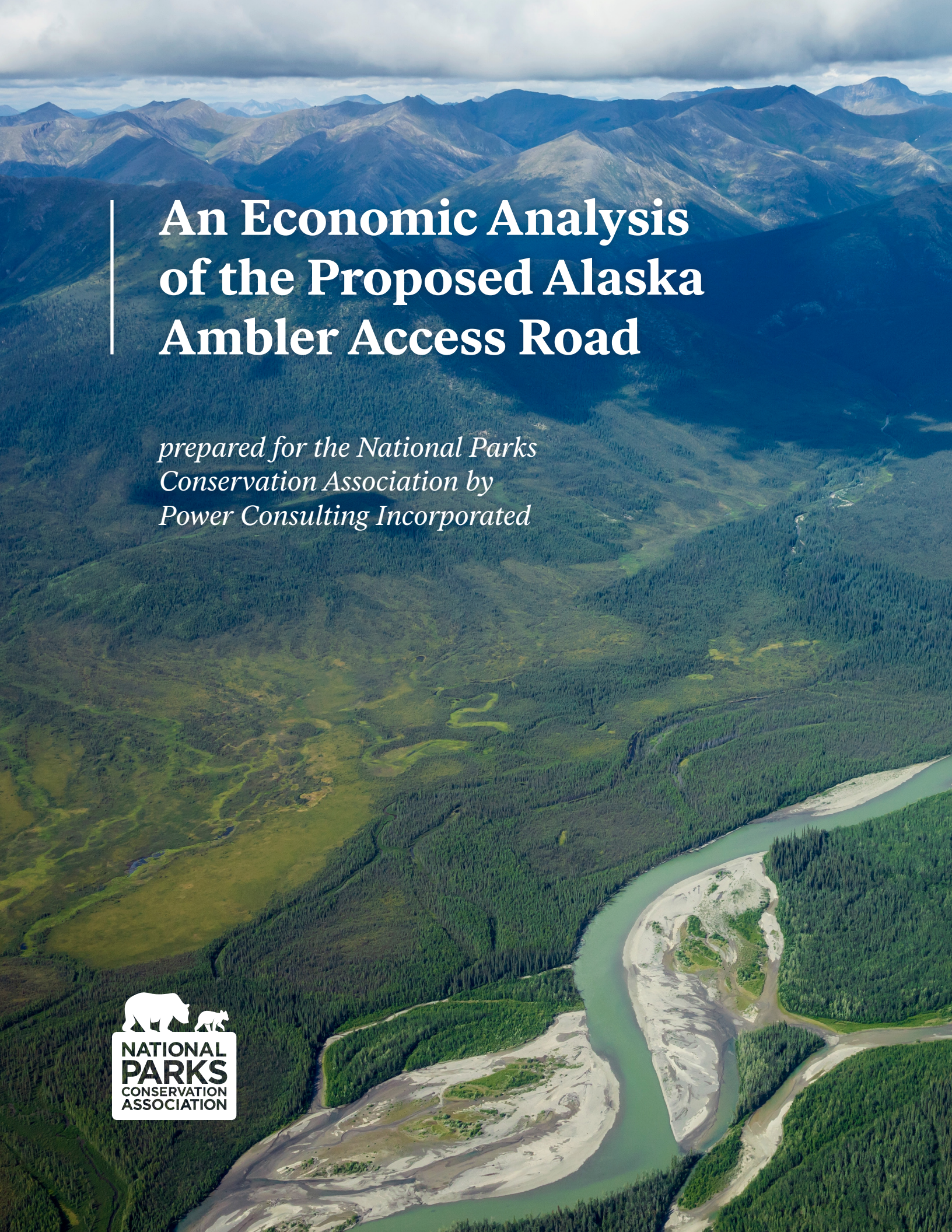

An Economic Analysis of the Proposed Alaska Ambler Access Road

prepared for the National Parks Conservation Association by Power Consulting Incorporated

NATIONAL PARKS CONSERVATION ASSOCIATION

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CHAPTER I

Introduction to the Economics of the Ambler Access Road Project

1. The Proposed Ambler Access Road Project

The Alaska Industrial Development and Export Authority (AIDEA)[1], has proposed to construct, operate, maintain, and, ultimately, remove and remediate a 211-mile, all-season, industrial access road from the Dalton Highway to the Ambler Mining District in the Brooks Range of northwest Alaska. The Ambler Mining District has been the subject of mineral exploration, evaluation, and some metal mining, for over a century. The primary identified mineral resources include copper, lead, zinc, silver, gold, cobalt, and molybdenum. There are over 1,300 active mining claims in the Ambler Mining District. A 2015 economic analysis identified four major mineral deposits likely to be developed if the Ambler Access Road were built at a low enough cost to the potential mining companies. The Arctic and Bornite deposits of Ambler Metals[2] are the most actively pursued mineral deposits in the Ambler District.[3]

