc.ca/mining.asp> (last visited January 17, 2013).

74. See PEBBLE LTD. P'SHIP, ENVIRONMENTAL BASELINE DOCUMENT (2012), available at <http://www.pebbleresearch.com> [hereinafter EBD].

75. See, e.g., Comment Submitted by John Shively, Chief [sic] Executive Officer, The Pebble Limited Partnership (PLP), on An Assessment of Potential Mining Impacts on Salmon Ecosystems of Bristol Bay, Alaska, to U.S. Env'tl. Prot. Agency (July 23, 2012), available at <http://www.regulations.gov/#!documentDetail;D=EPA-HQ-ORD-2012-0276-5419>.

the EPA's assessment of impacts and our estimate of the magnitude of impacts for which compensatory mitigation would be required. Inasmuch as NDM published its 2011 mine plan to comply with public disclosure laws, it is reasonable to use that information to assess potential impacts of mining on wetland and aquatic areas. It is also appropriate to use this plan because (a) the location of the ore deposit is known, (b) the wetlands and water bodies that overlie the deposit have been mapped and published by Pebble proponents,<sup>76</sup> and (c) the size and location of the initial tailings storage facility are based on environmental studies concluding that use of that drainage would minimize harm to fishery resources compared with other feasible sites.<sup>77</sup>

The plan describes three potential phases for mining the Pebble deposit, including a 25-year, a 45-year, and a 78-year mine.<sup>78</sup> It includes drawings showing the locations and footprints of the 25-year mine pit and an associated tailings storage facility in an unnamed tributary drainage of the North Fork Koktuli River.<sup>79</sup> The 25-year mine plan includes a mine pit and waste rock disposal area, covering approximately 5,400 acres, and an associated tailings storage facility, covering approximately 4,000 acres (Figure 2).<sup>80</sup> Our estimates of project impacts are based on the diagrams of these two areas and exclude other probable facilities, including access roads, processing facilities, pipelines, a power plant, and a proposed deepwater port on Cook Inlet. Thus, the figures used in our analysis likely underestimate impacts significantly.

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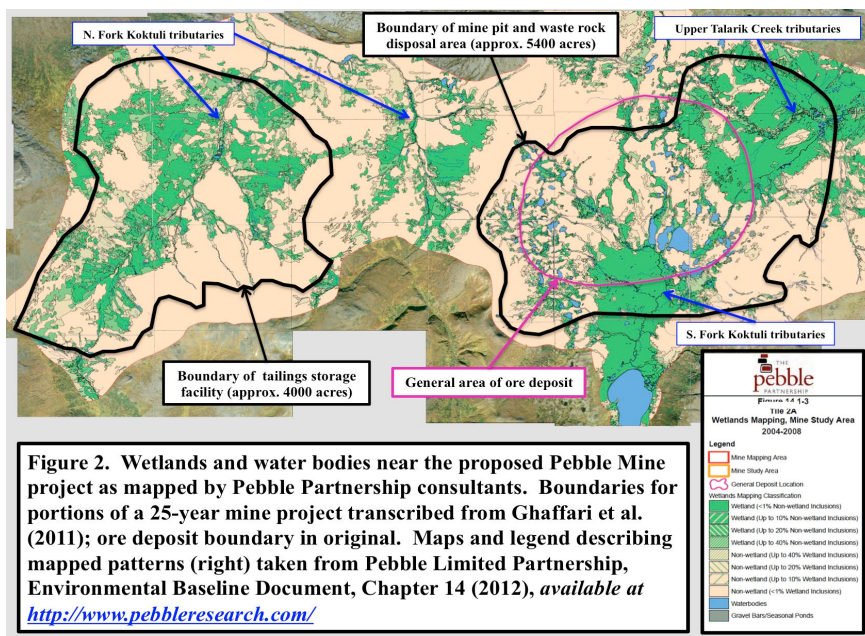
76. See EBD, *supra* note 74, at ch. 14.

77. KNIGHT PIESOLD CONSULTING, TAILINGS IMPOUNDMENT G, INITIAL APPLICATION REPORT, REF. NO. VA101-176/16-12, PREPARED FOR NORTHERN DYNASTY MINES, INC. (2006). This report accompanied a water rights application to impound the "Area G" drainage, an unnamed tributary to the North Fork Koktuli River that is also shown as the tailings storage facility in GHAFFARI ET AL., *supra* note 73 (the Wardrop report).

78. See GHAFFARI ET AL., *supra* note 73.

79. As recently as January, a diagram showing these same facilities appears on the Pebble Mine website of Northern Dynasty Minerals, one of the PLP partners. See *Preliminary Assessment 2011, The Pebble Project*, NORTHERN DYNASTY MINERALS LTD., [http://www.northerndynastyminerals.com/ndm/Prelim\\_A.asp](http://www.northerndynastyminerals.com/ndm/Prelim_A.asp) (last visited Jan. 17, 2013).

