

PEBBLE MINE: FISH, MINERALS, AND TESTING THE LIMITS OF ALASKA'S "LARGE MINE PERMITTING PROCESS"

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ABSTRACT

Two foreign mining companies plan to develop one of the world's largest copper and gold mines on mining claims staked on state land in the Bristol Bay drainages. Currently, this area of southwestern Alaska produces the world's largest commercial salmon fishery, offers world-class sport fishing, and provides an important food source for local communities. The promoters of the Pebble Mine promise they will create jobs and protect the environment in their quest to recover copper, gold, and molybdenum from a large metallic sulfide deposit containing iron and other metallic sulfides. However, such sulfide ore, by its nature, generates sulfuric acid when exposed to air and water. Sulfuric acid, in turn, dissolves metals present in the host rock. The dissolved metals, such as copper, can be toxic to salmon and other fish. This Article examines the adequacy of the State's large mine permitting process and finds it insufficient to deal with large metallic sulfide mines such as Pebble. The Article then analyzes current legislative responses to the Pebble Mine and discusses their relative strengths and weaknesses. Finally, the Article argues that these legislative solutions would not rise to the level of an unconstitutional taking of the mining claims.

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I. INTRODUCTION

A proposal by two foreign companies to mine a massive, low-grade, copper and gold deposit on state land in southwestern Alaska has sparked an intense conflict between fishing and mining interests. The “Pebble Mine” would be located at the headwaters of the Kvichak (pronounced KWEE-jak) and Nushagak (pronounced NUSH-a-gak) river drainages, in the Bristol Bay drainages, which are essential habitats for Alaska’s most productive salmon fisheries. Northern Dynasty Minerals Ltd. (“NDM”), a subsidiary of Hunter Dickinson,¹ and Anglo American Plc, the world’s second largest mining concern,² plan to develop the Pebble Mine over several decades.

This Article examines: (1) current statutory standards at the heart of the State’s “large mine permitting process;” (2) legislative proposals designed

1. NORTHERN DYNASTY MINERALS LTD., PEBBLE COPPER–GOLD–MOLYBDENUM PROJECT ALASKA, USA 13 (2007) [hereinafter NDM, PEBBLE COPPER], *available at* http://www.northerndynastyminerals.com/i/ndm/NDM_RobertDickinson_Nov2007.pdf. NDM and Hunter Dickinson are based in Vancouver, British Columbia. Northern Dynasty Mines, Inc., a United States subsidiary of NDM, owns the Pebble mining claims. Rio Tinto, a global mining concern based in London, England and Melbourne, Australia, has a 19.8 percent stake in NDM. RIO TINTO, *STAYING STRONG IN COPPER* (2006), http://www.riotinto.com/annualreview2006/5740_staying_strong_in_copper.asp. Mitsubishi bought a 6.1 percent stake in NDM in December 2007. See NORTHERN DYNASTY MINERALS LTD., *ADVANCING AMERICA’S MOST IMPORTANT NEW MINERAL DEPOSIT 2* (2008) [hereinafter NDM, *IMPORTANT NEW MINERAL DEPOSIT*], *available at* http://www.northerndynastyminerals.com/i/pdf/NDM_FactSheet_Jan2008.pdf.

2. ANGLO AMERICAN PLC, *ANNUAL REPORT 2006 51* (2006), *available at* www.angloamerican.co.uk/static/uploads/2006%20Annual%20Report%20Lo-Res-2.pdf. Anglo American has operations in forty-five countries on seven continents. *Id.* Anglo American entered into a staged-investment agreement with NDM that gives Anglo American rights to up to fifty percent of the Pebble Mine project. Press Release, Northern Dynasty Materials Ltd., Northern Dynasty & Anglo American Establish 50:50 Partnership to Advance Pebble Project to Production (July 31, 2007) [hereinafter *Advance Pebble Project to Production*], *available at* <http://www.pebblepartnership.com/files/July312007.pdf>.

to protect the fish, game, habitat, and public uses of them in the Bristol Bay drainages; and (3) claims that current legislative proposals will result in regulatory takings that require compensation. This Article concludes that: (1) current statutory standards are vague and open to wide discretion; (2) stricter statutory standards are needed to protect fish, game, wildlife, habitat, and public uses of fish and wildlife in the Bristol Bay drainages; and (3) no such stricter standard would constitute a regulatory taking requiring the state to compensate those who hold mining claims for minerals at the proposed Pebble Mine.

II. BACKGROUND

Fishing and mining ventures have played major roles in Alaska's history. In the late nineteenth and early twentieth centuries, absentee business interests controlled Alaska's commercial fishing and mining industries.³ One of the major players was the "Alaska Syndicate," which was a partnership formed by the Guggenheim family, whose American Smelting and Refining Company was a dominant force in the nation's hardrock mining industry,⁴ and J. P. Morgan, an East Coast investment banker.⁵ The Syndicate developed the Kennecott copper mine in the Wrangell Mountains north of Prince William Sound and held major interests in gold mines, the dredging, shipping, and transportation industries, as well as in Alaska's salmon canneries.⁶ In Washington, D.C., the Syndicate successfully lobbied the United States Congress to oppose further extension of Alaskan home rule.⁷

Other merchants and bankers, based in San Francisco and Seattle, supplied capital and dominated Alaska's commercial salmon fishing industry and canneries.⁸ Interests outside Alaska frustrated federal efforts to manage salmon harvests,⁹ held tight control of the territorial Senate,¹⁰

3. See, e.g., DANIEL NELSON, *NORTHERN LANDSCAPES: THE STRUGGLE FOR WILDERNESS ALASKA* 12–14 (2004).

4. IRWIN UNGER & DEBBI UNGER, *THE GUGGENHEIMS, A FAMILY HISTORY* 71–82 (2005).

5. Melody Webb Grauman, *Kennecott: Alaska Origins of a Copper Empire, 1900–1938*, 9 *W. HIST. Q.* 201 (1978).

6. *Id.* at 202. At the time, the Kennecott copper vein was the richest copper deposit in the country. *Id.*

7. CLAUD M. NASKE, *A HISTORY OF ALASKA STATEHOOD* 34–35 (1985).

8. See NELSON, *supra* note 3, at 12–13.

9. See JOHN H. CLARK ET AL., *ALASKA DEP'T OF FISH & GAME, 12 ALASKA FISHERY RES. BULL.* 1–2, *THE COMMERCIAL FISHERY IN ALASKA* (2006), available at http://www.adfg.state.ak.us/pubs/afrb/vol12_n1/clarv12n1.pdf. Between 1906

fought statehood because they feared the new state would impose taxes and limit access to fishing grounds,¹¹ and persuaded Congress that Alaska would remain an economic burden, demanding greater federal subsidies if it became a state.¹²

By the late 1930s, many of the high-grade mineral deposits were depleted, and the mining industry in Alaska appeared to have little future potential.¹³ By the time Congress conferred statehood on Alaska in 1959, the state's commercial salmon harvests had declined from an annual average of ninety million fish in the 1930s to an annual average of forty million fish in the 1950s.¹⁴

The Alaska Statehood Act granted the new state authority to manage fish and game.¹⁵ In January 1960, the new state's first governor, William A. Egan, addressed the state legislature about the need to restore the salmon fisheries:

On January 1 of this year, Alaska's Department of Fish and Game was handed the depleted remnants of what was once a rich and prolific fishery. From a peak of three-quarters of a billion pounds in 1936, production dropped in 1959 to the lowest in [sixty] years. On these ruins of a once great resource, the department

and 1924, forty-two bills introduced in Congress proposed a variety of means to regulate Alaskan commercial salmon fishing. *Id.* at 2. All were defeated or seriously weakened by the salmon canning industry. *Id.*

10. Richard Mauer, *Oil, a Foundation of Alaska, Works to Rebuild Its Image*, N.Y. TIMES, Nov. 29, 1989, at A1, available at <http://query.nytimes.com/gst/fullpage.html?res=950DE0DB103CF93AA15752C1A96F948260>.

11. *Id.* The canning industry also dominated the territorial legislature to prevent tax increases on canned salmon. NELSON, *supra* note 3, at 13.

12. Mauer, *supra* note 10, at A1.

13. See NELSON, *supra* note 3, at 22, 28.

14. CLARK ET AL., *supra* note 9, at 2-3. In 1924, the White Act, 43 Stat. 464, as amended, 48 U.S.C. §§ 221-28 (repealed), allowed the federal government to establish fishing seasons and hours, set catch limits, and regulate fishing practices, all of which improved salmon harvests. *Id.* at 2; see *Kake Vill. v. Egan*, 369 U.S. 60, 62 (1962). By 1939, harvests again declined due to, *inter alia*, industry resistance to regulation, lack of funding for federal enforcement and research, and overharvesting to meet food production goals during World War II. CLARK ET AL., *supra* note 9, at 3. When average annual harvests declined to forty million salmon, President Eisenhower declared parts of Alaska disaster areas, thereby authorizing emergency food supplies. *Id.*

15. Section 6(e) of the Alaska Statehood Act allowed the state to assume fish and wildlife management after the Secretary of the Interior certified to Congress that the Alaska State Legislature had made adequate provision for the administration, management, and conservation of fish and game "in the broad national interest." 48 U.S.C.S. prec § 21 (LexisNexis 2008).

must rebuild. Our gain is that we can profit by studying the destructive practices, mistakes and omissions of the past. The revival of the commercial fisheries is an absolute imperative. The livelihood of thousands of fishermen and the very existence of many communities scattered along thousands of miles of continental and island coastline depends upon improvement of the fisheries. To this end we will give our best efforts.¹⁶

A. The Fishing Economy of the Bristol Bay Drainages

Alaska salmon populations rebounded as a result of improved state and federal management. In 1973, the Alaska Legislature enacted the Limited Entry Act to control the issuance of commercial fishing permits and thereby limit salmon harvests.¹⁷ In 1976, Congress enacted the Magnuson-Stevens Fisheries Management and Conservation Act, which established an exclusive economic zone that extended United States jurisdiction over fisheries for 200 nautical miles beyond state waters.¹⁸ This allowed the federal government to regulate foreign fishing vessels and reduce their harvests of Alaska-bound salmon.¹⁹

Most of Alaska's salmon populations are thriving today,²⁰ which is a stark contrast to the steep declines in other Pacific salmon stocks that resulted from habitat loss.²¹ Alaska fisheries currently support lucrative commercial and sport industries, subsistence,²² and tourism. By 2001, about 54,000 people earned all or part of their annual incomes from fishing,

16. CLARK ET AL., *supra* note 9, at 3.

17. 1973 Alaska Sess. Laws ch. 79 § 1 (codified as amended at ALASKA STAT. § 16.43.010 (2006)).

18. Pub. L. No. 94-265, 90 Stat. 331 (codified as amended at 16 U.S.C. §§ 1801, 1811 (2000)).

19. *Id.*; see also CLARK ET AL., *supra* note 9, at 7.

20. CLARK ET AL., *supra* note 9, at 6.

21. T.L. Slaney et al., *Status of Anadromous Salmon and Trout in British Columbia and Yukon*, FISHERIES, Oct. 1996, at 20; Willa Nehlsen et al., *Pacific Salmon at the Crossroads: Stocks at Risk from California, Oregon, Idaho, and Washington*, FISHERIES, Mar.-Apr. 1991.

22. Federal and state statutes define "subsistence" as the "customary and traditional" uses of wild renewable resources by rural Alaska residents. 16 U.S.C. § 3113 (2000); ALASKA STAT. § 16.05.940 (2006). Unlike the federal program, the state does not give preference to rural residents in administering subsistence programs on state lands. See *McDowell v. State*, 785 P.2d 1 (Alaska 1989) (holding that state statute limiting subsistence to rural residents violates Alaska Constitution).

which provided more jobs than oil, gas, mining, timber, agriculture and forestry, combined.²³

In southwestern Alaska, the Bristol Bay drainages produce the world's largest commercial sockeye salmon fishery,²⁴ which is commercially the most valuable salmon species.²⁵ The Bristol Bay commercial sockeye salmon harvest is five-to-ten times larger than all other Alaska sockeye fisheries, combined.²⁶ Between 1986 and 2005, annual commercial catches of all five species of Pacific salmon in Bristol Bay averaged nearly 24 million sockeye (red), 70,000 Chinook (king), 922,000 chum, 103,000 coho (silver) and, in even years, 261,000 pink salmon.²⁷

Bristol Bay accounts for one third of all earnings from commercial salmon fishing in Alaska.²⁸ In 2005, all salmon harvested commercially in Bristol Bay accounted for \$226 million in wholesale value in the regional economy.²⁹ Between 1986 and 2005, commercial fishers received, in total, an average of \$128 million in income from salmon caught in Bristol Bay, with sockeye salmon accounting for \$125 million of that total.³⁰

Between 1983 and 2003, subsistence harvests of salmon from the Bristol Bay drainages averaged about 159,000 fish, of which 125,000 were sockeye

23. CLARK ET AL., *supra* note 9, at 21.

24. PAUL SALOMONE ET AL., ALASKA DEP'T OF FISH & GAME, 2006 BRISTOL BAY AREA ANNUAL MANAGEMENT REPORT 1, FISHERY MANAGEMENT REPORT NO. 07-22 (2007), available at <http://www.sf.adfg.state.ak.us/FedAidPDFs/Fmr07-22.pdf>.

25. Alaska Dep't of Fish and Game, Sockeye Salmon [hereinafter Sockeye Salmon], <http://www.adfg.state.ak.us/pubs/notebook/fish/sockeye.php> (last visited March 30, 2008).

26. *Id.*

27. SALOMONE ET AL., *supra* note 24, at 2. The Bristol Bay commercial salmon fishery provided a harvest of about twenty-six million salmon in 2005 at a value of more than \$93 million. U.S. BUREAU OF LAND MGMT., BAY PROPOSED RESOURCE MANAGEMENT PLAN/FINAL ENVIRONMENTAL IMPACT STATEMENT § 3-24 (2007), available at http://www.blm.gov/ak/st/en/prog/planning/bay_rmp_eis_home_page.html (follow "Bay Proposed RMP and Final EIS" hyperlink; then follow "Chapter 3-Affected Environment" hyperlink). The 1985-2004 average sockeye salmon harvest for the Naknek-Kvichak district was 7.8 million fish, about thirty-three percent of the total Bristol Bay sockeye harvest. *Id.* The average sockeye salmon harvest for the Nushagak district for the same time period was four million fish, seventeen percent of the total Bristol Bay sockeye harvest. *Id.* The 2005 Naknek-Kvichak district harvest was slightly less than average at 6.7 million sockeye, while the Nushagak district harvest was higher at 7.1 million sockeye. *Id.*

28. JOHN DUFFIELD ET AL., ECONOMICS OF WILD SALMON WATERSHEDS: BRISTOL BAY, ALASKA 14 (2007), available at http://www.housemajority.org/coms/hfsh/trout_unlimited_report.pdf.

29. *Id.* at 16.

30. SALOMONE ET AL., *supra* note 24, at 2.

salmon.³¹ Southwestern Alaska's world-class trout fisheries and plentiful king salmon attract sport anglers who annually contribute about \$61 million to the state's economy.³²

In 2005, the wild salmon watersheds in the Bristol Bay drainages generated \$324 million in regional expenditures related to fish and wildlife.³³ This created an estimated 5540 full-time-equivalent jobs in Alaska. Alaska residents held more than 3400 of these jobs, with almost 1600 held by residents of the Bristol Bay area.³⁴

The Bristol Bay drainages produce an average of 39 million sockeye salmon annually.³⁵ This is more than twice as many salmon, of all species, as the entire Columbia River drainage produced before those salmon

31. TIM SANDS, ALASKA DEP'T OF FISH & GAME, 2001–2003 OVERVIEW OF THE BRISTOL BAY SALMON FISHERY 2 (2003), available at <http://www.cf.adfg.state.ak.us/region2/pubs/bof/rr2a0327.pdf>.