Currently the Ambler Mining District is isolated. There are no roads or waterways that connect it to ports serving ocean-going commercial shipping or with Alaska's two metropolitan areas and transportation hubs in southcentral and the interior, Anchorage and Fairbanks. This makes exploration difficult because it is difficult to get large machinery to mineral deposits of interest. More important, there is no way to get bulk metal ore concentrates from mines and mills to ocean-going ships or to get mining machinery from Alaskan ports to the mining district. The Ambler Access Road is intended to reduce that isolation in hopes that the resulting lower transportation costs will help bring the high-value mineral resource areas in the Ambler Mining District into production.

2. The Costs of the Ambler Access Road and the Collection of Those Costs with Usage Tolls

As will be discussed in the next section of this report, (Section II.1), the total expenditures that will be required to build, maintain, and then decommission this proposed industrial road total about $1.4 billion. This includes construction and decommissioning costs of $579 million, ongoing maintenance costs ($9.2 million per year), and interest costs on bonds sold to finance construction ($551 million). Just the size of the Ambler Access Road costs is a concern to many, given the fragility of the Alaskan economy and

[1]AIDEA is a semi-independent, for profit, corporation charged by the Alaska Legislature with encouraging economic development and diversification across Alaska by providing various means of financing and assistance to Alaska businesses. Although AIDEA is an Alaska state agency, it has its own borrowing and lending authority that, typically, is backed only by its own assets. AIDEA also pays an annual dividend to the State of Alaska. "Alaska's Development Finance Authority," John Springsteen, Executive Director. 121418AIDEAOverview.pdf.

[2]Ambler Metals was previously called Trilogy Metals. Ambler Metals is now half-owned by Trilogy and half-owned by South 32.

[3]Ambler Access Road FEIS. 2020. Chapter 1, Introduction, pp. 1-1 and 1-2. The following seven paragraphs are a paraphrasing of the Ambler Access Road FEIS, Chapters 1 through 3.

state government fiscal balance as they struggle to recover from the collapse of its oil industry and the pandemic.

Advocates of the Ambler Access Road are not concerned about taxpayers and the State of Alaska being burdened by the Road's costs because AIDEA has firmly stated that it intends to sign lease agreements with the mining companies that will commit the mining companies to paying tolls that, collectively, will more than cover the full costs of building and operating the Road. Conceptually, those lease agreements will provide a revenue flow from the mining companies to AIDEA which will build and operate the Road. It is those road user fees from mining companies that are intended to cover all AIDEA's Ambler Access Road costs.

That flow of user fees or tolls from mining companies to AIDEA, however, is not riskless. If metal markets soften and the prices the miners can get for their metal ore concentrates plunge, the Ambler District mines may never get developed. Whether or not they get developed, the mining companies may not be able to make their contractual lease payments to AIDEA, which, in turn, may have to default on the bonds it sold to finance the building of the Ambler Access Road.

The overall cost of the proposed Ambler Access Road is also a concern because it would determine the size of the user fee or toll that AIDEA would impose on mining companies who use the road. Estimating the necessary toll to recover all the costs associated with the Ambler Access Road is discussed below in Section II.2. The higher the cost of the Road, other things remaining the same, the higher will be the user fee or toll levied on the mining companies. That, in turn, by raising the total cost of the metal ore concentrates delivered to international shipping could render the mines noncompetitive and infeasible, undermining the economics of the proposed Ambler Access Road itself. Accurately detailing the cost of the Road and the toll that would be levied on mining companies for using the road are important to the evaluation of the economics of the Ambler Access Road.

The cost of the Road is high, partially because of the difficult terrain it would have to traverse with many river and stream crossings along the southern flanks of the Brooks Range and across 26 miles of the Gates of the Arctic National Park and Preserve. The 211-mile length of the proposed road also adds to the cost, requiring thousands of culverts to channel flowing water under the road. The Red Dog Mine access road that AIDEA also financed and built several decades ago was, in contrast, only 52 miles long, one-fourth of the length of the proposed Ambler Access Road.