80. GHAFFARI ET AL., *supra* note 73; see also *Preliminary Assessment 2011*, *supra* note 79.



In its Environmental Baseline Document (EBD), a compilation of its baseline studies to date, PLP reported that roughly 33 percent of its “mine mapping area” was found to be wetlands and aquatic areas (see Figure 2, above).<sup>81</sup> PLP did not quantify these acreages with regard to any potential mine project footprint. The wetland maps in the EBD show that the low-lying areas that overlie the known Pebble ore deposit and the site of a likely tailings storage facility contain a high percentage of wetland and aquatic sites; however, these maps have not been verified. We therefore use PLP’s 33 percent average to estimate the acreage that might require compensatory mitigation, recognizing that these may be substantial underestimates for the proposed Pebble Mine as described in NDM’s preliminary mine plan.<sup>82</sup>

The preliminary mine plan shows an initial mining footprint that would cover approximately 9,400 acres for a 25-year mining project.<sup>83</sup> Using PLP’s overall estimate of wetland and aquatic areas within its mine mapping area, more than 3,000 acres of wetlands, streams, and open-water areas would be lost and subject to regulatory requirements for compensatory mitigation. This 3,000-acre estimate is used in our analysis to assess the availability of appropriate and practicable measures

81. See EBD, *supra* note 74, at ch. 14.

82. GHAFFARI ET AL., *supra* note 73, at 579.

83. RILEY & YOCOM, *supra* note 5. This footprint is similar to that of the hypothetical mine evaluated in the EPA’s draft BBWA.

to offset potential project impacts, recognizing that the actual impacts may be much larger, particularly if the mine operates for 45 years or more as the preliminary mine plan indicates is likely.<sup>84</sup>

Under the 2008 Mitigation Rule, the appropriate amount of compensatory mitigation would be determined, in the first instance, through a Corps-approved functional or conditional assessment to quantify the aquatic resource functions that would be lost if the Pebble Mine were built. This assessment would focus on the specific and unique functions performed by the headwater streams and wetlands in the area of the Pebble deposit, as described earlier. In the absence of such an assessment, the proper compensation ratio for the headwater streams and wetlands destroyed by discharges of dredged or fill material from mining the Pebble Deposit would be at least 2:1 if the mitigation method is restoration or enhancement, or at least 3:1 if the compensatory mitigation method is preservation.<sup>85</sup> This translates to at least 6,000 acres of compensatory mitigation for restoration or enhancement, and at least 9,000 acres of compensatory mitigation for preservation.

### *C. Potential Options for Compensatory Mitigation*

In its white paper for PLP, HDR Inc. lists types of compensatory mitigation that might be available to offset impacts from one or more large-scale hardrock mines in the Bristol Bay region:

Compensatory mitigation for wetlands impacts could, for example, take the form of anadromous fish habitat restoration, property acquisition for conservation easements, water quality improvements, remediation of contaminated sites, biodiversity offsets, funding for research and education, or other options. There may be opportunities for development organizations to join with local tribal governments and non-governmental organizations to create wetland mitigation banks or endowment funds to manage fish and wildlife, water quality, and preservation of undeveloped natural resources for generations to come...<sup>86</sup>

While these various measures can offset project impacts on a case-by-case basis, habitat restoration and enhancement are most effective at offsetting direct permanent losses of wetland and aquatic habitats. Preservation of existing habitat, even when there is clear evidence that

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84. See *The Pebble Project: The Future of U.S. Mining and Metals*, NORTHERN DYNASTY MINERALS LTD., [http://www.northerndynastyminerals.com/i/pdf/ndm/NDM\\_Presentation\\_Sept2012.pdf](http://www.northerndynastyminerals.com/i/pdf/ndm/NDM_Presentation_Sept2012.pdf) (last visited Mar. 6, 2013).

85. ALASKA RGL, *supra* note 48, at app. B.

86. WROBEL ET AL., *supra* note 71.

such habitat would be otherwise under immediate threat for destruction or degradation, does not offset project impacts or result in overall ecological improvement. Nevertheless, there is greater flexibility to mitigate through preservation and other in-lieu fee mechanisms in Alaska than there is in other parts of the United States, where opportunities for restoration and enhancement of degraded habitats are far greater.