32. DUFFIELD ET AL., *supra* note 28, at 15, 45.

33. *Id.* at 16.

34. *Id.* at 17. The following table reflects the distribution of jobs.

Total Full Time Equivalent (FTE) Employment in Alaska Dependent on Bristol Bay Wild Salmon Ecosystems, 2005

| Sector | Alaska Residents | | | Nonresidents | Total FTE jobs |
|--------------------------|------------------|---------------------|--------------|--------------|----------------|
| | Local residents | Non-local residents | Total Alaska | | |
| Commercial fishing | 689 | 667 | 1357 | 1172 | 2529 |
| Commercial processing | 465 | 449 | 914 | 796 | 1710 |
| Sport fishing | 288 | 435 | 723 | 123 | 846 |
| Sport hunting | 60 | 105 | 165 | 2 | 167 |
| Wildlife viewing/tourism | 82 | 139 | 222 | 17 | 239 |
| Subsistence | 14 | 34 | 49 | 0 | 49 |
| Total FTE jobs | 1598 | 1829 | 3430 | 2110 | 5540 |

Id. Hunting is included because wild salmon returning from the sea perform an "ecosystem service" of nutrient recycling to support habitat functions. *See id.* at 24–26. For example, in Alaska, marine nitrogen accounts for as much as ninety percent of the nitrogen in brown bears. *See* ROBERT J. NAIMAN ET AL., RIPARIA: ECOLOGY, CONSERVATION, AND MANAGEMENT OF STREAMSIDE COMMUNITIES 184–85 (2005).

35. *See* LOWELL F. FAIR, ALASKA DEP'T OF FISH & GAME, 10 ALASKA FISHERY RES. BULL. 95, CRITICAL ELEMENTS OF KVICHAK RIVER SOCKEYE SALMON MANAGEMENT (2003), available at http://www.adfg.state.ak.us/pubs/afrb/vol10_n2/fairv10n2.pdf.

populations declined.³⁶ Historically, the Kvichak River drainage is the world's single most productive sockeye salmon watershed.³⁷ The Nushagak River watershed is the largest producer of the other four (Chinook, chum, coho and pink) Pacific salmon species in the Bristol Bay drainages.³⁸

Furthermore, the area is home to the Mulchatna caribou herd, one of Alaska's largest herds. The Mulchatna herd numbered as many as 193,000 caribou in 1996, though the population has declined in recent years due to natural population cycles.³⁹ The Bristol Bay drainages also are a premier area for grizzly bear, which depend on salmon for food.⁴⁰

B. The Proposed Pebble Mine and Its Facilities

The Pebble deposit is located at the divide between the Kuktuli (pronounced KOKE-too-lee) River and the Upper Talarik (pronounced TALAR-ick) Creek.⁴¹ The Kuktuli River is part of the Nushagak drainage, and Upper Talarik Creek is part of the Kvichak drainage.

36. Before 1850, about sixteen million salmon and steelhead returned to the Columbia River basin annually to spawn. U.S. GEN. ACCOUNTING OFFICE, COLUMBIA RIVER BASIN SALMON AND STEELHEAD: FEDERAL AGENCIES' RECOVERY RESPONSIBILITIES, EXPENDITURES AND ACTIONS 1 (2002), *available at* <http://www.gao.gov/new.items/d02612.pdf>. Over the past twenty-five years, however, the number of salmon and steelhead returning to the Columbia River Basin has averaged around 660,000 per year. *Id.* The decline has been attributed to over-harvesting, construction and operation of hydroelectric dams, degradation of spawning habitat, increased human population, and unfavorable weather and ocean conditions. *Id.*

37. Sockeye Salmon, *supra* note 25.

38. R. ERIC MINARD, EFFORT AND CATCH STATISTICS FOR THE CHINOOK SALMON (*ONCORHYNCHUS TSHAWYTSCHA*) SPORT FISHERY IN THE LOWER NUSHAGAK RIVER, 1986, 1 FISHERY DATA SERIES NO. 15 (1987), *available at* <http://www.sf.adfg.state.ak.us/FedAidPDFs/fds-015.pdf>.

39. DIV. OF WILDLIFE CONSERVATION, ALASKA DEP'T OF FISH AND GAME, CARIBOU MANAGEMENT REPORT 24 (2001), *available at* http://www.wc.adfg.state.ak.us/pubs/techpubs/mgt_rpts/mca01-2mt_south.pdf; Interview with Jim Woolington, Wildlife Biologist, Div. of Wildlife Conservation, Alaska Dep't of Fish and Game (Mar. 14, 2008).

40. *See* ALASKA DEP'T OF FISH & GAME, BROWN BEAR MANAGEMENT REPORT 100-03 (2001), *available at* http://www.wc.adfg.state.ak.us/pubs/techpubs/mgt_rpts/mbr01_sc.pdf.

41. The proposed site of the Pebble Mine is about eighteen miles north of Iliamna Lake, nineteen miles southwest of the southern shore of Lake Clark, and about eighteen miles from the predominantly Native villages of Nondalton, Newhalen, and Iliamna. The Pebble Partnership, General Land Status Collings Proposed Route, http://www.pebblepartnership.com/images/LandStatus_D01-map.jpg (last visited Mar. 30, 2008).

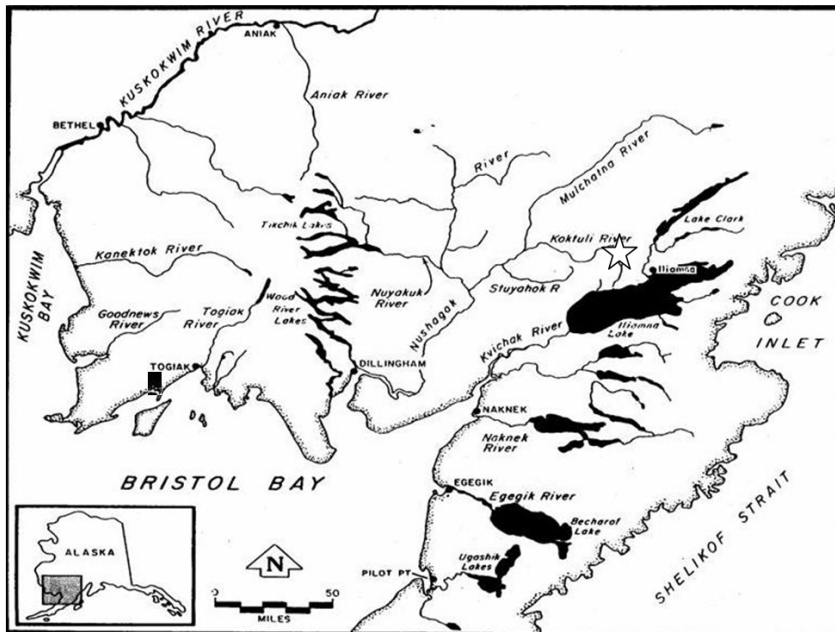


Figure 1. Schematic map of Bristol Bay watersheds. The star indicates the approximate location of the copper, gold, and molybdenum deposit comprising the proposed Pebble Mine. Map from the Alaska Department of Fish and Game.

NDM and Anglo American have asserted that the Pebble deposit “rank[s] among the world’s most important accumulations of copper, gold and molybdenum.”⁴² NDM has asserted that Pebble is the second largest copper mineral deposit in the world and that it contains about sixty-seven billion pounds of copper, four billion pounds of molybdenum, and eighty-two million ounces of gold.⁴³ NDM has indicated that, on the surface, the Pebble deposit is approximately 2.65 miles by 1.7 miles.⁴⁴

NDM divided the ore body into the “Pebble East” and “Pebble West” deposits.⁴⁵ NDM has asserted that the Pebble West deposit extends from the surface to a depth of about 2000 feet.⁴⁶ NDM also has asserted that

42. See Advance Pebble Project to Production, *supra* note 2.

43. NDM, PEBBLE COPPER, *supra* note 1, at 4, 11.

44. NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 2.

45. *Id.*

46. *Id.*

Pebble West contains 4.1 billion metric tonnes of ore and that it may develop an open pit mine.⁴⁷

NDM has analyzed the copper, gold, and molybdenum content in three quarters (3.026 billion tonnes) of the Pebble West deposit.⁴⁸ Converting NDM's data to United States tons indicates that each *ton* contains between 6.2 *pounds* and 10.1 *pounds* of copper, 0.010 *ounces* and 0.016 *ounces* of gold, and 0.33 *pounds* and 0.46 *pounds* of molybdenum.⁴⁹ At most, about 10.6 pounds of metals would be recovered from every 2000 pounds of ore.⁵⁰ The waste-to-metals ratio would be at least 189 to one.⁵¹ Thus, at least 99.5 percent of the deposit will be waste.⁵² NDM estimated a similar yield for the remaining 1.1 billion tonnes in the Pebble West deposit.⁵³

According to NDM, the Pebble East deposit is buried beneath overburden that ranges from several feet to more than 1000 feet deep at its eastern boundary.⁵⁴ NDM has estimated that the Pebble East deposit extends more than 5000 feet below the surface.⁵⁵ NDM has asserted that Pebble East contains 3.9 billion metric tonnes of ore.⁵⁶

NDM has also predicted that concentrations of copper, gold, and molybdenum in the Pebble East deposit will be higher than at Pebble West.⁵⁷ Converting NDM's data to United States tons indicates that, in February 2008, NDM "inferred" that each *ton* of ore at Pebble East *may* contain as much as between 12.8 *pounds* and 19.2 *pounds* of copper, 0.012 *ounces* and 0.017 *ounces* of gold, and 0.73 *pounds* and 0.77 *pounds* of

47. *Id.* at 1–2. Ore is defined as "rock that contains minerals in sufficient concentration, quantity, and value to be mined at a profit." See, e.g., Climax Molybdenum, Glossary, <http://www.climaxmolybdenum.com/Glossary/Glossary.htm> (last visited Mar. 30, 2008).

48. NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 2.

49. *Id.*

50. *See id.*

51. *See id.*

52. *See id.*

53. *Id.*

54. *Id.* Overburden is defined as "rock material of little or no value that overlies an ore deposit." See, e.g., Climax Molybdenum, Glossary, *supra* note 47.

55. NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 2.

56. Press Release, Northern Dynasty Minerals Ltd., Updated Resource Estimate Confirms Pebble East as One of the World's Most Important Copper-Gold-Molybdenum Deposits (Feb. 25, 2008) [hereinafter Updated Resource Estimate], available at <http://www.northerndynastyminerals.com> (follow "Investor Centre" hyperlink; then follow "News Releases" hyperlink; then follow "February 25, 2008").

57. *Id.*; see also NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 2.

molybdenum.⁵⁸ At most, based on NDM's estimations, less than twenty pounds of metals would be recovered from every 2000 pounds of ore mined at Pebble East.⁵⁹ The waste-to-metals ratio at Pebble East would be more than 100 to one.⁶⁰ Accordingly, more than 99 percent of all ore mined at Pebble East would be waste.⁶¹

Thus, if the eight billion tonnes of ore that comprise the Pebble East and Pebble West deposits are fully mined and processed, the Pebble Mine would produce more than seven billion tons of waste⁶² plus waste rock that would not be processed as ore. Presumably, almost all of these wastes would be stored on state-owned public lands near the mine in perpetuity.

In 2006, NDM submitted eleven permit applications to the Alaska Department of Natural Resources (DNR).⁶³ Six of these applications sought to appropriate surface or groundwater from the North and South Forks of the Koktuli River and from Upper Talarik Creek.⁶⁴ The other five applications sought permits to build five massive, earthen-fill dams or embankments to contain waste from the mine.⁶⁵

Although NDM later requested that DNR delay adjudicating the applications,⁶⁶ they provide insight into NDM's development plans. The Pebble Mine likely would include most of the following facilities:

1. An open pit mine at Pebble West that may be about 2000 feet deep and cover about two square miles and an underground mine at Pebble East that may be of comparable size and 5000 feet deep.⁶⁷

58. See Updated Resource Estimate, *supra* note 56. NDM stated that an "inferred" mineral resource is "estimated on the basis of geological evidence and limited sampling." *Id.* NDM has "reasonably assumed, but not verified" how much of the Pebble East deposit actually contains copper, gold, or molybdenum at these concentrations. *Id.*

59. See *id.*

60. See *id.*

61. *Id.*

62. See NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 2. NDM asserts that the size of Pebble East is "wide open to further expansion and delineation drilling is ongoing." *Id.* Thus, the amount of ore and corresponding waste from Pebble East could increase.

63. DIVISION OF MINING, LAND, AND WATER, ALASKA DEP'T. OF NATURAL RES., PEBBLE PROJECT [hereinafter PERMIT APPLICATIONS], <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/waterapp.htm> (providing hyperlinks to all available NDM permit applications) (last visited Mar. 30, 2008).

64. *Id.*

65. *Id.*

66. Letter from Michael C. T. Smith, NEPA and Permitting Manager, Northern Dynasty Mines Inc., to Thomas Crafford, Large Mine Coordinator, Alaska Dep't of Natural Res. (Oct. 12, 2006), available at <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/2006/acmp.pdf>.

2. Various stream diversion channels, wells and devices to: (a) prevent water from filling the open pit, (b) extract water that would be used for processing the ore, (c) transport ore concentrate in a slurry via pipelines, and (d) transport wastes in a slurry via pipelines.⁶⁸
3. A mill to crush, process, and concentrate the ore extracted from the open pit and underground mines.⁶⁹
4. Five dams or embankments composed of waste rock and earthen-fill material that together would span about nine linear miles. The three largest dams would be 740 feet high and 3 miles long, 700 feet high and 2.9 miles long, and 710 feet high and 1.3 miles long.⁷⁰ These dams and embankments would create and contain ponds that would cover at least 10 square miles and store chemically reactive, ore-processing wastes known as “tailings.”⁷¹
5. A deep-water port in marine waters on the west side of Cook Inlet (about 200 miles southwest of Anchorage) to load the ore concentrate on ocean freighters.⁷²
6. A 104-mile road to provide a transportation corridor from the mine facilities to the port.⁷³

67. See The Pebble Partnership, Project Status and Timeline [hereinafter Project Status and Timeline], <http://www.pebblepartnership.com/pages/project-information/project-status.php> (last visited March 30, 2008); NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1, at 1–2.

68. See *generally*, NORTHERN DYNASTY MINES INC., PEBBLE PROJECT: APPLICATION FOR WATER RIGHT: SOUTH FORK KOKTULI RIVER at Project Description 2, 4 (2006), available at <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/2006/swsfkorrig>.

69. Project Status and Timeline, *supra* note 67.

70. See KNIGHT PIESBOLD CONSULTING, NORTHERN DYNASTY MINES, INC., TAILINGS IMPOUNDMENT A INITIAL APPLICATION REPORT 2 (2006) (describing the dimensions of the dams or embankments) [hereinafter TAILINGS IMPOUNDMENT A REPORT], available at <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/2006/damaap.pdf>; KNIGHT PIESBOLD CONSULTING, NORTHERN DYNASTY MINES, INC., TAILINGS IMPOUNDMENT G INITIAL APPLICATION REPORT 1 (2006) [hereinafter TAILINGS IMPOUNDMENT G REPORT], available at <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/2006/damgap.pdf>.