The proposed Road, among other things, would fragment wildlife habitat, potentially disturbing the Western Arctic caribou herd. There would be impacts on subsistence activities of residents of 27 communities whose subsistence use areas would be adjacent to the Ambler Access Road.[4] There are other concerns over the potential environmental damage done by the construction and operation of this lengthy industrial road. The FEIS estimates that there would be peak traffic of about 170 one-way heavy (double trailer) truck trips *per day* or approximately 60,000 trips per year hauling ore and traveling across an area where there is currently no traffic."[5] In addition, this Road is designed to bring several new metal mines into operation, which themselves raise a broad range of other environmental concerns, including metal leaching and acid rock drainage and the risks of water pollution and catastrophic dam failure associated with storage of the tailings from the metal ore concentrates.

In addition, most of the projected new mines would be open pit mines that move much larger volumes of material from the mine site to the surface than do underground mines that tend to follow higher quality ore and can backfill mined areas with waste rock from other areas of the mine. Open pit mines remove all of the materials to the surface where both waste rock and the tailings from the concentration mills are stored. As a result,

[4]Ambler Access Road FEIS. p. ES-5. 2020.

[5]Ambler Access Road FEIS. Chapter 3, p. 3-42. 2020.

open pit mining tends to have higher negative visual and aesthetic impacts. In addition, open pit mines expose more waste rock to water and oxygen, increasing the risk of acid rock drainage and other chemical reactions that can mobilize the remnant metals in the waste materials. The pit is also likely to fill with water that is very toxic that may spill over into local ground water.[6]

3. One Dominant Company Using the Ambler Access Road

Discussions of the proposed Ambler Access Road often mention four separate ore deposits in the Ambler Mining District around which mines could be developed during the first thirty years of the Road's life. In addition, "other mines," not described or located, are projected to be developed in the last 20 years of the Road's life. Given the multiple different mines that are depicted as making use of the Ambler Access Road during different periods of time stretching over a fifty-year Road life,[7] it is difficult to conceptualize how tolls would be calculated and collected from each of the potential Road users that AIDEA indicates would be expected to sign 50-year leases committing the mines to pay specific tolls before AIDEA would undertake building the Road.

That focus on the potential multiple users of the Road over a 50-year period is not an accurate description of who would use the proposed Road and how much they would use it. For at least the first thirty years of the Ambler Access Road's life, the proposed Ambler Access Road would primarily serve the mining activities of a single mining company, Ambler Metals, that is half-owned by each of Trilogy Metals and South32. Ambler Metals plans to develop both the Arctic and Bornite mineral deposits in the Ambler Mining district.[8] These are also the mine proposals in the Ambler District that are furthest along in development. The Arctic and Bornite mines are projected to be the source of 88 percent of the metal ore concentrates that would be produced in the Ambler Mining District and hauled on the Ambler Access Road during the first thirty years of Road use.[9] That is, the proposed Ambler Access Road is primarily a haul road being built for Ambler Metals. The only other mining activity projected in the Ambler Mining district in the first 30 years would be in two small mines, Sun and Smucker, that, together, are projected to be the source of only 12 percent of the projected metal ore concentrates that would be transported on the proposed Ambler Access Road.

If tolls are based on the weight of the metal ore concentrates transported on the Ambler Access Road, Ambler Metals would be responsible for the vast majority of the costs of the construction, operation, and closing of the Ambler Access Road and removing and remediating its right-of-way. Assumedly, AIDEA would also require any other Ambler District miners that developed a mine to pay a toll in return for the right to use the Road. There is no indication, however, on how that toll might be calculated.

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[6]"Metal Mining and the Environment," American Geosciences Institute, Travis L. Hudson, et al. 1999. https://www.americangeosciences.org/sites/default/files/metalenvfull.pdf

[7]The 2020 Ambler Access Road FEIS analyzed an Ambler Access Road that had a fifty-year life. In most previous analyses, the Ambler Access Road's life was assumed to be 30 years because that was the longest term that financial markets allowed for municipal revenue bonds of the sort that AIDEA would sell to finance the construction of the Road. In the FEIS, AIDEA was assumed to still sell 30-year bonds, pay those off over thirty years and then continue to maintain and operate the Ambler Access Road, collecting tolls from mining companies that used the Road. Although those mining companies, ore deposits, mining technology, and markets could not be identified at this point in time, AIDEA assumed it would continue to earn substantial net income from the Road since the construction costs would have been paid off and AIDEA would still be collecting tolls.

[8]The Bornite Deposit is located entirely on lands owned by NANA, the Native Alaskan regional corporation. In 2011, Trilogy Metals and NANA Regional Corporation, Inc. entered into an agreement for the cooperative development of their respective resource interests in the Ambler mining district. It allows Trilogy Metals to develop a mine on the Bornite Deposit in return for a sharing of the benefits associated with that mine with NANA. Trilogy Metals Inc, Technical Report on the Bornite Project, Northwest Alaska, July 20, 2018, pp. 4-4 and 4-5.