Using the categories of compensatory mitigation described in the 2008 Mitigation Rule and the 2009 Corps, Alaska District guidance pursuant to that rule, we now examine the opportunities for mitigating impacts of one or more large-scale hardrock mines within the Mulchatna River and Lake Iliamna watersheds, including some of the actions suggested by HDR Inc., above.<sup>87</sup>

### 1. Mitigation Banks

As stated previously,<sup>88</sup> the 2008 Mitigation Rule expresses a preference for the use of a mitigation bank as compensatory mitigation when an approved mitigation bank is available and appropriate. A mitigation bank is defined as follows:

a site, or suite of sites, where resources (e.g., wetlands, streams, riparian areas) are restored, established, enhanced, and/or preserved for the purpose of providing compensatory mitigation for impacts authorized by [Section 404] permits. In general, a mitigation bank sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor.<sup>89</sup>

Mitigation banks are considered less risky and more effective than permittee-responsible mitigation because, among other things, they “typically involve larger, more ecologically valuable parcels, and more rigorous scientific and technical analysis, planning and implementation than permittee-responsible mitigation.”<sup>90</sup> The Corps, Alaska District lists four approved mitigation banks. However, none of these mitigation banks serve the Bristol Bay region,<sup>91</sup> so they would not be available or

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87. See *supra* note 71 and accompanying text. Some of the ideas described in the HDR white paper are not addressed herein because they would not offset the habitat losses caused by the proposed Pebble Mine and therefore would not be suitable as primary compensatory mitigation. These include rehabilitating chum and coho stocks in the southeastern Bering Sea through measures like mist incubation, rehabilitating sockeye stocks through lake fertilization, and funding research efforts or joint ventures.

88. See *supra* note 27 and accompanying text.

89. 40 C.F.R. § 230.92 (2012).

90. 40 C.F.R. § 230.93(b)(2) (2012).

91. See The Pebble Project: The Future of U.S. Mining and Metals, *supra* note 84.

appropriate for offsetting impacts to wetland and aquatic areas within the watersheds of Bristol Bay.

PLP has identified establishing a new mitigation bank as a possible compensatory mitigation measure. The Mitigation Rule provides extensive and detailed rules for establishing a mitigation bank, with which PLP would have to comply.<sup>92</sup> Most significantly, before a mitigation bank can release credits as compensatory mitigation for permitted impacts, it must have in place an approved instrument, including a mitigation plan, appropriate real estate and financial assurances, and have achieved “specific milestones associated with the mitigation bank site’s protection and development . . . .”<sup>93</sup>

A problem with the mitigation bank option is the lack of appropriate sites for restoration, enhancement, or preservation within the watersheds. The Mulchatna River and Lake Iliamna watersheds are largely intact and unaltered by human activities. There appear to be no degraded habitat areas of similar function and adequate size within the Upper Talarik Creek or Koktuli River drainages, or within the greater Mulchatna River or Lake Iliamna watersheds that could be restored or enhanced. Nor are there appropriate preservation sites within these drainages—i.e. sites that perform similar aquatic functions, are of the appropriate acreage, and are under threat of development—except for the Pebble site itself.

There are some scattered degraded sites within the more-distant Lower Nushagak watershed<sup>94</sup> that could benefit from restoration, but it is unlikely that these sites could provide the acreage or ecological function that would be lost at the Pebble site. Some of these degraded sites, moreover, are old mines that would require resolution of liability and contamination issues before they could serve as mitigation sites.<sup>95</sup> Preservation options are also limited in the Lower Nushagak watershed

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92. See generally 40 C.F.R. § 230.98.

93. 40 C.F.R. § 230.93(b)(2).

94. See *Surf Your Watershed: Lower Nushagak River Watershed*, U.S. ENVTL. PROT. AGENCY, [http://cfpub.epa.gov/surf/huc.cfm?huc\\_code=19030303](http://cfpub.epa.gov/surf/huc.cfm?huc_code=19030303) (last visited Mar. 6, 2013). The Lower Nushagak hydrologic unit as defined by USGS does not coincide with the physical boundaries of the lower Nushagak River watershed, as it separates the Wood River drainage into a separate hydrologic unit.

95. One example is the Red Top Mine on Marsh Mountain just east of Aleknagik, which produced about 120 flasks of mercury through 1970 and has apparently not been in production since then. See DONALD J. GRYBECK, ALASKA RESOURCE DATA FILE, NEW AND REVISED RECORDS VERSION 1.5, U.S. GEOLOGICAL SURVEY 564-566 (2008), available at [http://ardf.wr.usgs.gov/ardf\\_data/1225.pdf](http://ardf.wr.usgs.gov/ardf_data/1225.pdf). Although the acres of impact are not identified in the Alaska Resource Data File (ARDF), it can be inferred from the 10,000 feet of surface dozer trenching and about 1,480 feet of underground workings described in the ARDF that the acreage is fairly small. The ARDF description of the mine’s geology gives no indication of any aquatic resources similar to those at the Pebble site.

because of the sheer number of acres that would be required, and the difficulty of finding sites to offset the loss of pristine headwater streams and wetlands and their unique ecological functions.