71. The estimate that total area of the water surface in these two impoundments exceeds ten square miles is derived by summing the surface water area stated in the applications for permits to build dams or embankments described in the appendices to two reports. See TAILINGS IMPOUNDMENT A REPORT, *supra* note 70; TAILINGS IMPOUNDMENT G REPORT, *supra* note 70.

72. See NDM, PEBBLE COPPER, *supra* note 1, at 19; see also The Pebble Partnership, Road, Port, & Power [hereinafter Road, Port, & Power], <http://www.pebblepartnership.com/pages/project-information/road-port-power.php> (last visited Mar. 30, 2008).

73. *Id.*

7. Two 100-mile-long, fifteen inch-diameter pipelines that would run parallel to the road. One pipeline would be used to transport a slurry of copper ore concentrate from the mill to the port, where the slurry would be de-watered. The other pipeline would return the slurry water to the mine area.⁷⁴
8. Four 54-inch-diameter pipelines. Three of the pipelines, totaling 70,000 feet (13.25 miles), would transport mine wastes from the mill to the waste storage facilities. The fourth pipeline, totaling 17,000 feet (3.2 miles), would reclaim water from the waste facilities and transport it to the mill.⁷⁵
9. A 300-megawatt power plant that would be located on the Kenai Peninsula, across Cook Inlet.⁷⁶
10. More than 100 miles of transmission lines and undersea cables to transmit electricity from the power plant on the Kenai Peninsula to the mine site.⁷⁷

The Pebble Partnership asserts that development of the Pebble Project will generate 1000 skilled, high-wage jobs for fifty to eighty years and 2000 jobs during the project's two- to three-year construction phase.⁷⁸ The partnership claims the mine will generate tens of millions of dollars in

74. *See id.*; NORTHERN DYNASTY MINES INC., PEBBLE PROJECT: RESPONSE TO JULY 26, 2006 ADNDR ANALYSIS OF APPLICATION COMPLETENESS OF JULY 7, 2006 APPLICATION FOR SURFACE WATER RIGHT: SOUTH FORK KOKTULI RIVER (2006) [hereinafter NDM, RESPONSE TO JULY 26, 2006, ADNDR ANALYSIS], available at <http://www.dnr.state.ak.us/mlw/mining/largemine/pebble/2006/swsfkfinal.pdf>.

75. NDM, RESPONSE TO JULY 26, 2006, ADNDR ANALYSIS, *supra* note 74, at Table 3. During operation, water would circulate between the tailings impoundments and the tailings slurry pipelines. *Id.*

76. Shane Lasley, *Mining News: Mining and Fish Can Coexist*, NORTH OF 60 MINING NEWS, Dec. 30, 2007, available at <http://www.petroleumnews.com/pntruncate/91525336.shtml>.

77. Road, Port, & Power, *supra* note 72.

78. The Pebble Partnership, Pebble Facts [hereinafter Pebble Facts], <http://www.pebblepartnership.com/pages/project-information/pebble-facts1.php> (last visited Mar. 30, 2008). The Pebble Mine would be in the Lake and Peninsula Borough, which extends hundreds of miles from Lake Clark National Park and Preserve to the southern tip of the Alaska Peninsula. In 2006, the Borough population was 1557 people, of whom eighty percent were Alaska Native or part Native. *See* STATE OF ALASKA, ALASKA COMMUNITY DATABASE COMMUNITY INFORMATION SUMMARIES, http://www.commerce.state.ak.us/dca/commdb/CF_CIS.htm (follow "Lake and Peninsula Borough" hyperlink in box under "Select a Community") (last visited Mar. 30, 2008). Residents of the communities nearest the Pebble Mine are all predominantly Alaska Native. *Id.* In 2006, the populations of these villages were: Nondalton (pop. 196), Newhalen (pop. 167) and Iliamna (pop. 82). *Id.*

annual tax payments to state and local governments, as well as numerous local business opportunities.⁷⁹

C. The Pebble Mine is Likely to Generate Acid Mine Drainage

As previously noted, NDM may construct a block-cave underground mine at Pebble East and an open-pit mine at Pebble West.⁸⁰ Block cave mines often cause surface subsidence or settling.⁸¹ Subsidence occurs as the material above the ore body, including surface and rain water, gradually moves downward to replace the ore that has been mined.⁸²

Open pit and underground mines often must be dewatered to allow extraction of the ore.⁸³ Two methods used to dewater the mines are pumping from ground-water interceptor wells to lower the water table and pumping directly from the mine workings.⁸⁴ Dewatering can create a hydrologic cone of depression around the mine area and can prevent contamination from reaching the surrounding aquifer.⁸⁵ If pumping ceases after the mine is abandoned, the mine workings will fill partially or completely with water and may lead to uncontrolled releases of water.⁸⁶

The host rock associated with most types of metal mining activities contains metal sulfide minerals.⁸⁷ Most of the ore at the Pebble deposit contains iron and other metallic sulfides.⁸⁸ When such sulfides are exposed

79. Pebble Facts, *supra* note 78.

80. *Id.* Block caving is an underground mining method. Generally, the first step is to blast the ore body so it becomes fractured, creating a cavern of broken rock. See, e.g., RESOLUTION COPPER MINING, BLOCK CAVING AND SUBSIDENCE, <http://www.resolutioncopper.com/res/ourapproach/BlockCaveMining.pdf> (last visited Mar. 30, 2008). The second step is to drill a tunnel under the broken rock cavern. *Id.* Finally, narrow-necked chutes are constructed under the cavern to funnel the ore to collection points in the tunnels. *Id.*

81. *Id.*

82. *Id.*

83. OFFICE OF SOLID WASTE, U.S. ENVIRONMENTAL PROTECTION AGENCY, MINING INDUSTRY PROFILE: COPPER 1-63 (1994), available at <http://www.epa.gov/epaoswer/other/mining/techdocs/copper/copper1b.pdf>.

84. *Id.*

85. *Id.*

86. *Id.*

87. OFFICE OF SOLID WASTE, U.S. ENVIRONMENTAL PROTECTION AGENCY, TECHNICAL DOCUMENT: ACID MINE DRAINAGE PREDICTION 4 (1994) [hereinafter EPA, ACID MINE DRAINAGE PREDICTION], available at <http://www.epa.gov/epaoswer/other/mining/techdocs/amd.pdf>.

88. The predominant copper sulfide minerals in the Pebble deposit are chalcopyrite (CuFeS_2) and bornite (Cu_5FeS_4). See Press Release, Northern Dynasty Minerals Ltd., Major New Porphyry System Discovered at Pebble (Sept. 21, 2005),

to air and water, they generate sulfuric acid, which dissolves most metals, mobilizing them into solution.⁸⁹

Prior to mining, oxidation of these sulfides and the formation of sulfuric acid is a function of natural weathering processes.⁹⁰ The oxidation of undisturbed ore bodies, which is followed by release of acid and mobilization of metals, is slow.⁹¹ Discharge from such deposits poses little threat to receiving aquatic ecosystems.⁹²

Extractions and beneficiation operations associated with mining activity increase the rate of these same chemical reactions by exposing large volumes of sulfide rock material with increased surface area to air and water.⁹³ This process is commonly referred to as acid mine drainage.⁹⁴ In addition to the acid contribution to surface waters, acid mine drainage may cause metals such as arsenic, cadmium, copper, silver, zinc, iron, lead, and manganese to leach from mine wastes.⁹⁵

These leached metals cause environmental damage and are of greater concern than the acidity.⁹⁶ When dissolved metals enter surface waters, either directly or through groundwater, they become available to fish and the food chains upon which they depend.⁹⁷

The formation of acid mine drainage, and the contaminants associated with it, have been described as the largest environmental problem facing the U.S. mining industry.⁹⁸ Mine waste rock, tailings, overburden, and mine structures such as open pits and underground workings are sources of acid mine drainage.⁹⁹ Because the factors affecting the potential for acid mine drainage are highly variable from site to site, predicting the potential for acid mine drainage is difficult, costly, and of questionable reliability.¹⁰⁰

available at <http://www.northerndynastyminerals.com/ndm/NewsReleases.asp?ReportID=117769>; NDM, PEBBLE COPPER, *supra* note 1, at 15.

89. EPA, ACID MINE DRAINAGE PREDICTION, *supra* note 87, at 4–6.

90. *Id.* at 4.

91. *Id.*

92. *Id.*

93. *Id.* at 4.

94. *Id.* at 1.

95. *Id.* at 1, 7, 41.

96. *Id.* at 1.

97. See generally CAROL ANN WOODY, COPPER: EFFECTS ON FRESHWATER FOOD CHAINS AND SALMON: A REVIEW (2007), available at http://fish4thefuture.com/pdfs/Woody_Copper_Effects_to_Fish%20-%20FINAL2007.pdf.

98. EPA, ACID MINE DRAINAGE PREDICTION, *supra* note 87, at 1.

99. *Id.* at 1–2.

100. *Id.* at 1.

III. DISSOLVED METALS SUCH AS COPPER ARE TOXIC TO FISH

The late Jay Hammond, the popular Republican governor of Alaska from 1976 to 1982, made his home on the shore of Lake Clark, in the Bristol Bay drainages, thirty miles from the proposed Pebble Mine.¹⁰¹ On July 11, 2005, two weeks before his death, he expressed his views of the Pebble Mine:

When I was first asked about the Pebble Mine . . . I expressed this concern: that if I were asked where in Alaska would I least rather see the largest open-pit mine in the world, I can think of no more less appropriate spot than the headwaters of the Talarik Creek and Kokutli River, the drainages of two of the finest trout streams and salmon spawning areas in Alaska. But I have since modified that to where if asked that question again, I'd say there is one place I'd even less rather see it, and that's in my living room here at Lake Clark.¹⁰²

The Pebble Partnership asserts that about ninety-five percent of the metal that Pebble Mine would produce is copper.¹⁰³ This Part focuses on the toxic effects of copper on salmon and aquatic food chains.

Copper is essential to living organisms and no fatal copper deficiencies have ever been documented for any aquatic species.¹⁰⁴ Yet, concentrations just above the amount required for growth and reproduction can be highly toxic to aquatic species and cause irreversible harm.¹⁰⁵ The exact amount of dissolved copper that is toxic to fish and aquatic food chains can be

101. JAY S. HAMMOND, *TALES OF ALASKA'S BUSH RAT GOVERNOR: THE EXTRAORDINARY AUTOBIOGRAPHY OF JAY S. HAMMOND* 294 (1994).

102. Interview by Lance Holter with Jay S. Hammond, former Governor of Alaska, in Port Alsworth, Alaska (July 11, 2005) (available upon request from authors).

103. Elizabeth Bluemink, *Jewelers Announce Opposition to Pebble Prospect's 'Dirty Gold': Companies Call for Protection of River Drainages*, ANCHORAGE DAILY NEWS, Feb. 13, 2008, at A1, available at <http://www.adn.com/money/industries/mining/story/313462.html>.

104. 1 RONALD EISLER, *HANDBOOK OF CHEMICAL RISK ASSESSMENT: HAZARDS TO HUMANS, PLANTS, AND ANIMALS: METALS* 138 (2000).

105. Peter V. Hodson et al., *Toxicity of Copper to Aquatic Biota*, in *COPPER IN THE ENVIRONMENT: HEALTH EFFECTS PT. II*, 307, 307-08 (Jerome O. Nriagu ed., 1979); W. Scott Hall et al., *Monitoring Dissolved Copper Concentrations in Chesapeake Bay, U.S.A.*, 11 *ENVTL. MONITORING AND ASSESSMENT* 33 (1988); ELSA M. SORENSEN, *METAL POISONING IN FISH* 235-84 (1991); EISLER, *supra* note 104, at 144-73; David H. Baldwin et al., *Sublethal Effects of Copper on Coho Salmon: Impacts on Nonoverlapping Receptor Pathways in the Peripheral Olfactory Nervous System*, 22 *ENVTL. TOXICOLOGY AND CHEMISTRY* 2266, 2273 (2003).

difficult to predict¹⁰⁶ because many factors influence toxicity including: (1) species of copper, in elemental or compound forms, and the concentration;¹⁰⁷ (2) water quality, including pH, temperature, hardness, salinity, suspended solids, and organics; (3) synergistic interactions of copper with other local elements; and (4) species of fish or organism, age, size, reproductive condition, and prior exposure to copper.

Salmon and organisms comprising freshwater food chains are very sensitive to heavy metals, trace elements, and other contaminants found in mine wastes.¹⁰⁸ Because copper is highly toxic to freshwater aquatic organisms, understanding potential lethal and sublethal effects of copper on salmon and their freshwater food chains is important to address the adequacy of the state's large mine permitting process. Both lethal and sublethal effects of copper (Cu) on salmon and their food chains have been demonstrated¹⁰⁹ at concentrations below the Alaska state water quality criterion for protection of freshwater species (9 micrograms Cu per liter ($\mu\text{g Cu/L}$) calculated on 100 mg/L hardness (CaCO_3)) and well below the human drinking water criterion of 1300 $\mu\text{g Cu/L}$.¹¹⁰

Copper has sublethal effects on salmon that can reduce the viability of populations.¹¹¹ Concentrations below the accepted criterion for aquatic life in Alaska ($< 9 \mu\text{g Cu/L}$) have produced the following documented effects on fish: (1) impairment of sense of smell (olfaction);¹¹² (2) interference with

106. OFFICE OF RESEARCH AND DEVELOPMENT, U.S. ENVIRONMENTAL PROTECTION AGENCY, AMBIENT AQUATIC LIFE WATER QUALITY CRITERIA FOR COPPER 1-18 (1980), available at <http://www.epa.gov/waterscience/criteria/library/ambientwqc/copper80.pdf>; EISLER, *supra* note 104, at 133; Hodson et al., *supra* note 105, at 339-481.

107. Aquatic Life Ambient Freshwater Quality Criteria-Copper 2007 Revision. 72 Fed. Reg. 7983 (Feb. 22, 2007).

108. SORENSEN, *supra* note 105, at 233; A. Dennis Lemly, *Mining in Northern Canada: Expanding the Industry While Protecting Arctic Fishes—A Review*, 29 ECOTOXICOLOGY AND ENVTL. SAFETY 229, 230-34 (1994); EISLER, *supra* note 104, at 94-95.

109. EISLER, *supra* note 104, at 144-73.

110. ALASKA ADMIN. CODE tit. 18 § 70.020(b) (2007) (incorporating by reference the DEP'T OF ENVTL. CONSERVATION, ALASKA WATER QUALITY CRITERIA MANUAL FOR TOXIC AND OTHER DELETERIOUS SUBSTANCES (2003) (stating the copper criteria for freshwater aquatic life and for human health)), available at <http://dec.alaska.gov/water/wqsar/wqs/pdfs/70wqsmanual.pdf>.

111. Baldwin et al., *supra* note 105, at 2273; EISLER, *supra* note 104, at 163-66; SORENSEN, *supra* note 105, at 269-76.