[9]Ambler Access Road FEIS. Table 2-5, Appendix H, p. H-20. 2020.

The proposed Ambler Access Road is essentially a private road intended to assist the plans of a single mining company, Ambler Metals. AIDEA recognizes the dominance of Ambler Metals in the Ambler mining district. In February 2021, AIDEA announced it had signed a long-term agreement with Ambler Metals to share up to $70 million of the predevelopment costs for the proposed Ambler Mining District Access Road. The money would be spent on feasibility and permitting activities of the Ambler Access Road project through the end of December 2024.[10]

AIDEA Executive Director Alan Weitzner explicitly recognized the dominant position of Ambler Metals in the promotion of the Access Road: "They're the initial party, the initial user, we believe, with the Arctic Mine development, and they're contributing to the final feasibility permitting activities that gets us to the construction of that road as our partner..." Weitzner was also quoted as saying that "Ambler Metals will likely be the first commercial user of the road, considering its financial contributions and existing deposits in the Ambler Mining District. However, the road will be open to other commercial interests who want to access the mining district. They will have to pay full fees to use the road."[11]

This dominant position of Ambler Metals as the primary user of the proposed Ambler Access Road is important to keep in mind when discussing AIDEA's negotiations with Ambler Metals over the level of tolls that mining companies using the Road would have to pay. AIDEA will be primarily negotiating with Ambler Metals. As AIDEA emphasizes, the Ambler Access Road is a "public-private partnership" (PPP) with Ambler Metals, the primary "private" party, and AIDEA, apparently, the primary "public" party.[12]

4. The Purpose of the Ambler Access Road: To Reduce Mining Companies' Costs

The economic justification for an Alaska state agency to finance, build, and maintain an access road primarily for a single private mining company is that the mineral deposits in the Ambler Mining District are isolated with no surface access by land or water to international shipping. Typically, such isolation is provided as an explanation for why those mineral deposits have not been commercially developed thus far. That phrasing of the "problem" suggests an obvious solution: build an all-season road to the Ambler mineral deposits that would allow mineral exploration and development equipment to be transported in and the metal ore concentrates transported out to tidewater ports in the Anchorage area. The implicit assumption is that it is only the geographic isolation of these mineral deposits that has blocked their commercial development thus far. If such a road were built, it is implicitly suggested, multiple metal mines would be developed in the Ambler Mining District. No analysis has been provided to support that wishful claim.

Transportation costs are clearly an important economic consideration faced by most businesses. They affect the cost of the product delivered to markets as well as the delivered input costs to the production process. Alaska's huge size, challenging topography, and limited road and rail infrastructure make transportation costs even more limiting in the location of economic activity. Just as challenging mountainous terrain or low-grade ore can undermine the economic feasibility of developing a known mineral deposit, high transportation costs can do the same. This does not usually indicate that government intervention through mining subsidies or risk sharing to either reduce the economic cost or increase the revenues associated with mining is appropriate. Some

[10]North of 60 Mining News, February 12, 2021, R. Walker. https://www.ktoo.org/2021/03/12/ambler-metals-will-get-back-some-of-its-35m-investment-on-access-road-if-project-gets-built/ Alaska's Energy Desk, KTOO, March 12, 2021, Wesley Early.

[11]Ibid.

[12]AIDEA response to Representative Josephson, April 2, 2021, p. 2.

mineral deposits, probably most, simply are not economically feasible and from an economic point of view should be left in the ground. As the Ambler Access Road FEIS put it: "While an ore body may be present, if it does not appear to be of sufficient quantity and quality, it does not make sense to develop the mine."[13]

Ultimately, AIDEA suggests it can offer Ambler Metals a way of reducing the financial cost of building the Ambler Access Road below what it would cost for Ambler Metals to build it itself. If the Road is financed by AIDEA selling the equivalent of "municipal revenue bonds," as opposed to the mining companies raising the capital to build the road by selling their own corporate bonds or attracting more equity investors, the interest cost paid could be lower. When Trilogy Metals CEO Rick Van Nieuwenhuyse was asked why Trilogy, itself, was not financing the Ambler Access Road, he responded:

> "I think this [Red Dog] is a unique model and a unique opportunity with Red Dog as a model to demonstrate that this public-private partnership approach makes a lot of sense. In the end, it's about cost of capital. AIDEA has the ability to have a significantly lower cost of capital than we do."[14]