An additional challenge is that ownership of the land in the region is mixed amongst state and federal ownership, as well as private lands and Native allotments. Even though public lands can provide mitigation options in appropriate circumstances, credit for such mitigation is given only for “aquatic resource functions provided by the compensatory mitigation project, over and above those provided by public programs already planned or in place,”<sup>96</sup> and preservation is an acceptable mitigation method only when the mitigation site is threatened.<sup>97</sup> Further, preservation downstream from the proposed Pebble project would be effective only if the headwaters of the preservation area were not degraded. These limitations would preclude most sites with adequate acreage and similar aquatic function from serving as acceptable mitigation sites for the proposed Pebble project. Therefore, we conclude that mitigation banks are not a viable option due to a lack of appropriate sites that require either restoration or preservation from an immediate threat.

## 2. In-Lieu Fee Programs

In areas where the mitigation bank option not feasible, use of in-lieu fee credits rather than permittee-responsible mitigation is generally preferred for the same reasons that mitigation banks are preferred.<sup>98</sup> An in-lieu fee program is defined as follows:

a program involving the restoration, establishment, enhancement, and/or preservation of aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for [Section 404] permits. Similar to a mitigation bank, an in-lieu fee program sells compensatory mitigation credits to permittees whose obligation to provide compensatory mitigation is then transferred to the in-lieu program sponsor...<sup>99</sup>

As with mitigation bank credits, however, the use of in-lieu fee credits is allowed only where the in-lieu fee program sponsor “has the appropriate number and resource type of credits available . . . .”<sup>100</sup> For

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96. 40 C.F.R. § 230.93(a)(3).

97. *Id.* § 230.93(h)(1)(4).

98. *Id.* § 230.93(b)(3).

99. *Id.* § 230.92.

100. *Id.* § 230.93(b)(3).

this reason, and those that follow, in-lieu fee programs are similarly inappropriate.

The Corps, Alaska District lists three in-lieu fee sponsors.<sup>101</sup> One of these in-lieu fee sponsors—The Conservation Fund—is actively seeking to purchase conservation easements within the Bristol Bay region as part of its Southwest Alaska Salmon Habitat Initiative.<sup>102</sup> If the Corps determines that a proposal to mine the Pebble deposit would result in unavoidable impacts to salmon habitat, an in-lieu fee program is a potential avenue for mitigation. However, the magnitude of potential project impacts might preclude such a mechanism. No efforts to purchase conservation easements within the Mulchatna River or Lake Iliamna watersheds were identified during the preparation of this article.

The Conservation Fund has generally identified “[o]pportunities for compensatory mitigation through wetlands preservation [such as] the purchase of strategic in-holdings in Wood-Tikchik State Park, Togiak, Becharof, Alaska Peninsula Izembek and Kodiak National Wildlife Refuges, Afognak and Shuyak Island State Parks, Katmai and Lake Clark National Park and other state and federal conservation units.”<sup>103</sup> These locations, however, are far from the impact site, and only the Wood-Tikchik State Park reaches, though barely, into the Lower Nushagak hydrologic unit as defined by USGS. According to the most recent land use plan for the Wood-Tikchik State Park, private inholdings within the park that are not already subject to conservation easements are limited to 27 very small Native allotments (80 or 160 acres) and 9 private inholdings, which are also quite small.<sup>104</sup> It is unlikely that many of these contain wetlands of any significance. Regardless, accepting preservation in these distant locations as mitigation for impacts in the Mulchatna River and Lake Iliamna watersheds would be inconsistent with the Mitigation Rule emphasis on providing ecological benefits close to the site of impact.<sup>105</sup>

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101. See *Alaska District In-Lieu Fee Sponsors*, [http://www.poa.usace.army.mil/Portals/34/docs/regulatory/Alaska District In-lieu Fee Sponsors.pdf](http://www.poa.usace.army.mil/Portals/34/docs/regulatory/Alaska%20District%20In-lieu%20Fee%20Sponsors.pdf) (last visited Feb. 5, 2013). The other in-lieu fee sponsors approved by the Corps Alaska District do not serve the Bristol Bay region.

102. See *Southwest Alaska Salmon Habitat Initiative*, CONSERVATION FUND, <http://www.conservationfund.org/projects/southwest-alaska-salmon-habitat-initiative/> (last visited Mar. 7, 2013). This effort is aided, in part, by donations from Bristol Bay Native Corporation.

103. The Conservation Fund, *A Prospectus to Establish and Administer the Alaska Statewide In-Lieu Fee Compensatory Mitigation Program 12* (March 2011) (on file with authors).

104. Alaska Dep’t of Natural Resources, Div. Parks & Outdoor Rec’n, *Wood-Tikchik State Park Management Plan 2-2, Map 2-1, 7-11* (2002), available at <http://dnr.alaska.gov/parks/plans/woodt/wtplan4mb.pdf>.