112. J. Raloff, *Aquatic Non-Scents: repercussions of water pollutants that mute smell*, SCIENCE NEWS, Jan. 27, 2007, at 59.

normal migration;¹¹³ (3) impairment of their ability to fight disease (immune response);¹¹⁴ (4) difficulties in breathing;¹¹⁵ (5) disruption of osmoregulation (ability to control internal salinity of body fluids);¹¹⁶ (6) impairment of ability to sense vibrations via their lateral line canals (a sensory system that helps fish avoid predators);¹¹⁷ (7) impairment of brain function;¹¹⁸ (8) changes in enzyme activity, blood chemistry, and metabolism;¹¹⁹ and (9) delay or acceleration of natural hatch rates.¹²⁰

Many metals toxic to aquatic life are commonly released at hard rock mining sites, and interactive effects on salmon and aquatic systems are not well studied.¹²¹ Few studies exist on the “cocktail” effects that multiple metals have on fish and aquatic food chains. However, combined effects can be more toxic than any single element.¹²² For example, copper (Cu) and zinc (Zn) often co-occur; a 6:1 ratio of soluble Zn:Cu caused additive toxicity to fish in hard water, meaning that together the elements were more toxic to fish than either alone.¹²³ Rainbow trout exposed to sublethal concentrations of Cu, Cu+ low concentrations of Zn, or Cu + high concentrations of Zn consistently exhibited depressed levels of lymphocytes and elevated levels of neutrophils, two white blood cell types key to immune function.¹²⁴

Moreover, interactions among metals, such as copper and zinc, can produce more than additive effects. Mixtures of the metals cause higher rates of mortality in fish than would be expected by simply adding the

113. J.N. Goldstein et al., *Movements of Adult Chinook Salmon During Spawning Migration in a Metals-Contaminated System, Coeur d'Alene River, Idaho*, TRANSACTIONS OF THE AMERICAN FISHERIES SOCIETY 121-29 (1999); D.F. Woodward et al., *Brown Trout Avoidance of Metals in Water Characteristic of the Clark Fork River, Montana*, 52 CANADIAN JOURNAL OF FISHERIES AND AQUATIC SCIENCES 2031-37 (1995); SORENSEN, *supra* note 105, at 254, 265.

114. R.J. Baker et al., *Susceptibility of Chinook Salmon, Oncorhynchus tshawytscha (Walbaum), and Rainbow Trout, Salmo gairdneri, Richardson, to Infection with Vibrio anguillarum Following Sublethal Copper Exposure*, 3 JOURNAL OF FISH DISEASES 267-75 (1983).

115. SORENSEN, *supra* note 105, at 266-69.

116. *Id.* at 256-62; EISLER, *supra* note 104, at 180.

117. SORENSEN, *supra* note 105, at 253.

118. EISLER, *supra* note 104, at 163.

119. SORENSEN, *supra* note 105, at 256-62; EISLER, *supra* note 104, at 180.

120. SORENSEN, *supra* note 105, at 271.

121. EISLER, *supra* note 104, at 102-05.

122. WOODY, *supra* note 97, at 14.

123. SORENSEN, *supra* note 105, at 335-39.

124. Gail M. Dethloff et al., *Alterations in Physiological Parameters of Rainbow Trout (Oncorhynchus mykiss) with Exposure to Copper and Copper/Zinc Mixtures*, 42 ECOTOXICOLOGY AND ENVTL. SAFETY 253, 260 (1999).

effects of each element alone.¹²⁵ Once inside an organism, metallic elements exist in a specific form and ratio to other elements and will interact directly or indirectly based on a multitude of parameters.¹²⁶ For example, survival from egg to hatch of catfish (*Ictalurus* spp.) treated with a 1:1 ratio of Cu:Zn declined predictably under an additive model up to a concentration of ~1 ppm. With increasing concentrations, mortality rates increased synergistically at higher than predicted rates.¹²⁷ However, relatively few studies of synergistic effects exist, and the scientific understanding of such effects is still developing.

Bristol Bay salmon populations are comprised of several hundred genetically and phenotypically discrete stocks displaying different life history characteristics and local adaptations.¹²⁸ This biodiversity allows the aggregate populations to sustain their productivity, despite major changes in climatic conditions affecting the freshwater and marine environments during the last century.¹²⁹ The stability and sustainability of Bristol Bay sockeye salmon have been greatly influenced by different populations performing well at different times.¹³⁰ If managers in earlier times had decided to focus management on the most productive runs at the time, the biocomplexity that later proved important could have been lost.¹³¹ This biocomplexity is important on small scales as well, as lakes and tributaries show asynchronous shifts in density and productivity.¹³²

Long-term sustainability is derived in large part from complementary patterns of productivity in different stock components.¹³³ Defining the entire stock as healthy, simply because a large component is doing well, might lead to decline and extinction if the conditions that fostered success of the healthy component disappear, and the alternate strategy, which

125. J.B. Sprague & B.A. Ramsay, *Lethal Levels of Mixed Copper-Zinc Solutions for Juvenile Salmon*, 22 J. OF THE FISHERIES RES. BD. OF CAN. 425 (1965); SORENSEN, *supra* note 105, 335-39; EISLER, *supra* note 104, at 104.

126. H.H. SANDSTEAD, EFFECTS AND DOSE-RESPONSE RELATIONSHIPS OF TOXIC METALS 511 (1976); SORENSEN, *supra* note 105, at 335.

127. Wesley J. Birge & Jeffrey A. Black, *Effects of Copper on Embryonic and Juvenile Stages of Aquatic Animals*, in COPPER IN THE ENVIRONMENT: HEALTH EFFECTS PART II 373, 386-88 (Jerome O. Nriagu ed., 1979).

128. Ray Hilborn et al., *Biocomplexity and Fisheries Sustainability*, 100 PROC. OF THE NAT'L ACAD. OF SCI. 6564 (2003), available at <http://www.pnas.org/cgi/reprint/100/11/6564?ck=nck>.

129. *Id.*

130. *Id.* at 6567.

131. *Id.*

132. *Id.* at 6568.

133. *Id.*

would have done well in the new environmental conditions, has been lost.¹³⁴ Conservation of a diverse “salmon stock portfolio,” much like a diverse retirement portfolio, increases the likelihood of long-term sustained salmon returns into the future.

Thus, the following factors should be considered in devising state statutory standards: (1) scientific findings demonstrate toxic affects on fish below established limits for copper, (2) multiple parameters affect toxicity of copper alone and in synergistic combination with other metals, and (3) the understanding of synergistic effects is developing.

IV. STATE STATUTORY STANDARDS ARE INADEQUATE TO PROTECT FISH FROM THE PEBBLE MINE

The Alaska Department of Natural Resources (DNR) asserts that its “large mine permitting process,” which depends substantially on the preparation of federal environmental impact statements (“EIS”) under the National Environmental Policy Act (“NEPA”),¹³⁵ will adequately protect fish, wildlife, and public uses of fish and game from potential adverse effects of the Pebble Mine.¹³⁶

134. *Id.*

135. 42 U.S.C. § 4321 (2000).

136. *See* OFFICE OF PROJECT MANAGEMENT AND PERMITTING, ALASKA DEP’T. OF NAT. RES., PERMITTING LARGE MINE PROJECTS IN ALASKA 5 (2006), *available at* http://www.dnr.state.ak.us/mlw/mining/largemine/lmpt_process.pdf; Press Release, Alaska Dep’t of Nat. Res., Commissioner Irwin Voices Supports For Resource Development in Alaska (July 3, 2007), *available at* http://www.dnr.state.ak.us/standard/dsp_media_release.cfm?id=885&title=Commissioner%20Irwin%20Voices%20Supports%20for%20Resource%20Development%20in%20Alaska.

In 2006, a groundbreaking study¹³⁷ systematically compared predicted and actual water quality at hardrock mines operating in the United States, including in Alaska.¹³⁸ The study compared pre-mining water quality data presented in federal EISs¹³⁹ to operational and post-operational water quality data in order to assess the reliability of predictions relied upon by agency personnel making permitting decisions.¹⁴⁰ Four of the study's conclusions are particularly useful for assessing the adequacy of current state statutory standards. They are:

1. Actual water quality impacts are closer to potential (pre-mitigation) impacts rather than the predicted (post-mitigation) impacts stated in the EISs. The threshold inquiry for determining the environmental significance (or effect) of agency permitting decisions, e.g., for purposes of determining whether permitting the mine would “significantly affect the quality of the human environment,”¹⁴¹ should be a mine's *potential* rather than *predicted* impacts.¹⁴²

137. JAMES R. KUIPERS ET AL., COMPARISON OF PREDICTED AND ACTUAL WATER QUALITY AT HARDROCK MINES: THE RELIABILITY OF PREDICTIONS IN ENVIRONMENTAL IMPACT STATEMENTS (2006), available at <http://www.earthworksaction.org/pubs/ComparisonsReportFinal.pdf>. For mines with potential for acid drainage or metals leaching, the study found that eighty-five percent polluted surface water and ninety-three percent polluted groundwater. *Id.* at ES-11,12. At the time of permitting, eighty-nine percent of the environmental review documents for those mines underestimated the potential of the mines to pollute. *See id.* at ES-09. Nearly all of the environmental impact statements examined by the report predicted that the mines would be able to comply with water quality standards. *Id.* at ES-8. In actuality: seventy-six percent of the mines polluted ground or surface water in excess of water quality standards, *id.* at Table ES-7b; sixty percent of mines polluted surface water severely enough to exceed water quality standards, *id.* at Table ES-5; fifty-two percent of mines polluted ground water severely enough to exceed water quality standards, *id.* at Table ES-6; seventy-three percent of mines exceeded surface water quality standards despite predicting that mitigation would result in compliance, *id.* at Table ES-5; seventy-seven percent of mines that exceeded groundwater quality incorrectly predicted that mitigation to correct problems would result in compliance, *id.* at Table ES-6. Mitigation measures failed sixty-four percent of the time. *Id.* at 192. Of the mines analyzed that polluted ground and surface water, sixty-three percent released toxic metals such as lead, mercury, cadmium, copper, nickel, or zinc. More than half of the mines released arsenic, sulfates, and cyanide. *Id.* at ES-9.

138. *Id.* at i, ES-3.

139. The National Environmental Policy Act requires a detailed EIS on “major Federal actions significantly affect[ing] the quality of the human environment.” 42 U.S.C. § 4332(C) (2000).

140. KUIPERS ET AL., *supra* note 137, at ES-1.

141. 42 U.S.C. § 4332(C).

142. KUIPERS ET AL., *supra* note 137, at ES-15.

2. State and federal agencies should require a minimum and relatively consistent set of geochemical tests, for example to determine sulfide and metals content at the Pebble deposit.¹⁴³
3. Mines with close proximity to water sources—as Pebble Mine would be—or with moderate to high acid drainage potential—as the Pebble deposit is—should undergo more scrutiny by agencies in the permitting process than mines with low inherent potential for impacting water quality.¹⁴⁴
4. Failure to accurately characterize hydrological conditions can be addressed by requiring adequate characterization and conservative assumptions about water quality and quantity.¹⁴⁵

Most Alaska statutes that apply to the permitting, operation, and closure of mines, and the use of lands and waters for mining-related activities, are administered by DNR. The remainder of this section summarizes the State’s statutory framework and addresses whether the statutory standards¹⁴⁶ are adequate to protect fish, wildlife, their habitats, and the uses of fish and game from the potential impacts associated with the Pebble Mine.

Pursuant to section 27.05.010 of the Alaska Statutes, DNR is “the lead agency for all matters relating to the exploration, development, and management of mining, and, in its capacity as lead agency, shall coordinate all regulatory matters concerning mineral resource exploration, development, mining, and associated activities.”¹⁴⁷ The statute requires all other state agencies to consult with DNR before “tak[ing] action that may directly or indirectly affect the exploration, development, or management of mineral resources.”¹⁴⁸ Thus, section 27.05.010 provides only a standard

143. *Id.*; see, JAMES R. KUIPERS ET AL., PREDICTING WATER QUALITY AT HARDROCK MINES: METHODS AND MODELS, UNCERTAINTIES, AND STATE-OF-THE-ART (2006) [hereinafter KUIPERS ET AL., METHODS AND MODELS], available at <http://www.earthworksaction.org/pubs/PredictionsReportFinal.pdf>.

144. KUIPERS ET AL, *supra* note 137, at ES-15.

145. *Id.*

146. Although most state statutes relevant to mining are administered by DNR, the United States Environmental Protection Agency administers the issuance of permits under the National Pollutant Discharge Elimination System (“NPDES”) because Alaska is not authorized to implement the NPDES program under section 402(b) of the Clean Water Act. 33 U.S.C. § 1342(b) (2000). See U.S. Environmental Protection Agency, National Pollutant Discharge Elimination System, State Program Status, <http://cfpub.epa.gov/npdes/statestats.cfm> (last visited Mar. 30, 2008).

147. ALASKA STAT. § 27.05.010(b) (2006).

148. *Id.*

that other agencies must consult with DNR before taking actions that “directly or indirectly affect” mining, and the statute contains no standard for DNR’s role as the “lead agency” that “coordinate[s] all regulatory matters” concerning mining.

The general standard that governs DNR’s management of state lands is found in section 38.04.005 of the Alaska Statutes. The statute requires DNR to “provide for maximum use of state land consistent with the public interest.”¹⁴⁹ Without identifying any of the values to be considered in determining the public interest, the statute allows DNR wide discretion and does not specifically address fish, wildlife, or uses of them. The statute stands in stark contrast to section 16.05.020 of the Alaska Statutes, which imposes on the Alaska Department of Fish and Game (ADF&G) a duty to “manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state in the interest of the economy and general well-being of the state.”¹⁵⁰

Section 38.05.035 of the Alaska Statutes spells out powers and duties of DNR with respect to managing state lands, including its power to “approve contracts for the sale, lease, or other disposal” of state land, resources, property, or interests in them.¹⁵¹ In approving these contracts, DNR must issue “a written finding that the interests of the state will be best served.”¹⁵² The statute provides eight exceptions to the requirement for a best interest finding.¹⁵³ These exceptions include: revocable permits or authorizations; mining claims;¹⁵⁴ mining leases;¹⁵⁵ leases for surface use of land or water necessary for mining operations, such as for mill sites, tailings disposal, and other mine-related facilities;¹⁵⁶ and permits, rights-of-way, or easements for roads, ditches, pipelines, electric transmission lines,

149. ALASKA STAT. § 38.04.005(a) (2006).

150. ALASKA STAT. § 16.05.020 (2006).

151. ALASKA STAT. § 38.05.035(e) (2006).

152. *Id.*

153. *See* ALASKA STAT. § 38.05.035(e)(6)(A)–(H).

154. *See* ALASKA STAT. § 38.05.035(e)(6)(D) (exempting approval of mineral claims under section 38.05.195 of the Alaska Statutes from the requirement in section 38.05.035(e) of the Alaska Statutes of “a written finding that the interests of the state will be best served”).

155. *See* ALASKA STAT. § 38.05.035(e)(6)(E) (exempting approval of mineral leases under section 38.05.205 of the Alaska Statutes from the requirement in section 38.05.035(e) of the Alaska statutes of “a written finding that the interests of the state will be best served”).

156. *See* ALASKA STAT. § 38.05.035(e)(6)(G) (exempting approval of surface uses under section 38.05.255 of the Alaska Statutes from the requirement in section 38.05.035(e) of the Alaska Statutes of “a written finding that the interests of the state will be best served”).

and similar uses or improvements.¹⁵⁷ Thus, this “best interest” standard contains many exceptions for mining; it is also vague, does not address fish, game, habitat, or uses of them, and is open to wide discretion.