As will be discussed below, metal mining companies are perceived by investors as relatively risky because of the volatility of international metal markets, the environmental risks associated with metal mining, and its vulnerability to state and federal regulation. AIDEA, on the other hand, primarily supports loans to Alaska businesses with the aim of supporting state economic diversification and economic development. It sells "municipal bonds," with AIDEA as the "municipality," that are backed by the loan repayments from the business loans that have been made by Alaska financial institutions. Those AIDEA revenue bonds have a relatively high security rating and a matching low interest rate. Whether that low-risk-low-cost characterization of AIDEA bonds will carry over to the financing of an expensive mining haul road, the revenue for which comes from tolls that will be charged to individual mining companies who use the road, is questionable.

The "municipal revenue bonds" that AIDEA would offer for sale to cover the costs of building the Ambler Access Road are presented as a relatively low-cost source of capital That, however, assumes that investors would ignore the fact that the bonds they are buying are financing a mining access road and that all the risk associated with the mining companies paying their share of the costs of the access road would be on those who purchase the AIDEA bonds, not on AIDEA or the state of Alaska. Investors did not ignore that risk with the Red Dog road and port. In floating the bonds for the Red Dog road and port, AIDEA had to ensure the bond payments by purchasing bond insurance and providing an irrevocable letter of credit. The state of Alaska also provided collateral in the form of state assets that AIDEA could use to assure that it would be able to pay off the bonds.[15] As will be discussed below (section IV.3.), AIDEA, along with Teck Resources, the Red Dog mining company, also faced considerable risk during its initial years of operation, going without earning a profit for much of the first decade of its operations.[16] There is little evidence to suggest that investors in Ambler Road bonds sold by AIDEA would be blind to the risks of the investment and that AIDEA's participation can significantly reduce the costs of capital associated with the proposed road without the backing of state funds.

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[13]Ambler Access Road FEIS. Appendix H, page H-7. 2020.

[14]AIDEA response to Representative Josephson, April 2, 2021, p. 2.

[15]"Delong Mountain Transportation System: Asset Management Review, prepared for AIDEA by Arcadis, December 2017, pp. 17, 18, and 42.

[16]Delong Mountain Transportation System: Asset Management Review, Final Report. December 2017. Page 7. Prepared for AIDEA by ARCADIS.

5. No Impact on Economic Development and Diversity in Rural Alaska

Given the economic isolation of the Ambler Mining District, it should not be surprising that the areas along the proposed Ambler Access Road are highly rural with villages that are quite small. The FEIS estimated that there were nine communities within 50 miles of the proposed Road's right-of-way.[17] Five of those villages had fewer than 20 residents. Four of the villages had populations over one hundred. The largest had 260 residents. The average population of those nine villages within 50 miles of the proposed Ambler Access Road right-of-way was 101.[18] The proposed Ambler Access Road would also intersect the subsistence use areas of fifty three other communities.[19]

Communities this small will not have the commercial infrastructure to provide residents and mining operations with the supplies they need. Basic consumer goods for the mines will have to be purchased from outside the Ambler Mining District and flown into the Ambler Mining District area from the Fairbanks or Anchorage areas or delivered by barge up the Kobuk River or hauled on the Ambler Access Road that would not directly serve those villages. The same is obviously true about the machinery and supplies that the mining companies will need to mine and concentrate the metal ores. This means that the expenditures of the mines and mine workers will not have much of a positive economic impact on the small villages located in the vicinity of the Ambler Access Road. In fact, there will only be limited public use of the Ambler Access Road, and AIDEA does not intend to provide connections from the Ambler Access Road to any of the local villages. The local villages will remain isolated unless very costly access roads are built from the Ambler Access Road to the villages, several of which are 30 to 100 miles distant. This is discussed further in Chapters IV and V of this report.

[17]Ambler Access Road FEIS, Appendix F, Table 1. Alternative A. Table 1 shows 14 communities within 50 miles of one of the alternative locations of the proposed Ambler Access Road. If we focus on the alternative road location the FEIS and ROD chose, Alternative A, there are nine communities within 50 miles of the Alternative A right-of-way.

[18]Alaska Population Estimates by Alaska Native Village Statistical Areas and Census Designated Places. Estimate for July 2020.020

[19]Ambler Access Road FEIS. Appendix F, Chapter 3, Table 15, pp. F-21 and F-22. Also, Table 20, Communities most likely to experience subsistence impacts. 2020.