105. See *supra* notes 28-33 and accompanying text.



### 3. Permittee-Responsible Compensatory Mitigation

Permittee-responsible compensatory mitigation is defined as “an aquatic resource restoration, establishment, enhancement, and/or preservation activity undertaken by the permittee (or an authorized agent or contractor) to provide compensatory mitigation for which the permittee retains full responsibility.”<sup>106</sup> The Mitigation Rule provides the following order of priorities: first, a watershed approach is preferred; second, on-site, in-kind mitigation; and finally, off-site, out-of-kind mitigation is considered as a last resort.<sup>107</sup>

#### *a) Fish Passage: Road Crossings*

One measure that could be compatible with a watershed approach is to provide fish passage across man-made features such as road crossings. Virtually all streams near the Pebble deposit support anadromous and resident fish.<sup>108</sup> Because stream crossings can impact spawning, rearing,<sup>109</sup> and refuge habitats,<sup>110</sup> they can reduce genetic diversity,<sup>111</sup> thereby reducing long-term sustainability of salmon populations.<sup>112</sup> Fish passage is a problem commonly associated with declines in salmon and other fish populations throughout the United States,<sup>113</sup> including Alaska.<sup>114</sup> One possible compensatory mitigation measure could be to remove crossings at non-project sites that create barriers to fishes, and

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106. 40 C.F.R. § 230.92 (2012).

107. *See id.* § 230.93(b)(4)-(6).

108. WOODY & O'NEAL, *supra* note 63, at 48; *Anadromous Waters Catalog*, ALASKA DEP'T OF FISH & GAME, <http://www.sf.adfg.state.ak.us/SARR/awc/> (last visited Mar. 6, 2013).

109. Jeffrey C. Davis & Gay A. Davis, The Influence of Stream-Crossing Structures on the Distribution of Rearing Juvenile Pacific Salmon, 30 J. N. AM. BENTHOLOGICAL SOC'Y 1117 (2011); M.B. Sheer & E.A. Steel, Lost Watersheds: Barriers, Aquatic Habitat Connectivity, and Salmon Persistence in the Willamette and Lower Columbia River Basins, 135 TRANSACTIONS AM. FISHERIES SOC'Y 1654 (2006).

110. David M. Price et al., Fish Passage Effectiveness of Recently Constructed Road Crossing Culverts in the Puget Sound Region of Washington State, 30 AM. J. FISHERIES MGMT. 1110 (2010).

111. Helen Neville et al., *Influences of Wildfire, Habitat Size, and Connectivity on Trout in Headwater Streams Revealed by Patterns of Genetic Diversity*, 138 TRANSACTIONS AM. FISHERIES SOC'Y 1314 (2009); John E. B. Wofford, Robert E. Gresswell & Michael A. Banks, *Influence of Barriers to Movement on Within-Watershed Genetic Variation of Costal Cutthroat Trout*, 15 ECOLOGICAL APPLICATIONS 628 (2005).

112. Ray Hilborn, Thomas P. Quinn, Daniel E. Schindler & Donald E. Rogers, *Biocomplexity and Fisheries Sustainability*, 100 PROC. NAT'L ACAD. SCI. 6564 (2003); Schindler et al., *supra* note 6.

113. Willa Nehlsen, Jack E. Williams & James A. Lichatowich, *Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington*, 16 FISHERIES 4 (1991); KEN BATES ET AL., WASH. DEP'T OF FISH AND WILDLIFE, DESIGN OF ROAD CULVERTS FOR FISH PASSAGE 112 (2003).

114. *Fish Passage Improvement Program*, ALASKA DEP'T OF FISH AND GAME, <http://www.adfg.alaska.gov/index.cfm?adfg=fishpassage.projects> (last visited Mar. 6, 2013).

replace them with crossings that improve fish passage. Where fish passage is essentially blocked, and where habitat above the blockage is suitable, providing permanent improvements to fish passages or access is a form of restoration and/or enhancement for which compensatory mitigation credit could be determined appropriate. Although such actions could provide improved habitat access by anadromous fishes, they would not offset the direct loss of thousands of acres of wetlands, water bodies, or stream miles.

Whether a fish passage project is a suitable mitigation measure would depend in part on whether there is already a party responsible for maintaining fish passage or repairing and replacing road crossings; if so, it would be inappropriate for PLP to use such a project for mitigation credit. In addition, quantifying the compensatory mitigation credit to assign to any particular fish passage improvement or series of improvements would require complex assessments of existing conditions and potential improvements in habitat functions. Further, such improvements, as with other forms of compensatory mitigation, would need to be permanent and include long-term maintenance in perpetuity.

One problem with this measure is that Pebble Mine proponents may find it challenging enough to ensure unimpeded fish passage at road crossings for the proposed eighty-six-mile road between the Pebble ore deposit and Cook Inlet, due to the high gradient terrain surrounding much of the potential road corridor.<sup>115</sup> The proposed road would require at least eighty stream crossings, ranging from small headwaters to large perennial rivers such as the Iliamna and Newhalen rivers,<sup>116</sup> and all fish passage sites would require regular maintenance. Construction of this road may, moreover, open the door to additional spur road construction. Thus, even if efforts to maintain or improve fish passage at non-project sites were successful, these gains could be erased by the adverse impacts associated with road construction for the mine itself.