Section 38.05.255 of the Alaska Statutes, in turn, governs surface use of state lands and water by mining operations. It states that “surface uses of land or water included within a mining property by the owners, lessees, or operators shall be limited to those *necessary* for the prospecting for, extraction of, or basic processing of minerals and shall be *subject to reasonable concurrent uses*.”¹⁵⁸ Without defining what constitutes a “necessary” use of land and water, this provision appears to give DNR wide latitude to approve use of as much land and water as it deems necessary, subject to “reasonable concurrent uses.”¹⁵⁹

By failing to provide an adequate definition of what would be deemed “necessary” for prospecting, extraction, and processing, the statute gives wide latitude to the agency to defer to the mining company. DNR would have difficulty deciding whether, for example, housing and sewage treatment for two thousand workers are a “necessary” use of state land when alternatives may exist on private land that would not infringe on concurrent uses. The introduction of two thousand workers into an area sparsely populated by residents in small villages could have substantial impacts on local subsistence activities far beyond the land addressed by section 38.05.255(a) of the Alaska Statutes. Also, this statute fails to provide guidance to DNR as to whether it should take cost into account in deciding whether use of state land is necessary. DNR would have no basis to decide whether it could require the mine to house its workers or provide sewerage facilities on private land, which may be significantly more expensive. This type of permitting decision could have serious regional impacts on fish, game, and uses dependent on these resources. Even the requirement that the land remain subject to “reasonable concurrent use” does not address off-site impacts that are potentially more significant.

Section 38.05.850 of the Alaska Statutes authorizes DNR to issue permits, rights-of-way, or easements on state land for uses or improvements such as roads, trails, ditches, pipelines, telephone or electric

157. See ALASKA STAT. § 38.05.035(e)(6)(H) (exempting approval of permits, rights-of-way, or easements for roads, ditches, pipelines, electric transmission and distribution lines, and similar uses or improvements under section 38.05.850 of the Alaska Statutes from the requirement in section 38.05.035(e) of the Alaska Statutes of “a written finding that the interests of the state will be best served”).

158. ALASKA STAT. § 38.05.255(a) (emphasis added).

159. *Id.*

transmission and distribution lines, and production facilities for recovering minerals.¹⁶⁰ The statute requires DNR to “give preference to that use of the land that will be of greatest economic benefit to the state and the development of its resources.”¹⁶¹ The statute, however, does not spell out the factors that DNR should consider in making such a determination. The statute also fails to identify the intended beneficiary of the economic benefit, or in other words, whether the term “the state” refers to the state treasury, the general economy, or the citizens of Alaska.

Section 46.15.080 of the Alaska Statutes governs applications to appropriate state owned waters. Approval of an application to appropriate water must be “in the public interest.”¹⁶² In determining the public interest, section 46.15.080 requires DNR to “consider” eight criteria: (1) benefit to the applicant resulting from the proposed appropriation, (2) effect of the economic activity resulting from the proposed appropriation, (3) effect on fish and game resources and on public recreational opportunities, (4) effect on public health, (5) effect of loss of alternate uses of water that might be made within a reasonable time if not precluded or hindered by the proposed appropriation, (6) harm to other persons resulting from the proposed appropriation, (7) intent and ability of the applicant to complete the appropriation, and (8) effect upon access to navigable or public water.¹⁶³

The requirement that DNR “consider” these eight factors is far short of a substantive standard requiring DNR to protect fish and game, and avoid, minimize, or mitigate harms and risks to fish, wildlife, and public uses of them. Also, “considering” the effects on fish is far short of a statutory standard that articulates a standard for deciding whether a certain level of harm to fish is acceptable.

Section 46.17.010 *et seq.* of the Alaska Statutes applies to permits authorizing construction of dams, such as for tailings impoundments. Dams must be designed, constructed, operated, and maintained “consistent with the protection of life and property.”¹⁶⁴ This standard ignores fish, game, habitat, and uses of these resources. It leaves such

160. ALASKA STAT. § 38.05.850(a) (2006).

161. *Id.*

162. ALASKA STAT. § 46.15.080 (a)(4) (2006).

163. ALASKA STAT. § 46.15.080(b)(1)–(8) (2006).

164. ALASKA STAT. § 46.17.010 (2006).

matters to other statutes such as the Fishway Act¹⁶⁵ and the Anadromous Fish Act,¹⁶⁶ both discussed below.

The Alaska Coastal Management Program (“ACMP”)¹⁶⁷ applies to state agency decisions on a proposed project located in the coastal zone, as identified by state or district coastal management plans. Section 46.40.096 of the Alaska Statutes provides that agency decisions must be reviewed for “consistency” with statewide coastal zone standards adopted under section 46.40.040 of the Alaska Statutes and the enforceable policies in an applicable district coastal management plan. In 2003, then Governor Frank Murkowski issued Executive Order 106, which transferred the ACMP from the Office of the Governor to DNR.¹⁶⁸ Under DNR’s administration of the ACMP, the districts amended their district coastal management plans to eliminate many prior district policies that sought to balance conservation and development.¹⁶⁹

165. Currently codified as ALASKA STAT. §§ 41.14.840–860 (2006). On February 13, 2008, Alaska Governor Sara Palin issued Executive Order 114, which effectively reversed an earlier Executive Order, changing the statutory language and restoring the administration of the Fishway Act and the Anadromous Fish Act to ADF&G. Alaska Exec. Order No. 114 (Feb. 13, 2008); *see infra* note 168 and accompanying text. The legislature, pursuant to the Alaska constitution, has sixty days to disapprove the executive order. *See* ALASKA CONST. art. 3, § 23. If the legislature does not disapprove Executive Order 114, then, effective July 1, 2008, the statute will be codified pursuant to the Executive Order as ALASKA STAT. §§ 16.05.841–861.

166. Currently codified as ALASKA STAT. §§ 41.14.870–900 (2006). *See supra* note 165 for description of pending change in codification and statutory language. Effective July 1, 2008, the Anadromous Fish Act may be codified as ALASKA STAT. §§ 16.05.871–901.

167. ALASKA STAT. §§ 46.40.010–100 (2006).

168. ALASKA STAT. §§ 46.39.010–040 (2006); *see also* Exec. Order No. 106 (Feb. 13, 2003), *available at* <http://www.legis.state.ak.us/PDF/23/EO/exor0106.pdf>.

169. For example, the policies of Lake and Peninsula Borough Coastal Management Plan (“LPB-CMP”) in 1996 provided:

C-12 Mining and Mineral Processing Waste Disposal

Mining and mineral processing activities which dispose of potentially toxic tailings or discharge processing effluents which may contain toxic materials shall ensure that:

- 1) effluents are treated to remove materials toxic to human health, fish, or wildlife prior to discharge;
- 2) tailings are treated, stored and disposed in a manner which avoids any possibility of toxic runoff to surface waters or infiltration of toxic waters into the groundwater aquifer; and
- 3) if conditions 1) and 2) cannot be achieved and satisfactorily demonstrated, all potentially toxic tailings and process waters shall be contained in a zero-discharge disposal facility or impoundment.

Section 27.19.020 of the Alaska Statutes governs reclamation of mining sites. It states that “[a] mining operation shall be conducted in a manner that prevents *unnecessary and undue degradation* of land and water resources, and the mining operation shall be reclaimed *as contemporaneously as practicable* with the mining operation to leave the site in a *stable condition*.”¹⁷⁰ “Unnecessary and undue degradation” is defined in section 27.19.100(9) of the Alaska Statutes as “surface disturbance greater than would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and considering site specific conditions” and “includes the failure to initiate and complete reasonable reclamation.”¹⁷¹ This standard does not address fish and wildlife or public use of public land and is almost impossible to enforce because the terms “prudent operator,” “usual, customary, and proficient,” “similar,” “considering site specific conditions,” “failure to initiate,” and “reasonable” are all open to wide interpretation and dispute.

Section 27.19.100(7) of the Alaska Statutes defines “stable condition” as “the rehabilitation, where feasible, of the physical environment of the site to a condition that allows for the reestablishment of renewable resources on the site within a reasonable period of time by natural processes.”¹⁷² Thus, reclamation to a “stable condition” is unenforceable in that it is qualified by “where feasible,” which is an amorphous standard. It also does not address rehabilitation of the area to a condition approximating that which existed before the mining activity because the statute does not specifically define what constitutes “reestablishment of renewable resources.” Thus, the statute allows the establishment of any renewable resources, as opposed to resources that were present before the mining activity. Similarly, reclamation “as contemporaneously as practicable” is

LAKE AND PENINSULA BOROUGH COASTAL MANAGEMENT PLAN, ENFORCEABLE AND ADMINISTRATIVE POLICIES 16 (1996), *available at* <http://www.alaskacoast.state.ak.us/Explore/EPSpdf/LakePen.pdf>.

Then, under DNR’s administration of the ACMP, the current Lake and Peninsula Borough Coastal Management Plan *deleted* the above policy that bears upon Pebble Mine. *See* LPB-CMP, Enforceable Policies (approved by DNR Oct. 29, 2007; federal approval pending as of Feb. 16, 2008). *See* ALASKA DEP’T OF NATURAL RES., FINAL COASTAL DISTRICT PLAN APPROVALS (2008), *available at* <http://www.alaskacoast.state.ak.us/District/html/ProgressApproval.htm> (last visited Mar. 30, 2008), <http://alaskacoast.state.ak.us/District/FinalFinalPlans/LakePen/LPB%20policies.pdf> (last visited Mar. 30, 2008).

170. ALASKA STAT. § 27.19.020 (2006) (emphases added).

171. ALASKA STAT. § 27.19.100(9) (2006).

172. ALASKA STAT. § 27.19.100(7).

open to differing interpretation and addresses the timing of restoration rather than fish or wildlife.

In addition to statutes implemented by DNR, ADF&G has some permitting authority over activities related to the proposed Pebble Mine.¹⁷³ This is because the mine and its associated facilities may trigger the Fishway Act¹⁷⁴ and the Anadromous Fish Act.¹⁷⁵

The Fishway Act requires permits for activities that could obstruct fish passage, such as dams and culverts, in order to assure fish passage “if the commissioner considers it necessary.”¹⁷⁶ ADF&G has discretion in determining what is “necessary,” but the issue quickly gets complicated by technical matters, such as the proper design and placement of culverts to allow fish passage.¹⁷⁷

The Anadromous Fish Act requires permits to assure “proper protection” for activities that use or pollute waters “specified” by the commissioner as “important” for anadromous fish such as salmon.¹⁷⁸ The “proper protection” standard and the discretion to determine which streams are “important” are vague, subjective, open to discretion, and lack statutory definition. Many anadromous waters remain to be identified. The state currently lists approximately 16,000 streams, rivers, and lakes in Alaska which have been specified as important for the spawning, rearing, and migration of anadromous fish.¹⁷⁹ Based upon thorough surveys of a few drainages, it is believed that this number represents less than fifty percent of the streams, rivers, and lakes actually used by anadromous

173. On February 13, 2008, Alaska Governor Sara Palin issued Executive Order 114, which effectively reversed former Governor Murkowski’s Executive Order 107, and restored the administration of the Fishway Act and the Anadromous Fish Act to ADF&G. *See supra* notes 165, 166 and accompanying text.

174. Currently codified as ALASKA STAT. §§ 41.14.840–.860 (2006). *See supra* note 165, 166 for description of pending change in codification and statutory language.

175. Currently codified as ALASKA STAT. §§ 41.14.870–.900 (2006). *See supra* notes 165, 166 for description of pending change in codification and statutory language.

176. ALASKA STAT. § 16.05.841 (2006) (codified as amended by Executive Order 114); *see* Alaska Exec. Order No. 114 (Feb. 13, 2008). *See supra* note 165 for description of pending change in codification and statutory language.

177. *See, e.g.*, Alaska Dep’t of Fish & Game, Fish Passage Improvement Program, Fish Passage Inventory Projects, abstracts, http://www.sf.adfg.state.ak.us/SARR/Fishpassage/FP_inventory.cfm (last visited Mar. 30, 2008).

178. ALASKA STAT. § 16.05.871 (2006) (codified as amended by Executive Order 114); *see* Alaska Exec. Order No. 114 (Feb. 13, 2008). *See supra* note 166 for description of pending change in codification and statutory language.

179. Alaska Dep’t of Fish & Game, Fish Distribution Database, http://www.sf.adfg.state.ak.us/SARR/FishDistrib/FDD_intro.cfm (last visited Mar. 30, 2008).

fish.¹⁸⁰ At least another 20,000 anadromous water bodies have not been identified or specified under the Act.¹⁸¹

Several conclusions seem inescapable. First, none of the statutes that are administered by DNR and that apply to permitting facilities related to Pebble Mine articulate clear standards for protecting fish and game, habitats, and public uses of them. Only the Water Use Act at section 46.15.080 of the Alaska Statutes mentions fish, game, and recreation (but not commercial or subsistence use).¹⁸² The Act only requires DNR to “consider” fish, game, and recreation, rather than to protect them.¹⁸³ Furthermore, all of the applicable statutes, even the Fishway and Anadromous Fish Acts, administered by ADF&G, are subject to broad discretion.

Second, no statute requires DNR to approve the mine’s plan of operation. Instead, the state process consists of a series of unrelated permits, most of which derive from statutes not tailored specifically to mining.

Third, none of the statutes specifically address modern, large scale mining, such as the Pebble Mine, that exploits massive, low-grade, ore deposits. Some of the statutes were enacted before the risks of contemporary mining of massive, low-grade, metallic sulfide ores posed to ecosystems were widely recognized.¹⁸⁴

Fourth, although section 27.05.010 of the Alaska Statutes requires DNR to “coordinate” matters related to mining, no statute actually *creates* DNR’s so-called “large mine permitting process.” Instead, DNR’s “large mine permitting process” is a *personnel action*, i.e., the selection of a staff person as a “project manager” who coordinates permit applications, agency reviews, and authorizations for large mines under pre-existing discretionary authority and vague statutes.¹⁸⁵

180. *Id.*

181. *Id.*

182. ALASKA STAT. § 46.15.080 (2006).

183. *See id.*

184. The statute that gave DNR authority over all mining activities was enacted in 1949, before Alaska was a state. *See* ALASKA STAT. § 27.05.010 (2006).

185. *See* OFFICE OF PROJECT MANAGEMENT AND PERMITTING, ALASKA DEP’T OF NATURAL RESOURCES, PERMITTING LARGE MINE PROJECTS IN ALASKA (2006), *available at* http://www.dnr.state.ak.us/mlw/mining/largemine/lmpt_process.pdf. A mining company proposing a large mine can opt to engage the process by entering into a “memorandum of agreement” with DNR, whereby the company reimburses DNR for personnel time and costs related to the permits. *Id.* at 6. This creates a potential conflict between DNR’s duties to perform objective analysis and DNR’s reliance on the industry to pay DNR staff to perform that analysis.

Other states have addressed the problems that arise from mining massive, low-grade deposits. Michigan and New Mexico, for example, require mines to show at the time they receive permits to operate that they will not require “perpetual care” after they close.¹⁸⁶ Wisconsin has imposed a moratorium on permits to mine metallic sulfides until the industry can show that a single mine in North America has operated for ten years without creating acid mine drainage and that a single mine has been closed for ten years without creating acid mine drainage.¹⁸⁷ To date, the industry does not appear to have been able to meet these statutory standards.¹⁸⁸

V. PROPOSED LEGISLATION AIMS TO IMPROVE STATUTORY STANDARDS, BUT FURTHER TIGHTENING IS NEEDED

In response to the controversy surrounding Pebble Mine, two state legislators introduced legislation to create more stringent standards for permitting mines such as the Pebble Mine.

A. Proposed Legislation Would Establish a State Fish and Game Refuge in the Kvichak and Nushagak Drainages.

1. *Proposed Legislation.* Senator Gary Stevens (R-Kodiak), whose district includes the Kvichak drainage, introduced Senate Bill 67, which aims to permanently protect fish, wildlife, habitat, and public uses of these resources on state lands in the Kvichak and Nushagak drainages. Senate Bill 67 would designate about seven million acres of state lands and waters in these drainages as a fish and game refuge named after former governor Jay Hammond.¹⁸⁹

186. See MICH. COMP. LAWS § 324.63209 (2006); N.M. STAT. § 69-36-12 (2007). These standards are an effort to avoid perpetual care because once a mine requires perpetual care, the taxpayers usually end up having to cover the costs.