CHAPTER II

Covering the Costs of the Ambler Access Road: Not Enough Mines, Not Enough Toll Revenues

1. Introduction

Although the Ambler Access Road is explicitly intended to promote mining activity in the Ambler Mining District,[20] AIDEA has emphatically stated that no public money, state or federal, would be used to pay for the construction of the road.[21] The mining and other industrial companies who are expected to use that access road would, collectively, be expected to cover all the road's costs through lease agreements that would require regular payments to AIDEA by mines that use the road. Those user payments are expected to fully cover the costs associated with the construction, maintenance, and the ultimate closure and remediation of the Ambler Access Road.

One way to judge the rationality and viability of the proposed Ambler Access Road is to study the costs associated with the building, operation, closing and removing of the road at the end of its useful life, as well as remediating the environmental damage associated with the road. Since the proposed funding of the construction of the Ambler Access Road and its related auxiliary infrastructure is based on AIDEA selling 30-year revenue bonds in the municipal bond market, there will be significant annual financing costs, including interest, that will also have to be recovered by the tolls paid by road users. Finally, there will be ongoing road maintenance costs. These Ambler Access Road-related costs can be used to estimate the road tolls that would have to be paid by the mines that use the road and what level of metal ore concentrate production would have to be realized over the life of the proposed Ambler Access Road to pay for that road. If the projected toll that prospective Ambler District mines would have to pay to cover access road costs significantly raises the mines' production costs, those mines are less likely to be economically rational to develop. Therefore, it is important to look at the proposed tolls for those mines and put them in an economic context to see how those tolls might impact the feasibility of both the mines and the Ambler Access Road.

[20]"...the "Project Purpose [is] to unlock the resource-rich [Ambler] region's area." AIDEA Infrastructure Development Senior Finance Officer Jeff San Juan testimony before the Alaska State Legislature Senate Resources Standing Committee, February 13, 2019, p.6. ", the AMDIAP road is to unlock resources for a whole district, not just for a specific mine as was done with the Red Dog Mine.", p. 14. "AIDEA will not build the road without agreements from the mining companies." P. 13." AIDEA believes that there's a good chance to enter into agreements [with the mining companies] after the EIS. Mr. Davis emphasized that AIDEA is, "Not going to build the road and hope that somebody shows up." "AIDEA's model is not to use state funds or any federal funds." P. 15. Mark Davis, Chief Infrastructure Development Officer, AIDEA.

[21]"The bonds would be repaid by assessing annual fees on the users of the road through a lease agreement. AIDEA has stated at Draft EIS public meetings and indicates on its website that the project would not move ahead with road construction until legal agreements were in hand with the mining companies that would use the road. Ambler Access Road FEIS. Page 2-9. 2020.

The expected weight of metal mine concentrates will be important in determining the size of the toll per tonne of metal ore concentrate produced and shipped. The larger the weight of ore concentrate shipped, the lower the per-tonne-shipped toll will be.[22]

The estimated per unit toll that will have to be collected from all mines using the Ambler Access Road is an important determinant of the economic feasibility of both the access road and the potential metal mines in the Ambler District. The Pre-Feasibility (February 2018) and Feasibility (August 2020) Studies for Trilogy's[23] proposed Arctic Mine in the Ambler District both estimated what the per tonne toll was likely to be. Unfortunately, serious inconsistencies in these calculations of the tolls that Ambler Access Road users would have to pay compared to the total cost of the road make many of the economic calculations provided on the Ambler Access Road unreliable. We will discuss those calculations below.

2. Measuring the Costs Associated with the Ambler Access Road

There are several different components of the cost of the Ambler Access Road. In an attempt to clarify the different presentations of the costs of the Road, we will present each of these different costs and explain why it is important to clarify the different presentations of the costs of the Road in the FEIS,[24] the Feasibility Study,[25] and the Ambler Mining Region Economic Impact Analysis[26] which present partial, conflicting, or misleading costs for the proposed road. For reference, we present the cost information for the road from the FEIS in Table 1 on page 12.

a. The "Construction Cost" is one of the most common statements of the cost of the Ambler Access Road. It is an incomplete measure of road cost for several reasons.

i. It primarily refers to the capital amount that will be borrowed to build the road while not including the borrowing cost, i.e., the interest. Compare lines 7 and 15 in Table 1. Interest costs may be as high as or more than the construction cost.

ii. The construction cost often is narrowly defined to be construction only of the Road itself. Auxiliary infrastructure costs needed to safely operate and maintain the road (e.g., maintenance stations, communication centers, and airstrips) may be ignored. See Table 1 on page 12 which lays out the different measure of "construction costs" (lines 1, 5, 6 and 7).

iii. The regular maintenance costs to protect the usefulness and safety of the Road and related infrastructure must be included. See lines 8 to 11 in Table 1 on page 12.