#### *b) Fish Passage: Beaver Dams*

In its EBD, PLP identified beaver dams of 0.25 m and higher as potential temporary barriers,<sup>117</sup> raising the possibility that PLP may

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115. GHAFFARIET AL., *supra* note 73.

116. PND Engineers, Inc., Iliamna Regional Transportation Corridor Analysis, Prepared for Alaska Dep't of Transp. and Pub. Facilities 148 (2007), *available at* [http://www.dowlhkm.com/projects/SWAKTP/new\\_website/docs/iliamna\\_reg\\_transp\\_corr\\_final\\_rpt\\_12-31-07.pdf](http://www.dowlhkm.com/projects/SWAKTP/new_website/docs/iliamna_reg_transp_corr_final_rpt_12-31-07.pdf).

117. EBD, *supra* note 74, at ch. 15 app. B. Elsewhere, however, PLP acknowledges that beaver ponds may serve as important habitat for adult spawning and juvenile overwintering for Pacific salmon. *See id.* at ch. 15, Technical summary, page 15.1-14 ("While beaver ponds were relatively

propose beaver dam removal as a compensatory mitigation measure. Although people may perceive beaver dams as impediments to fish passage, studies supporting this perception are generally speculative,<sup>118</sup> and no study has demonstrated adverse population impacts to fish from beaver dams. Beaver dams are semipermeable and may limit fish movement temporarily during low stream flows<sup>119</sup> but generally do not constitute significant barriers to salmonid migration.<sup>120</sup> When beaver dams do present barriers they are generally short-lived, as dams are often overtopped or blown out by storm surges.<sup>121</sup>

Pacific salmon and other fish species are commonly found above beaver dams. In southeast Alaska, for example, coho salmon were documented upstream of all surveyed beaver dams, including a two-meter-high beaver dam; highest coho densities were documented in streams with beaver. Furthermore, both adult and juvenile sockeye salmon, coho salmon, steelhead, cutthroat, and char have been documented upstream of beaver dams,<sup>122</sup> as have Chinook juveniles.<sup>123</sup> Some anecdotal evidence suggests that beaver dams can be an obstacle to upstream chum salmon movement.<sup>124</sup>

A recent meta-analysis of the impacts of beaver on freshwater fish indicates that beaver have a positive impact on coho, Chinook, Dolly

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scarce in the mainstem UT [Upper Talarik Creek], the off-channel habitat study revealed a preponderance of beaver ponds in the off-channel habitats. As in the SFK [South Fork Koktuli] watershed, beaver ponds accounted for more than 90 percent of the off-channel habitat surveyed. Beaver ponds in the UT provided habitat for adult spawning and juvenile overwintering for Pacific salmon. The water temperature in beaver ponds in the UT was slightly warmer than in other habitat types and thus, beaver ponds may represent a more productive habitat as compared to other mainstem channel habitat types.”)

118. Paul S. Kemp et al., Qualitative and Quantitative Effects of Reintroduced Beavers on Stream Fish, 13 FISH & FISHERIES 158 (2012).

119. Michael M. Pollock, Morgan Heim & Danielle Werner, *Hydrologic and Geomorphic Effects of Beaver Dams and Their Influence on Fishes*, in THE ECOLOGY AND MANAGEMENT OF WOOD IN WORLD RIVERS 213 (Stan V. Gregory, Kathryn L. Boyer & Angela M. Gurnell eds., 2003).

120. *Id.*; Robert S. Rupp, Beaver-Trout Relationships in the Headwaters of Sunhaze Stream, Maine, 84 TRANSACTIONS AM. FISHERIES SOC'Y 75 (1955); Richard Gard, Effects of Beaver on Trout in Sagehen Creek, California, 25 J. WILDLIFE MGMT. 221(1961).

121. Kemp et al., *supra* note 118; Karen Leidhold-Bruner, David E. Hibbs & William C. McComb, Beaver Dam Locations and Their Effects on Distribution and Abundance of Coho Salmon Fry in Two Costal Oregon Streams, 66 NORTHWEST SCI. 218 (1992).

122. S. Swales et al., *Overwintering Habitats of Coho Salmon (Oncorhynchus Kisutch) and Other Juvenile Salmonids in the Keogh River System, British Columbia*, 66 CAN. J. ZOOLOGY 254 (1988); Michael L. Murphy et al., *Habitat Utilization by Juvenile Pacific Salmon (Oncorhynchus) in the Glacial Taku River, Southeast Alaska*, 46 CAN. J. FISHERIES & AQUATIC SCI. 1677 (1989); Pollock et al., *supra* note 119.