187. WIS. STAT. § 293.50 (2006).

188. Telephone Interview with Philip Fauble, State Mining Coordinator, Wis. Dep’t of Natural Res., in Madison, Wis. (Mar. 18, 2008).

189. S.B. 67, 2007 Leg., 25th Sess. (Alaska 2007), available at <http://www.legis.state.ak.us/PDF/25/Bills/SB0067A.pdf>. As introduced, Senate Bill 67 would be codified at section 16.20.045 of the Alaska Statutes by adding a new section to the Alaska Code. The refuge still may be revised to exclude land within the Nushagak drainage, which is concomitantly south of Wood-Tikchik Park and west of the Lake and Peninsula Borough, so as to allow potential land selections of a possible future borough in the Dillingham/Nushagak area from the excluded area. Section 29.65.030 of the Alaska Statutes entitles municipal governments to select ten percent of “vacant, unappropriated, unreserved land”

The central provisions of Senate Bill 67, as in any refuge legislation, are the purposes for which the refuge is established and the “compatibility test,” which is a standard that allows uses of resources not within refuge purposes to proceed if compatible with refuge purposes.¹⁹⁰ Accordingly, Senate Bill 67 provides:

- (b) The Jay Hammond State Game Refuge is established to protect the
1. fish and wildlife habitat and populations, including the salmon and trout spawning and rearing habitat, and critical caribou, moose, and brown bear habitat;
 2. public use of fish and wildlife and their habitat, particularly subsistence, commercial, and recreational fishing, hunting, trapping, viewing, and general public recreation in a high quality environment; and
 3. use and disposition of other resources when the activities are not incompatible with (1) and (2) of this subsection.¹⁹¹

within its boundary. Senate Bill 67 excludes Wood-Tikchik State Park and should be revised to exclude any state and federal lands in the Nushagak and Kvichak drainages that already are designated as parks or refuges.

190. Other refuge statutes contain compatibility tests. See ALASKA STAT. § 16.20.033(b)(3) (2006) (applying to the Yakataga State Game Refuge); ALASKA STAT. § 16.20.036(c) (2006) (applying to the Susitna Flats State Game Refuge); ALASKA STAT. § 16.20.037(b)(3) (2006) (applying to the Minto Flats State Game Refuge); ALASKA STAT. § 16.20.038(c) (2006) (applying to the Trading Bay State Game Refuge); ALASKA STAT. § 16.20.041(b)(3) (2006) (applying to the McNeil River State Game Refuge). See also 16 U.S.C. § 668dd(d) (2000) (applying to all national wildlife refuges). The compatibility test seeks to simultaneously protect fish, game, habitat, and uses of them, while protecting other uses, such as valid existing mining claims, so long as they are compatible with protecting fish, wildlife, habitats, and public uses of them. *Id.*

191. S.B. 67, 2007 Leg., 25th Sess. (Alaska 2007). Because of commercially harvested salmon, the proposed Jay Hammond refuge would probably produce more economic benefits from fish and wildlife than any national wildlife refuge in the United States. As explained in text, direct expenditures/sales in the Alaskan regional economy resulting from commercial, recreational, subsistence, and nonconsumptive use of fish and wildlife in the Bristol Bay drainages were estimated at approximately \$324 million in 2005. See DUFFIELD ET AL., *supra* note 28, at 15. Although not all of this value is attributable to the Kvichak and Nushagak drainages, the Kvichak drainage is historically the most productive of sockeye salmon and therefore the most economically productive and the Nushagak is historically the most productive for other salmon. See *id.* at 15–16. In contrast, the total direct expenditures/sales in the regional economies from consumptive and nonconsumptive use of fish and wildlife in all 548 national wildlife refuges in the United States was estimated at almost \$1.7 billion in 2006. See ERIN CARVER & JAMES CAUDILL, DIV. OF ECONOMICS, U.S. FISH & WILDLIFE SERVICE, BANKING ON NATURE 2006: THE ECONOMIC BENEFITS TO LOCAL COMMUNITIES OF NATIONAL WILDLIFE REFUGE

In late 2007, the Pebble Partnership issued a series of statements about its ability to develop the Pebble Mine in a manner that protects fish and wildlife and the public uses of these resources:

“If a mine cannot be designed that protects the water, fisheries, and wildlife resources of Bristol Bay, it will not be built.”¹⁹²

“Pebble will be . . . engineered to protect all things Alaskans value. Or it won’t be built at all.”¹⁹³

“Fish come first. We simply won’t develop Pebble if it harms commercial, subsistence or sport fishing in this remarkable region.”¹⁹⁴

“We simply will not develop a mine that damages Alaska’s fish and wildlife.”¹⁹⁵

“We will not be associated with the development of a mine that damages Alaska’s Bristol Bay fishery and wildlife, or those in the communities whose livelihoods depend on those resources. If the mine cannot be developed in a way that provides proper protections, we will not build it.”¹⁹⁶

“If the mine cannot be planned in a way that provides proper protections, it should not be built.”¹⁹⁷

VISITATION, ES-ii (2007), available at <http://www.fws.gov/refuges/policyMakers/BankingOnNature.html>.

192. The Pebble Partnership, *Setting Each Piece in Place* (quoting Cynthia Carroll, CEO, Anglo American). <http://www.pebblepartnership.com/files/5%20Principles%20Mosaic.pdf>.

193. The Pebble Partnership, *Not Your Grandfather’s Copper Mine*, <http://www.pebblepartnership.com/files/Pebble%204%20Science.pdf> (last visited Mar. 30, 2008).

194. The Pebble Partnership, *Fish Come First*, <http://www.pebblepartnership.com/files/Pebble%203%20Fish.pdf> (last visited Mar. 30, 2008).

195. *Id.* (quoting Cynthia Carroll, CEO, Anglo American).

196. Cynthia Carroll, Editorial, *Pebble Partnership Promises Responsible Development*, ANCHORAGE DAILY NEWS, Dec. 1, 2007, available at <http://dwb.adn.com/opinion/compass/story/9490777p-9401615c.html>.

197. Speech by Cynthia Carroll, CEO, Anglo American plc, to Resource Development Council, in Anchorage, Alaska (Oct. 23, 2007), http://www.pebblepartnership.com/related_media/speech.pdf.

Although none of these statements addressed specific legislation, one could conclude from these statements that the Pebble Partnership may not oppose the refuge purposes and compatibility test of Senate Bill 67.

Senate Bill 67 would also close the refuge to new mining claims¹⁹⁸ and prohibit storage or disposal of industrial waste in the refuge.¹⁹⁹ Subject to the refuge purposes, closure to new mining claims, and prohibition of disposal of industrial waste, ADF&G and DNR would exercise their respective authorities over the refuge consistent with a management plan prepared by ADF&G in consultation with DNR.²⁰⁰ A citizens' advisory committee, composed of representatives of subsistence users, state, municipal and tribal entities, tourism and recreation, mining and industry, and sport and commercial fishing, would assist ADF&G and DNR regarding management of the refuge.²⁰¹ Furthermore, refuge management plans are usually adopted into regulation.²⁰² Doing so provides an opportunity for public notice and comment under the Alaska Administrative Procedure Act.²⁰³ Finally, ADF&G's overall policy statute, which requires ADF&G to "manage, protect, maintain, improve, and extend the fish, game and aquatic plant resources of the state in the interest of the economy and general well-being of the state," would apply.²⁰⁴

2. The Legislature May Wish to Consider Several Revisions to the Refuge Bill. First, because the Bristol Bay drainages are so valuable for fish and

198. Senate Bill 67 could be clarified to provide that the closure to new mining claims (mineral entry) is subject to valid existing rights, so as to accommodate concerns that the legislation would not otherwise protect valid existing rights. See S.B. 67, 2007 Leg., 25th Sess. (Alaska 2007).

199. Industrial waste is defined as:

[A] liquid, gaseous, solid, or other waste substance or a combination of them resulting from process of industry, manufacturing trade or business, or from the development of natural resources; however, gravel, sand, mud, or earth taken from its original situs and put through sluice boxes, dredges, or other devices for the washing and recovery of the precious metal contained in them and redeposited in the same watershed from which it came is not industrial waste.

ALASKA STAT. § 46.03.900 (2006).

200. See S.B. 67, 2007 Leg., 25th Sess. (Alaska 2007). For example, DNR would continue to exercise authority to lease for oil and gas and permit dams for Pebble Mine and rights of way as long as such activities were compatible with refuge purposes.

201. *Id.*

202. ALASKA ADMIN. CODE tit. 5, §§ 95.500–.545 (2007).

203. ALASKA STAT. §§ 44.62.190–.290 (2006).

204. ALASKA STAT. § 16.05.020 (2006).

game production, the legislature should consider a “no perpetual care” standard to be used at the time of permitting a metallic sulfide mine. This could be similar to “no perpetual care” standards in Michigan and New Mexico mining statutes.²⁰⁵ Such an amendment might read:

A mine for sulfide minerals or ores in the refuge shall be permitted only if the mining area and affected area, including all facilities, shall be reclaimed and remediated to achieve a naturally self-sustaining ecosystem appropriate for the area that does not require long-term or perpetual care, including treatment, and the areas shall be returned as expeditiously as possible to the ecological conditions that approximate pre-mining conditions.

Imposing such a standard at the time of permitting would not foreclose requiring perpetual care after closure of the mine. The legislature also could require that any waste rock piles and tailings facilities be isolated hydrologically from surface and groundwater. As noted above, such hydrological isolation may be difficult due to the fracturing of rock that occurs in block caving.²⁰⁶

Second, with respect to mining metallic sulfides in the refuge, the legislature should consider adopting the “precautionary approach” of the Alaska Board of Fisheries. Such an approach is already used in its Policy for the Management of Sustainable Salmon Fisheries.²⁰⁷ The precautionary

205. See MICH. COMP. LAWS § 324.63209 (2006); N.M. STAT. § 69-36-12 (2007).

206. See *supra* note 80.

207. ALASKA ADMIN. CODE tit. 5, § 39.222 (2007). The Policy for the Management of Sustainable Salmon Fisheries adopts the precautionary approach, at ALASKA ADMIN. CODE tit. 5, § 39.222(c)(5) (2007), which provides:

(5) in the face of uncertainty, salmon stocks, fisheries, artificial propagation, and essential habitats shall be managed conservatively as follows:

(A) a precautionary approach, involving the application of prudent foresight that takes into account the uncertainties in salmon fisheries and habitat management, the biological, social, cultural, and economic risks, and the need to take action with incomplete knowledge, should be applied to the regulation and control of harvest and other human-induced sources of salmon mortality; a precautionary approach requires

- (i) consideration of the needs of future generations and avoidance of potentially irreversible changes;
- (ii) prior identification of undesirable outcomes and of measures that will avoid undesirable outcomes or correct them promptly;
- (iii) initiation of any necessary corrective measure without delay and prompt achievement of the measure’s purpose, on a time scale

approach requires an agency to be cautious—in effect to err on the side of conservation—when information is inadequate or still developing, as in the case of synergistic effects of copper, and the absence of adequate information is not a reason to fail to take conservation measures.

Third, the legislature could clarify that the compatibility test refers to the refuge purposes and is not a part of the purposes themselves.²⁰⁸ Doing so would avoid confusion between the purposes of the refuge—protecting fish, wildlife, habitat and public uses of these resources—and other potential uses, such as development of pre-existing mining claims, which would be permitted only if compatible with the purposes of the refuge. Thus, the proposed subsection 16.20.045(b) of the Alaska Statutes should be amended to be two subsections, (b) and (c), as follows:

- (b) *The Jay Hammond State Game and Wild Salmon Protection Area is established to protect the*
 1. *fish and wildlife habitat and populations, including the salmon and trout spawning and rearing habitat, and critical caribou, moose, and brown bear habitat; and*
 2. *public use of fish and wildlife and their habitat, particularly subsistence, commercial, and recreational fishing, hunting, trapping, viewing, and general public recreation in a high quality environment.*
- (c) *The use and disposition of other resources may be permitted when the activities are not incompatible with subsections (b)(1) and (b)(2).*

Fourth, the legislature could amend the proposed section 16.20.045(d) of the Alaska Statutes in order to focus statutory prohibitions or restrictions on the environmental issues posed by development of pre-existing mining

not exceeding five years, which is approximately the generation time of most salmon species;

(iv) that where the impact of resource use is uncertain, but likely presents a measurable risk to sustained yield, priority should be given to conserving the productive capacity of the resource;

(v) appropriate placement of the burden of proof, of adherence to the requirements of this subparagraph, on those plans or ongoing activities that pose a risk or hazard to salmon habitat or production;

(B) a precautionary approach should be applied to the regulation of activities that affect essential salmon habitat.

208. In most refuge statutes, the compatibility test is a separate subsection that refers to the refuge purposes. See ALASKA STAT. § 16.20.036(c) (2006) (applying to the Susitna Flats State Game Refuge); ALASKA STAT. § 16.20.038(c) (2006) (applying to the Trading Bay State Game Refuge); see also 16 U.S.C. § 668dd(d) (2000) (applying to all national wildlife refuges).

claims for metallic sulfide ore. By focusing in this manner, the refuge bill could address (1) sulfuric acid, acid mine drainage, toxic agents such as cyanide used in ore processing, and ammonia residues from explosives used in mining; (2) storage or disposal of industrial waste, waste rock, overburden, and tailings; and (3) withdrawal, appropriation, and diversion of surface or subsurface water. The following is suggested language that would prohibit acid mine drainage in the refuge:

No state agency shall issue a permit or authorization for activities that would have potential to create acid mine or acid rock drainage into surface or groundwater.

Fifth, the legislature could implement the Kuipers-Maest procedural recommendations by requiring that permitting agencies (1) use *potential* impacts to water quality rather than *predicted* impacts to water quality when making permitting decisions,²⁰⁹ (2) establish a minimum and relatively consistent set of geochemical tests to determine geochemistry and sulfide content of ore,²¹⁰ (3) impose stricter scrutiny of any potential metallic sulfide mine that is near water and has potential for acid drainage,²¹¹ and (4) ensure hydrological conditions are adequately characterized based on conservative assumptions about water quality and quantity.²¹²

Sixth, the legislature should provide longer opportunities for public comment on permits for metallic sulfide mining in the refuge. Except for the consistency findings under the Alaska Coastal Management Program and land disposals or leases under section 38.05.035(e) of the Alaska Statutes, the remainder of the state statutes implemented by DNR or ADF&G, and applicable to Pebble Mine, do not afford public notice and comment. Hence, DNR and ADF&G will depend on a federal EIS under NEPA²¹³ to provide notice and comment on state permits. This will occur by virtue of NEPA regulations, which require the EIS to be coordinated with state and local permits.²¹⁴ The result is that state and local permits will be adjudicated contemporaneously with federal permits. However, under NEPA regulations, the minimum comment period on a draft EIS is ninety days and on a final EIS only thirty days.²¹⁵ In the case of the Pebble Mine,

209. KUIPERS ET AL., *supra* note 137, at ES-15.

210. *Id.*; see also KUIPERS ET AL., METHODS AND MODELS, *supra* note 143.

211. KUIPERS ET AL., *supra* note 137, at ES-15.

212. *Id.*

213. 42 U.S.C. § 4321 (2000).

214. 40 C.F.R. § 1506.2 (2007).