[22]The toll is supposed to be designed so that the revenues from it cover all the costs associated with building and operating the Ambler Access Road. Most of the costs of the road are fixed costs that do not vary with the weight of metal ore concentrates transported on the Road. Only the part of the maintenance cost that is tied to the wear and tear on the road varies with the weight transported. The higher the weight of transported ore concentrates over which the fixed costs of the Road can be spread, the smaller will be the fixed costs per tonne transported.

[23]Trilogy Metals has changed its name to Ambler Metals. Trilogy owns half of Ambler Metals and 30 South owns the other half. Ambler Metals controls development of both Arctic Mine and Bornite Mine.

[24]Ambler Access Road FEIS. Appendix H. 2020. Table 3-6 presents the "Principal" needed for the road as $412 million. This is inconsistent with the table on page C-4 of Volume I Appendix C of the Ambler FEIS which has the road costs alone at $447 million and the total cost of "Construction plus reclamation" at $579.3 million.

[25]Arctic Feasibility Study. Page 21-12 has the cost of the road at $449 million.

[26]Cardno. Ambler Mining Region Economic Impact Analysis. Project Number E514004900. February 2015. Economic Analysis. Table 6-1 has the total cost of Ambler Access Road construction at $304.9 to $346.5 million. Page 6-5.

Table 1: The Construction and Maintenance Costs Associated with the Ambler Access Road

Cost of Construction (2 Lane Road) by Component	$ millions
1. Road	447.0
2. Landing strips	2.5
3. Maintenance stations	26.4
4. Communications	43.4
5. Construction (total)	519.3
6. Closure and reclamation	60.0
7. Construction plus reclamation (total)	579.3
Cost of Annual Road Maintenance	**$ millions/year**
8. Road	6.6
9. Maintenance stations and landing strips	2.0
10. Communications	0.6
11. Annual maintenance (total)	9.2
12. Levelized annual payment on debt (30 yr. life, 5% interest). Line 7.	37.7
13. Levelized annual payment on debt finance and maintenance: add line 11	46.9
14. Total payments on road over 30-year life	1,406.1
15. Total interest cost over life of road	551.2

Source: Ambler Road FEIS, Bureau of Land Management, March 2020. Volume 1, Appendix C, Table P. C-4. Alternative A. The costs were developed for AIDEA by its engineering consulting firm, DOWL, and submitted to BLM for the FEIS.

b. The total cost of the Ambler Access Road

The capital construction cost or amount borrowed to build the road can be converted into the necessary levelized annual payments to cover the construction bonds, including interest, by asking how much it would cost over the life of the Road to pay off the construction costs if the interest rate and term of the loan were known. The Ambler Access Road FEIS estimates that the interest rate for the bonds will be 5 percent, and the term of the loan will be 30 years.[27] We can then use that information to calculate a necessary annual levelized payment. Think of this as the yearly amount that must be paid to cover the mortgage on a house, but in this case, it is the cost of a road. The annual cost of the road can be seen in Table 1, line 13 ($46.9 million). The difference between the amount borrowed and the sum of the levelized annual costs over the life of the Road indicates the interest costs associated with financing that

[27]Ambler Access Road FEIS. Appendix H, at H-75.

construction, which can be seen in line 15 ($551.2 million). In Table 1 above, the sum of the annual levelized costs totals $1.4 billion while the total construction cost was $579 million. Compare lines 7, 14, and 15 in the table above. The difference between the $1.4 billion total payment necessary to cover all the costs of the Road and the $579 million construction cost is the interest and maintenance costs. In other words, the road will cost $579.3 million to build and decommission; there is an annual maintenance cost for the road of $9.2 million that must be paid for 30 years; and the interest associated with the bond is $551.2 million, for a total cost of $1.4 billion.

3. Trilogy's Estimate of the Construction Cost of the Ambler Access Road Is Significantly, about 30%, below the Construction Cost Provided in the Ambler Access Road FEIS

The FEIS table reproduced above also lays out all of the other "construction costs" related to the Ambler Access Road. Without landing strips, maintenance stations, and communications infrastructure, the Road cannot be safely operated and maintained year around, so those costs clearly need to be included. In addition to constructing those necessary associated facilities, there is also a regular annual cost to maintain the Road and those associated facilities. Finally, at the end of the Road's life, the Road must be closed, the physical components removed, and the right-of-way reclaimed. That cost, too, must be considered in setting tolls for Road usage that would assure all the costs associated with the Ambler Access Road are recovered from the mining and other companies that use the Road. As shown in Table 1 above, the total construction cost when those related Road construction costs are included is $579.3 million, 30 percent higher than the construction cost of just the road presented in the FEIS and 29 percent higher than the $449 million that is presented in the Arctic Feasibility Study.[28] Compare lines 7 and 1 in the table above. In addition, there is a $9.2 million per year road and related maintenance cost that also must be covered by the usage toll as well as the interest charges associated with borrowing the money to make that construction possible.