123. MARVIN ROSENAU & MARK ANGELO, PAC. FISHERIES RES. CONSERVATION COUNCIL, FRESHWATER HABITAT (1999).

124. Pollock et al., *supra* note 119.

Varden, rainbow trout, sockeye salmon, and steelhead.<sup>125</sup> The most frequently cited benefits in this study were increased habitat heterogeneity, rearing and overwintering habitat, flow refuge, and invertebrate production.<sup>126</sup> The most frequently cited negative impacts included impeded fish movement, siltation of spawning habitat, and low O<sub>2</sub> in ponds; the majority of studies citing negative impacts, however, were speculative rather than data driven.<sup>127</sup> In sum, there is not sufficient scientific evidence to support the notion that beaver dams impede fish passage; therefore, beaver dam removal would not be an appropriate compensatory mitigation measure for the proposed Pebble Mine.

### *c) Fish Passes*

Thousands of fish passes have been installed worldwide in efforts to reverse continued human-caused extirpation or extinction of fish species.<sup>128</sup> Every fish pass represents a singular experiment with unique environmental and biological conditions. Most North American fish passes focus on facilitating upstream passage of a single life stage and one or a few species (e.g. adult salmon), although the number of fish successfully passing relative to the number that attempt to pass is rarely monitored.<sup>129</sup> Even with this limited focus, fish passes still delay or prevent upstream passage of both target and non-target species,<sup>130</sup> which can cause delayed mortality or reduced spawning success.<sup>131</sup> Combined with the fact that fish passes require constant maintenance, upkeep, and repair,<sup>132</sup> their ability to mitigate for long-term or perpetual development impacts is untenable.

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125. Kemp et al., *supra* note 118.

126. *Id.*

127. *Id.*

128. Nehlsen et al., *supra* note 113; Sheer & Steel, *supra* note 109.

129. C.M. Bunt et al., *Performance of Fish Passage Structures at Upstream Barriers to Migration*, 28 RIVER RES. & APPLICATIONS 457 (2012).

130. David W. Roscoe & Scott G. Hinch, *Effectiveness Monitoring of Fish Passage Facilities: Historical Trends, Geographic Patterns and Future Directions*, 11 FISH & FISHERIES 12 (2010); Bunt et al., *supra* note 129; Cheri Patterson, N.H. Fish and Game Dep't, *Operations and Maintenance of Fishways for River Herring in New Hampshire Coastal Rivers*, National Conference on Engineering and Ecohydrology for Fish Passage, UNIV. OF MASS. AMHERST SCHOLARWORKS (June 6, 2012), [http://scholarworks.umass.edu/fishpassage\\_conference/2012/June6/33/](http://scholarworks.umass.edu/fishpassage_conference/2012/June6/33/).

131. D.W. Roscoe et al., *Fishway Passage and Post-Passage Mortality of up-River Migrating Sockeye Salmon in the Seton River, British Columbia*, 27 RIVER RES. & APPLICATIONS 695 (2011).

132. TIM O'BRIEN, TOM RYAN, IVOR STUART & STEVE SADDLIER, REVIEW OF FISHWAYS IN VICTORIA 1996–2009, ARTHUR RYLAH INST. ENVTL. RES. TECHNICAL REP. SERIES NO. 216 (2010); WASH. DEP'T OF FISH AND WILDLIFE, CONTROL NO. 117192-1, HYDRAULIC PROJECT APPROVAL, FISHWAY STRUCTURES IN FRESHWATERS STATEWIDE (JUNE 2, 2009).

To emulate or replace lost wetland ecosystem function, fish passes must allow both upstream and downstream movement of the full suite of fish species and life stages within the watershed of interest. There is insufficient scientific evidence indicating that fish passes can attain this goal, making this an inappropriate compensatory mitigation measure for the Pebble Mine.

#### *d) Hatcheries*

Although there are no current proposals to provide hatchery production to offset fishery losses caused by the proposed Pebble Mine, it is likely that such proposals would not be viewed favorably by relevant decision makers. Preservation of wild salmon has broad political support in Alaska. For example, Alaska's senior senator, Sen. Lisa Murkowski (R-AK), introduced legislation with Sen. Maria Cantwell (D-WA) in 2011 to create a public-private partnership focused on sustaining strong wild salmon populations.<sup>133</sup> According to Senator Murkowski: "[t]hrough the creation of a public/private partnership and grant program, it is my hope that we can ensure that these salmon strongholds will continue to produce abundant wild salmon runs long into the future."<sup>134</sup> Offsetting the loss of wild salmon habitat with hatchery production would not be compatible with this goal.