215. 40 C.F.R. § 1506.10 (2007).

the EIS is likely to be so voluminous and complicated by issues of science, engineering, and law that it could defeat the ability of the public to comment effectively. The legislature would be wise to amend state law to give the public time to become educated about what is likely to be a very complex matter and to afford judicial review.²¹⁶ For example, the legislature could amend Senate Bill 67 to include the following:

Any permit, lease, compatibility determination, or authorization for facilities related to mining sulfide minerals or ores in the refuge shall be subject to a public notice and comment period of at least 180 days, after which the agency shall respond to comments in writing and with scientific or technical justification for the agency's position. Any person who participated in the public comment process may seek judicial review of the agency decision.

Finally, the legislature should amend Senate Bill 67 to condition annual exploration permits, which generally are issued prior to applications that trigger the NEPA process, upon a duty to release and summarize environmental data as they are gathered by the Pebble Partnership. The partnership claims to have spent \$55 million on environmental and socio-economic studies to assist it in developing a project plan to be submitted for governmental and public review.²¹⁷ However, no statute or regulation requires the Pebble Partnership to disclose these studies, the underlying data, protocols used to gather data, or assumptions made in designing the studies.²¹⁸ NEPA regulations provide that environmental information must

216. The Alaska Administrative Procedure Act, see ALASKA STAT. § 44.62.330(a)(6) (2006), affords judicial appeal to review DNR's decisions under the Alaska Land Act, ALASKA STAT. § 38.05 *et seq.*, "where applicable." The Alaska Land Act, at § 38.05.035(l), provides for appeal to a superior court from a written finding by DNR that it is in the best interest of the state to sell, lease, or dispose of land under § 38.05.035(e)(6). However, § 38.05.035(e)(6)(A)–(H) lists eight exceptions to the requirement of a written best interest finding. These exceptions include approvals of: (1) revocable permits or authorizations; (2) mineral claims located under § 38.05.195; (3) mineral leases under § 38.05.205; (4) surface use leases (e.g., for mill sites, tailings disposal and other mine-related facilities) under § 38.05.255; and (5) permits, rights-of-way, or easements (e.g., for roads, ditches, pipelines, electric transmission lines) under § 38.05.850. Thus, a result of the exemptions in section 38.05.035(e)(6) is that many of DNR's decisions related to mining may not be subject to appeal to the courts under the Administrative Procedure Act because the decision will not depend on an approval based on a best interest finding.

217. The Pebble Partnership, Environment Overview, <http://www.pebblepartnership.com/pages/environment/environment-overview.php> (last visited Mar. 30, 2008).

218. For example, whenever NDM discloses the content of valuable metals in its ore (which presumably bolsters marketing the prospective mine to investors) but

be “high quality” and that “[a]ccurate scientific analysis, expert agency comments, and public scrutiny are essential.”²¹⁹ Requiring disclosure to agencies and the public would help assure high quality information, improve public understanding of the issues, and facilitate more informed public scrutiny. The legislature also should require analysis of socio-economic impacts on public uses of natural resources—such as subsistence and recreational uses of fish and game—that occur substantially outside of conventionally quantifiable market transactions, such as commercial fishing.²²⁰

B. Proposed Legislation Would Regulate Use of State Waters in the Bristol Bay Drainages

1. *Proposed Legislation.* State Representative Bryce Edgmon (D-Dillingham), whose district includes the Nushagak drainage, introduced House Bill 134, which aims to provide additional protections for water used by salmon or for human consumption.²²¹ As introduced, House Bill 134 provided that, subject to exceptions for most current uses of water, a person may not “withdraw, obstruct, divert, inject, pollute, or pump” surface or ground water or “alter, destroy, displace, relocate, channel, dam, [or] convert to dry land” any water body in the Nushagak, Kvichak, Naknek, Egegik, and Ugashik river drainages—all of which flow to Bristol Bay.²²²

The House Special Committee on Fisheries revised the bill to focus on mining metallic sulfides. The committee substitute bill, CS House Bill 134, provided in part:

does not disclose the sulfide content, then the public is put at a disadvantage for purposes of protecting public interests in fish. NDM, PEBBLE COPPER, *supra* note 1, at 4.

219. 40 C.F.R. § 1500.1 (2007).

220. See DUFFIELD ET AL., *supra* note 28, at 14 (providing an example of a natural resource economic study that quantifies socio-economic values for activities such as subsistence and recreation that occur substantially outside of market-transactions and the ordinary market economy).

221. H.B. 134, 2007 Leg., 25th Sess. (Alaska 2007), available at <http://www.legis.state.ak.us/PDF/25/Bills/HB0134A.pdf>. While Senate Bill 67 primarily seeks to protect fish, game, habitat, and public uses of these resources, and would be implemented by ADF&G and DNR, House Bill 134 would add a new section to the Alaska Code, section 16.10.015 of the Alaska Statutes, and would be implemented by the Alaska Department of Environmental Conservation (DEC).

222. See H.B. 134, 2007 Leg., 25th Sess. § 2 (Alaska 2007).

Sec. 16.10.015. Protection of salmon streams within certain drainages affecting Bristol Bay. (a) Notwithstanding any other provision of law, a person may not withdraw, obstruct, divert, inject, pollute, or pump, either temporarily or permanently, any subsurface or surface water within the anadromous fish waters of the Bristol Bay watershed in connection with a sulfide mining operation.

(b) Notwithstanding any other provision of law, a person may not alter, destroy, displace, relocate, channel, dam, convert to dry land, or otherwise adversely affect any portion of the anadromous fish waters of the Bristol Bay watershed in connection with a sulfide mining operation.

(c) In addition to any other penalties, a person who violates (a) or (b) of this section, upon conviction, is punishable by a fine of not less than \$100,000 a day or more than \$1,000,000 a day. Each day on which a violation described in (a) or (b) of this section occurs constitutes a separate violation of (a) or (b) of this section.

(d) In this section,

(1) “anadromous fish waters of the Bristol Bay watershed” means the waters in the Bristol Bay watershed that are specified under [the Anadromous Fish Act] as being important for the spawning, rearing, or migration of anadromous fish;

(2) “sulfide mining operation” means a mining operation for (A) antimony, arsenic, copper, iron, lead, mercury, molybdenum, nickel, palladium, platinum, silver, or zinc; or

(B) gold associated with any of the minerals listed in (A) of this paragraph.²²³

This revision of House Bill 134 clarified that it applied solely to metallic sulfide mining operations and did not ensnare individuals engaged in relatively harmless activities. Nonetheless, to achieve its goal of protecting the Bristol Bay watershed, the legislature could further revise the legislation.

2. *Legislature Could Further Revise the Legislation.* First, the legislature should define “pollution” in a bill such as CS House Bill 134. It does not do so. Thus, to adjudicate any challenge brought in the absence of a definition,

223. Comm. Substitute for H.B. 134, 2007 Leg., 25th Sess. § 2 (Feb. 2008), available at <http://www.legis.state.ak.us/PDF/25/Bills/HB0134B.pdf>.

a court would be forced to rely on the definition of “pollution” found in section 46.03.900(20) of the Alaska Statutes. It reads as follows:

“[P]ollution” means the contamination or altering of waters, land, or subsurface land of the state in a manner which creates a nuisance or makes waters, land, or subsurface land unclean, or noxious, or impure, or unfit so that they are actually or potentially harmful or detrimental or injurious to public health, safety, or welfare, to domestic, commercial, industrial, or recreational use, or to livestock, wild animals, bird, fish, or other aquatic life[.]²²⁴

In defining “pollution,” the bill should address issues such as acid mine drainage, toxic effects of copper at levels below state standards, synergistic effects, use of toxic agents such as cyanide, and ammonia residues, all of which may be toxic to salmon and other organisms. The bill should also address the storage or disposal of industrial waste, waste rock, overburden, and tailings, all of which can impair water quality.

Second, the legislature could rely on a *combination* of standards and restrictions or prohibitions in House Bill 134, as Senate Bill 67 does. House Bill 134 relies on prohibitions, instead of standards by which to measure a proposed activity. Relying solely on prohibitions to protect the Bristol Bay watershed from mine pollution requires the legislature to foresee *every* potential activity associated with the Pebble Mine that could harm fish populations. In contrast, Senate Bill 67 focuses first on standards—i.e., the purposes of the refuge and a compatibility test by which to evaluate *any* proposed action, foreseeable or not, that is not within refuge purposes—and then addresses prohibitions. Relying on a combination of standards and prohibitions or restrictions helps the legislature draft legislation capable of addressing unforeseeable issues.

Third, in the proposed section 16.10.015(a) of the Alaska Statutes, the legislature should clarify what it means by “any subsurface or surface water within the anadromous fish waters.” The language is unclear whether it intends to protect any subsurface water from pollution and other activities related to metallic sulfide mining or only subsurface water that feeds anadromous surface water.

Fourth, instead of defining anadromous waters by reference to the Anadromous Fish Act, which dates to 1959, the legislature may wish to

224. ALASKA STAT. § 46.03.900(2) (2006).

model its definition on a more modern statute. For example, the Alaska Forest Practices Act provides:

- (1) “anadromous water body” means the portion of a fresh water body or estuarine area that
 - (A) is cataloged under [the Anadromous Fish Act] as important for anadromous fish; or
 - (B) is not cataloged under [the Anadromous Fish Act] as important for anadromous fish but has been determined [by ADF&G] to contain or exhibit evidence of anadromous fish in which event the anadromous portion of the stream or waterway extends up to the first point of physical blockage.²²⁵

The legislature could also amend House Bill 134 by incorporating the suggestions made above with respect to Senate Bill 67. The legislature could add to House Bill 134 the “no perpetual care” and “precautionary approach” standards to be used at permitting, add a more protective post-closure reclamation and restoration standard, improve public notice and opportunities for comment and public involvement, require the permitting agencies to respond to public comments, allow for judicial review, place conditions on exploration permits that require the mining company to release all scientific data when gathered, and otherwise improve regulation and permitting of metallic sulfide mines as suggested above.

Finally, the best approach to producing final legislation that protects the Bristol Bay drainages may be for the legislature to combine Senate Bill 67 and House Bill 134 and then select the most appropriate combination of standards, procedures, prohibitions and restrictions pertaining to metallic sulfide mining. Doing so would allow the legislature, the public, and the agencies to speak to both approaches and all matters at once.²²⁶

VI. THE PROPOSED LEGISLATION WOULD NOT CONSTITUTE A TAKING

The Takings Clause of the Fifth Amendment to the United States Constitution, made applicable to the states through the Fourteenth

²²⁵ ALASKA STAT. § 41.17.950(1) (2006).

²²⁶ No discussion of elevated standards is complete without recognizing that the importance of fish and game to Alaskans prompted Alaska’s lawmakers to criminalize most violations of Title 16 of the Alaska Statutes. *See, e.g.*, ALASKA STAT. § 16.05.925(a) (2006). Nearly all violations of Title 38 (DNR statutes) are civil violations. ALASKA STAT. §§ 38.05.005–.95.300 (2006).

Amendment,²²⁷ provides that private property shall not “be taken for public use, without just compensation.”²²⁸ The Takings Clause “does not prohibit the taking of private property, but instead places a condition on the exercise of that power.”²²⁹ In other words, it “is designed not to limit the governmental interference with property rights *per se*, but rather to secure *compensation* in the event of otherwise proper interference amounting to a taking.”²³⁰ Similarly, Article I, section 18 of the Alaska Constitution provides: “[p]rivate property shall not be taken or damaged for public use without just compensation.”²³¹

Proponents of Pebble Mine have asserted that, if House Bill 134 becomes law and stops the Pebble Mine project, it will constitute a taking of NDM’s mining claims and require the State to compensate NDM.²³² The Legal Services Division of the Alaska Legislature advised Representative Edgmon that if, after a holder of a mining claim has acquired rights, the law is changed in such a way that “no longer allows [the holder of a mining claim] to use its land for the intended profit-making purpose, then it seems likely a taking has occurred.”²³³

In analyzing whether a governmental action constitutes a taking, “the logically antecedent inquiry [is] into the nature of the owner’s estate” and to ascertain whether the proscribed use interests were part of his title.²³⁴ Thus, the threshold inquiry in this case must be into the nature of the property rights that a mining claimant holds on state-owned public land.

Mining claims are a “unique form of property.”²³⁵ Unlike ordinary private property, the government is the owner of the underlying fee title to

227. See *Chicago, B. & Q. R. Co. v. City of Chicago*, 166 U.S. 226, 233–34 (1897).

228. See U.S. CONST. amend. V.

229. *Lingle v. Chevron U.S.A., Inc.*, 544 U.S. 528, 536 (2005) (citing *First English Evangelical Lutheran Church of Glendale v. County of Los Angeles*, 482 U.S. 304 (1987)).

230. *First English Evangelical Lutheran Church*, 482 U.S. at 315.

231. ALASKA CONST. art. I, § 18.

232. See, e.g., *Hearing on H.B. 134 Before Alaska H. Fisheries Comm.*, 2007 Leg., 25th Sess. (Alaska 2007) (statement of Gail Phillips, Truth About Pebble), available at http://www.legis.state.ak.us/basis/get_minutes_comm.asp?hse=H&session=25&comm=FSH&date=20070305&time=0842. Phillips previously served as speaker of the Alaska House of Representatives. *Id.*

233. Memorandum from Brian J. Kane, Legislative Counsel, Legal Services Division of Legal and Legislative Research, Legislative Affairs Agency, State of Alaska, to Rep. Bryce Edgmon (Feb. 12, 2008) (on file with author).

234. *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1027 (1992).

235. *Best v. Humboldt Placer Mining Co.*, 371 U.S. 334, 335–36 (1963) (stating that a mining claim is a “possessory interest” that is “mineral in character” within the limits of the claim). Unless otherwise provided, the uses and interpretations of

the public domain.²³⁶ As the owner, the government maintains broad powers over the terms and conditions upon which the public lands can be used, leased, and acquired.²³⁷ Alaska law contains no provision for patenting a mining claim, which would convey fee-simple title.²³⁸

In Alaska, a “prior right” to mineral deposits on state land open to claim staking may be acquired by discovery, location, and recording.²³⁹ The claimant has an “exclusive” right to possess and extract minerals within the boundaries of the claim.²⁴⁰

The holder of a state mining claim, however, has “no right to mine” because that right is always contingent on state permission.²⁴¹ In other words, a mining claim does not constitute an absolute right to mine; it vests in the claimant a right to exclude others who wish to mine the same minerals within the boundaries of the mining claims.²⁴²

For a mining claim to be valid, the discovery must ultimately pass the “marketability test.”²⁴³ This test requires the claimant to show that the minerals can be extracted at a profit.²⁴⁴

A. Legal Standards Governing Takings Analysis

In examining whether a government intrusion on private property rights constitutes a taking, several factors have particular significance. The

federal mining law as supplemented by state law apply to sections 38.05.185–.275 of the Alaska Statutes. ALASKA STAT. § 38.05.185(c) (2006).

236. *United States v. Locke*, 471 U.S. 84, 104 (1985) (citing, e.g., *Kleppe v. New Mexico*, 426 U.S. 529, 539 (1976)).

237. *Locke*, 471 U.S. at 104.

238. *See* ALASKA STAT. §§ 38.05.185 *et seq.* (2006).

239. “Prior discovery, location, and filing, as prescribed by law, shall establish a prior right to these minerals and also a prior right to permits, leases, and transferable licenses for their extraction.” ALASKA CONST. art. VIII, § 11.

240. ALASKA STAT. § 38.05.195(a). In order to maintain the claim, a claimant must comply with requirements for annual labor, pursuant to section 38.05.210 of the Alaska Statutes; annual rental, pursuant to section 38.05.211 of the Alaska Statutes; and production royalties, pursuant to section 38.05.212 of the Alaska Statutes. ALASKA STAT. § 38.05.185(a).