According to the Northwest Fisheries Science Center (NOAA Fisheries), wild salmon populations have declined dramatically over the past several decades, "despite, and perhaps sometimes because of, the contribution of hatcheries. Many salmon stocks in Washington and Oregon are now listed as either threatened or endangered under the U.S. Endangered Species Act. With this decline has come an increased focus on the preservation of indigenous wild salmon stocks."<sup>135</sup> Remaining wild populations provide a better chance for long-term survival of salmon inasmuch as these populations have evolved in response to significant environmental changes over many thousands of years and can be expected to do so in the future.

Hatchery-produced salmon lack the genetic diversity of wild salmon,<sup>136</sup> which is essential to the sustainability of salmon and

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133. See Mark Yuasa, *Bill Introduced by Senator Maria Cantwell Would Help Boost Wild Salmon Runs*, Seattle Times, Aug. 6, 2011, [http://seattletimes.com/html/reeltime/northwest/2015837836\\_bill\\_introduced\\_by\\_senator\\_mar.html](http://seattletimes.com/html/reeltime/northwest/2015837836_bill_introduced_by_senator_mar.html) (discussing introduction of the Pacific Salmon Stronghold Conservation Act of 2011).

134. *Id.*

135. See *Salmon Hatchery Q&A*, NW FISHERIES SCI. CEN., [http://www.nwfsc.noaa.gov/resources/search\\_faq.cfm?faqmaincatid=3](http://www.nwfsc.noaa.gov/resources/search_faq.cfm?faqmaincatid=3) (last visited Mar. 6, 2013).

136. Mark R. Christie, Melanie L. Marine, Rod A. French & Michael S. Blouin, *Genetic Adaptation to Captivity Can Occur in a Single Generation*, 109 PROC. NAT'L ACAD. SCI. 238

prevention of fisheries collapses.<sup>137</sup> Inter-breeding between hatchery and wild fish consequently lowers survival and fitness of wild salmon.<sup>138</sup> Hatchery fish also compete with wild salmon for food and habitat in both freshwater and marine environments, and in some cases prey directly on wild salmon.<sup>139</sup> Despite billions of dollars spent to produce hundreds of thousands of hatchery salmon in the Pacific Northwest in an attempt to recover threatened and endangered salmon, stocks remain imperiled and indeed are further threatened by interactions with hatchery fish.<sup>140</sup>

#### V. CONCLUSION

There appear to be few, if any, reasonable and practicable compensatory mitigation measures within the associated watersheds that could offset the enormous losses of headwater streams, wetlands, and aquatic habitats that would be destroyed by the proposed Pebble Mine. It is clear that the direct losses of habitat could be thousands of acres, and the means to offset such losses would require a multiple of that acreage figure under the 2008 Mitigation Rule.

There are various potential means of offsetting unavoidable project impacts, including mitigation banks, in-lieu fee mechanisms, various types of permittee-responsible mitigation projects, and preservation of existing, but threatened, habitat. Nevertheless, these methods do not appear to be available or practicable within the Mulchatna River or Lake Iliamna watersheds. There are no mitigation banks that serve these watersheds, nor any in-lieu fee projects there. The habitats that would be destroyed in mining the Pebble deposit are ecologically intact, and there are no known means of recreating such areas. Furthermore, preserving such habitat elsewhere does little to offset permanent losses.

There may be some opportunities to restore degraded habitat at former mining sites, and opportunities to improve migratory fish passage across, around, or through man-made barriers. However, such opportunities have the following three flaws: they are not likely to be plentiful enough to offset thousands of acres of mining-related losses;

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(2011); D.J. Fraser, *How Well Can Captive Breeding Programs Conserve Biodiversity? A Review of Salmonids*, 4 EVOLUTIONARY APPLICATIONS 535 (2008).

137. Schindler et al., *supra* note 4.

138. R.S. Waples, *Genetic Interactions Between Hatchery and Wild Salmonids: Lessons from the Pacific Northwest*, 48 CAN. J. FISHERIES & AQUATIC SCI. 124 (1991).

139. Peter S. Rand, Barry A. Berejikian, Todd N. Pearsons & David L. G. Noakes, *Ecological Interactions Between Wild And Hatchery Salmonids: An Introduction To The Special Issue*, 94 ENVTL. BIOLOGY FISHES 1 (2012).

140. Kathryn Kostow, *Factors that Contribute to the Ecological Risks of Salmon and Steelhead Hatchery Programs and Some Mitigating Strategies*, 19 REV. FISH BIOLOGY & FISHERIES 9 (2009).

they are not particularly effective at offsetting project impacts; and they are likely to require maintenance in perpetuity.

In summary, it is neither reasonable nor practicable to offset the impacts of mining the Pebble deposit through the use of compensatory mitigation within the Mulchatna River or Lake Iliamna watersheds. As a result, the Corps could amply support a determination that the project would cause or contribute to significant degradation of the waters of the United States based solely on the otherwise unmitigated project impacts. Under these circumstances, the proposed mining project would not qualify for permitting under Section 404 of the Clean Water Act.