241. *Beluga Mining Co. v. Dep’t of Natural Res.*, 973 P.2d 570, 575–76 (Alaska 1999).

242. The right to exclude other subsequent mining claimants, however, is not a right to exclude the public at large. *See* ALASKA STAT. § 38.05.255 (2006) (providing that a holder of a mining claim has limited use of surface land and waters within the boundaries of the claim, subject to reasonable concurrent uses by the ordinary public).

243. *United States v. Coleman*, 390 U.S. 599, 602–03 (1968).

244. *Id.*

economic impact of the regulation on the claimant and, particularly, on the extent to which the regulation has interfered with distinct investment-backed expectations are two primary factors.²⁴⁵ Also relevant is the character of the governmental action, i.e., whether it amounts to a physical invasion or merely affects property interests “through some public program adjusting the benefits and burdens of economic life to promote the common good.”²⁴⁶ These three factors all aim to identify regulatory actions that are functionally equivalent to a direct appropriation or ouster from private property in that each focuses on the severity of the burden that the government imposes on property rights.²⁴⁷

B. House Bill 134 and Senate Bill 67 Would Not Constitute Takings

In assessing the character of the government action, a court may more readily find a “taking” when the interference with property can be characterized as a physical invasion by government than when interference arises from some public program adjusting the benefits and burdens of economic life to promote the common good.²⁴⁸ Under Alaska law, this inquiry also examines the legitimacy of the interest advanced by the regulation or land-use decision.²⁴⁹

The legislature may enact legislation that is designed to protect activities and industries it deems important, even if it thereby restricts other types of industries, without having to compensate the industry that suffers a loss as a result of the legislature’s action.²⁵⁰ In a wide variety of

245. *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 124 (1978).

246. *Id.* Prior to *Pennsylvania Coal Co. v. Mahon*, 260 U.S. 393 (1922), it was generally thought that the Takings Clause reached only a “direct appropriation” of property or the functional equivalent of a “practical ouster of [the owner’s] possession.” *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1014 (1992) (citations omitted). *Mahon* established the oft-cited maxim that, “while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.” *Id.* (citing *Mahon*, 260 U.S. at 415).

247. *Lingle v. Chevron U.S.A., Inc.*, 544 U.S. 528, 539 (2005).

248. *Penn Cent.*, 438 U.S. at 124.

249. *Beluga Mining Co. v. Dep’t of Natural Res.*, 973 P.2d 570, 575 (Alaska 1999). The Supreme Court of the United States rejected this prong of the analysis, stating that it “prescribes an inquiry in the nature of a due process, not a takings test, and that it has no proper place in . . . takings jurisprudence.” *Lingle*, 544 U.S. at 540.

250. *Miller v. Schoene*, 276 U.S. 272, 279 (1928) (finding no taking where state required destruction of one owner’s rust-infected cedar trees with the intent to prevent destruction of apple orchards because “the state does not exceed its constitutional powers by deciding upon the destruction of one class of property in order to save another, which, in the judgment of the legislature, is of greater value to the public”).

contexts, the government may execute laws or programs that adversely affect recognized economic values.²⁵¹ “Even with respect to vested property rights, a legislature generally has the power to impose new regulatory constraints on the way in which those rights are used, or to condition their continued retention on performance of certain affirmative duties.”²⁵² This power includes the enactment of new land designations encompassing existing mining claims.²⁵³

In enacting more stringent environmental regulations or establishing a refuge in the Bristol Bay drainages, the legislature would simply be adjusting the benefits and burdens of economic life to promote the common good.²⁵⁴ In Alaska, the common good includes protecting the public interest in the conservation of fish, wildlife, and habitat; the protection of commercial, sport and subsistence fishing, and hunting; and other public uses “in a high quality environment.”²⁵⁵

The Bristol Bay drainages support multi-million dollar commercial, sport, and subsistence fisheries. Thus, if the legislature restricts mining in the Bristol Bay drainages in an effort to protect the fisheries, it would not have to compensate the affected mining claimants if, in the judgment of the legislature, the fisheries are of greater value to the public.²⁵⁶

The legitimacy of the state interests advanced by House Bill 134 and Senate Bill 67 is supported by Article VIII of the Alaska Constitution. Article VIII: (1) requires the legislature to provide for the conservation of natural resources for the maximum benefit of the people;²⁵⁷ (2) reserves fish, wildlife, and waters to the people for common use;²⁵⁸ (3) provides that fish, forests, wildlife, grasslands, and all other replenishable resources are to be maintained on a sustained yield basis;²⁵⁹ and (4) requires the

251. *Penn Cent.*, 438 U.S. at 124.

252. *Reeves v. United States*, 54 Fed. Cl. 652, 672 (2002) (quoting *United States v. Locke*, 471 U.S. 84, 104 (1985)).

253. *See id.* at 672.

254. *See Penn Cent.*, 438 U.S. at 124.

255. *See, e.g.*, ALASKA STAT. §§ 16.20.033(b)(1)–(2) (2006) (stating that purposes of the Yakataga State Game Refuge include protecting fish and wildlife habitat, populations, and public use).

256. *See, e.g.*, *Miller v. Schoene*, 276 U.S. 272, 279 (1928).

257. ALASKA CONST. art. VIII, § 2 (“The legislature shall provide for the utilization, development and conservation of all natural resources belonging to the State, including land and waters, for the maximum benefit of its people.”).

258. ALASKA CONST. art. VIII, § 3 (“Whenever occurring in their natural state, fish, wildlife, and waters are reserved to the people for common use.”).

259. ALASKA CONST. art. VIII, § 4 (“Fish, forests, wildlife, grasslands, and all other replenishable resources are to be utilized, developed and maintained on the sustained yield principle, subject to preferences among beneficial uses.”).

legislature to provide for the administration of public lands.²⁶⁰ The progeny of these constitutional authorities includes: statutes that regulate mining, such as Title 27 and sections 38.05.185–.275 of the Alaska Statutes; set aside land as refuges under sections 16.20.010–.080 of the Alaska Statutes; and the other statutes discussed herein.

The second prong of the takings analysis is the economic impact of the regulation or legislation. This test is essentially an ad hoc, factual inquiry into the circumstances of a particular case.²⁶¹

Here, the economic losses may include the expenditures by NDM and its partners to maintain their claims so as to pass the marketability test. These losses may range from the annual rental, pursuant to section 38.05.211 of the Alaska Statutes, to the total investments by NDM and its partners in maintaining their claims prior to the passage of the legislation.²⁶² Any compensable economic losses would not include a right to mine, the value of the mined metals, or lost profits because a state mining claim does not bestow on its possessor a right to mine.²⁶³ In any event, “mere diminution in the value of property, however serious, is insufficient to demonstrate a taking.”²⁶⁴

The last prong of a takings analysis requires an examination of whether further regulation, such as the regulations specified in House Bill 134, or the refuge compatibility test inherent in Senate Bill 67, were part of the

260. ALASKA CONST. art. VIII, § 6 (“Lands and interests therein, including submerged and tidal lands, possessed or acquired by the State, and not used or intended exclusively for governmental purposes, constitute the state public domain. The legislature shall provide for the selection of lands granted to the State by the United States, and for the administration of the state public domain.”).

261. *See, e.g.*, Kaiser Aetna v. United States, 444 U.S. 164, 175 (1979).

262. NDM claims to have invested \$180 million since 2002 in exploring the mineral potential of the Pebble project. NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1.

263. *See* Beluga Mining Co. v. Dep’t of Natural Res., 973 P.2d 570, 575 (Alaska 1999) (stating that mining claim provides no right to mine). As a legal matter, the Supreme Court of the United States has emphasized that “[t]he loss of future profits . . . provides a slender reed upon which to rest a takings claim.” *Andrus v. Allard*, 444 U.S. 51, 66 (1979). “Prediction of profitability is essentially a matter of reasoned speculation that courts are not especially competent to perform.” *Id.* “Further, perhaps because of its very uncertainty, the interest in anticipated gains has traditionally been viewed as less compelling than other property-related interests.” *Id.* This is especially true regarding the speculative profits of modern mining concerns that routinely vary their production levels, or even cease operations temporarily, in response to changes in market conditions and technology.

264. *Concrete Pipe & Prods. of Cal., Inc. v. Constr. Laborers Pension Trust for S. Cal.*, 508 U.S. 602, 645 (1993).

investment-backed expectations of the property owner. The investment-backed expectations of a mining enterprise include the possibility of government regulation, and revisions to those regulations, because mining is always contingent on state permission.²⁶⁵ Many takings challenges have failed on the ground that, while the government action caused economic harm, it did not interfere with interests that were sufficiently bound up with the reasonable expectations of the claimant to constitute “property” for Fifth Amendment purposes.²⁶⁶

Where an entity that is already subject to government regulation claims that further regulation constitutes a taking, a court is likely to reject the claim on the grounds that further regulation was part of the company’s investment-backed expectations.²⁶⁷ After all, “[g]overnment hardly could go on if to some extent values incident to property could not be diminished without paying for every such change in the general law.”²⁶⁸

NDM and its partners invested in the Pebble Mine with the expectation that their mining activities would be regulated by, *inter alia*, DNR permitting statutes, the Anadromous Fish Act, the Fishway Act, and the

265. See *Beluga Mining Co.*, 973 P.2d at 575–76. On federal public lands, for example, any right in a mining claim is contingent upon compliance with applicable environmental and other regulatory requirements. 30 U.S.C. § 22 (2006) (stating that staking and patent of mineral claims on federal land must comply with all federal regulations). See, e.g., *Reeves v. United States*, 54 Fed. Cl. 652, 672–73 (2002) (finding no taking where miners holding unpatented mining claims on federal land designated as wilderness study area were forced to comply with non-impairment standard); *Clouser v. Espy*, 42 F.3d 1522, 1529–30 (9th Cir. 1994) (mining operations must comply with Forest Service regulations to protect forest resources).

266. *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 125–26 (1978) (citations omitted).

267. *Concrete Pipe & Prods.*, 508 U.S. at 645 (citation omitted). See also *Usery v. Turner Elkhorn Mining Co.*, 428 U.S. 1, 16 (1976) (stating that legislation readjusting rights and burdens is not unlawful solely because it upsets otherwise settled expectations).

268. *Pennsylvania Coal Co. v. Mahon*, 260 U.S. 393, 413 (1922). Zoning laws are the classic example. See *Gorieb v. Fox*, 274 U.S. 603, 608 (1927) (providing requirement that portions of parcels be left un-built); *Euclid v. Ambler Realty Co.*, 272 U.S. 365 (1926) (providing a prohibition of industrial use); *Welch v. Swasey*, 214 U.S. 91 (1909) (providing height restrictions). The Court has viewed these and other regulations as permissible governmental action even when they prohibited the most beneficial use of the property. See *Penn Cent.*, 438 U.S. at 125. Takings challenges have also been held to be without merit in a wide variety of situations where the challenged governmental actions “prohibited a beneficial use to which individual parcels had previously been devoted and thus caused substantial individualized harm.” *Id.* at 125–26 (citing *Miller v. Schoene*, 276 U.S. 272 (1928)).

federal Clean Water Act.²⁶⁹ The Kvichak and Nushagak drainages are historically important to commercial, subsistence, and recreational fishing. Hence, a developer of a massive, sulfide mineral deposit in these drainages should reasonably expect the possibility that the legislature would implement stricter statutory standards to protect these fisheries. A mine developer also would expect procedural reforms, such as adoption of a “precautionary approach” in legislation, or other suggestions discussed herein, that would refine the mine permitting process to further protect the Bristol Bay drainages and the valuable fisheries they support.²⁷⁰

In a mining venture, a reasonable investment-backed expectation would be that permission to mine might not be granted.²⁷¹ Where government approval is required but not assured for a project, any investment in that project is akin to a business gamble.²⁷² “A mere unilateral expectation or an abstract need” is not a property interest entitled to protection.²⁷³

By the time Anglo American entered into its partnership with Northern Dynasty, legislators had already introduced Senate Bill 67 and House Bill 134.²⁷⁴ That the state might establish a refuge, or further protect water, must have been within the investment-backed expectations of the Pebble Partnership. Those who do business in a regulated field cannot object if the legislative scheme is buttressed by subsequent legislation or regulation.²⁷⁵

269. See Clean Water Act, § 402(b), 33 U.S.C. § 1342(b) (2000) (providing for the National Pollutant Discharge Elimination System); see also Clean Water Act § 404, 33 U.S.C. 1344 (2000) (providing for wetland dredge and fill program).

270. See *United States v. Locke*, 471 U.S. 84, 107–08 (1985) (stating that newly enacted requirements mandating that the claimants timely register prior mining claims and forfeit their claims upon failure to comply do not “take” the claims of those who fail to comply).

271. *Beluga Mining Co. v. Dep’t of Natural Res.*, 973 P.2d 570, 575–76 (Alaska 1999).

272. *Anchorage v. Sandberg*, 861 P.2d 554, 560 (Alaska 1993) (finding that developer who purchased land and planned housing development did not have reasonable expectations that the city government would fund access road, water, and sewer).

273. *Webb’s Fabulous Pharmacies, Inc. v. Beckwith*, 449 U.S. 155, 161 (1980) (citing, e.g., *Penn Cent.*, 438 U.S. at 122); *Dep’t of Natural Res. v. Arctic Slope Regional Corp.*, 834 P.2d 134, 140 (Alaska 1991) (quoting *Ruckelshaus v. Monsanto Co.*, 467 U.S. 986, 1005 (1984)).

274. See *Advance Pebble Project to Production*, *supra* note 2; S.B. 67, 2007 Leg., 25th Sess. (Alaska 2007); H.B. 134, 2007 Leg., 25th Sess. (Alaska 2007). Mitsubishi also bought into NDM after Senate Bill 67 and House Bill 134 were introduced. See *supra* note 1.

275. *Concrete Pipe & Prods. of Cal., Inc. v. Const. Laborers Pension Trust for S. Calif.*, 508 U.S. 602, 645 (1993).

NDM and its partners claim they have invested large sums in the Pebble mine.²⁷⁶ If these investors invested in the Pebble Mine with the expectation that the state would approve their plans to develop the mine, their economic losses would have been based on a “mere unilateral expectation” and would not be property interests entitled to constitutional protection.²⁷⁷ In other words, these investments would have been a business gamble.²⁷⁸

Because the reasonable, investment-backed expectations of NDM and its partners were that the Pebble Mine might be subject to further regulation, NDM and its partners have no constitutionally protected interest for which they must be compensated should House Bill 134 or Senate Bill 67 be enacted into law.

VII. CONCLUSION

Heightened regulation is necessary to protect the Bristol Bay drainages and the valuable commercial, subsistence, and recreational fisheries from the risks posed by the Pebble Mine. House Bill 134 and Senate Bill 67 attempt to provide that protection, but such legislation must survive takings challenges by the mine proponents. Nonetheless, government regulation was part of the investment-backed expectations of Northern Dynasty Minerals and its partners. From the start, they had no right to mine these claims, which are on state land, because that “right” was always contingent on the state granting them permission to mine. Thus, if the Alaska Legislature enacts legislation to impose new regulatory constraints on metallic sulfide mining in the Bristol Bay drainages, its actions would not constitute a taking of property for which the state would be required to compensate the owners of the Pebble Mine claims.

276. NDM claims to have invested \$180 million since 2002 in exploring the mineral potential of the Pebble project. NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1.

277. See *Webb's Fabulous Pharmacies, Inc.*, 449 U.S. at 161; see also NDM, IMPORTANT NEW MINERAL DEPOSIT, *supra* note 1.

278. See *Anchorage v. Sandberg*, 861 P.2d 554, 560 (Alaska 1993).