Those total costs of the Ambler Access Road can be the basis for the estimated annual toll the Road users collectively must pay to cover the total Ambler Access Road costs including interest costs associated with funding the construction by borrowing the money. For instance, the levelized annual payments Road users together must make if, as the FEIS assumed, the Road's construction cost is $412 million[29] is $26.6 million per year for 30 years.[30] If, instead, the total Ambler Access Road construction cost is $579.3 million as shown in the FEIS as well as in Table 1 above, the levelized annual payment would be $37.7 million per year for 30 years, 42 percent higher.[31] The total levelized annual payment Road users would have to collectively pay, including the annual maintenance cost of $9.2 million per year, would be $46.9 million per year for 30 years. Over 30 years the total payments to cover these Road costs, including interest would be $1.4 billion.

Those annual levelized payments can be converted to a toll per tonne transported on the Ambler Access Road by using the projected life-of-mine metal ore concentrate production at the Ambler District mines that are projected to be developed

[28]Trilogy. Arctic Feasibility Study. Page 21-12. 2020.

[29]Why the FEIS presents the "principal" for the "Ambler Access Road Bond" as $412 million in table 3-6 on page H-75, in place of the actual costs that are presented in the FEIS in table C-4, is unclear. What is clear, is that the significantly diminished costs of the principal also significantly diminish the annual payment that is necessary to pay off the bonds. The result is that the "example" that is presented dramatically understates the annual payment.

[30]Ambler Access Road FEIS. Table 3-6, page H-75. 2020.

[31]Using the Excel payment (PMT) function assuming a 5 percent interest rate and a 30-year life of the Road. Annual road maintenance costs are not included in these *levelized* annual payments. They are separately accounted for as an annual cost.

because of the availability of the Road. We will present that value below. The important point is that the Arctic Mine Feasibility Study ($449 million) and the Minimum Annual Assessment analysis in the FEIS ($412 million) both seriously understate the cost associated with constructing, financing, operating, and closing the Ambler Access Road. This can lead to an underestimate of the user toll necessary to recover the costs associated with the Ambler Access Road.

These divergent Ambler Access Road cost estimates are *not* primarily due to differences in the estimate of the construction costs of *only* the Ambler Access Road itself. The FEIS table, above, estimated the road construction cost to be $447 million and the Arctic Feasibility Study estimates that to be $449 million.[32] In other words, the construction costs presented in the FEIS and the Feasibility Study are within one half of one percent of one another. However, in the FEIS table reproduced above, the total cost of construction including the other road-related costs, is $579.3 but the road-only construction costs are $447 million. The real difference between the two is that in the Feasibility Study, as well as in Table 3-6 of the FEIS, only *Road* construction costs are presented, leaving out the "other costs" that turn out to be far more expensive. Compare line 7 and line 1 in the table above. Including the other road-related costs raises the overall construction cost of the road by about 30 percent. These "construction costs" represent the total amount of money that would have to be borrowed to finance that construction. It does not include the interest costs that will have to be paid nor the Road and related facilities' maintenance costs. We add them as an annual cost to the levelized annual costs. When those are included, the total payments that users of the Road would be responsible for total $1.4 billion as we show in table 1 above. In other words, when all of the costs are included, the road construction costs represent only 32 percent of the total costs of the proposed road. See lines 12 through 15 in table 1 above.

The reason that these costs are important to nail down is that the road tolls that we will present next, from the Arctic Feasibility Study, did not reflect the actual total cost of the Road. By allowing cost estimates to be presented that are too low, road toll estimates are created that are both artificially low and will not cover the cost of the Road.

4. The Inadequacy of the Estimated Road User Toll for the Arctic Mine

A simple way to look at what the road toll would have to be to cover all the Ambler Access Road costs is to take the FEIS total cost of the Road that we have already presented in Table 1 above (line 14: $1,406.1 million) and divide by the total amount of metal ore concentrate that is projected in the FEIS to be moved on the road (17.06 million tonnes) over the life of the four mines.[33] This leads to an estimate of a toll per tonne of metal ore concentrate produced that will cover all of the Ambler Access Road costs for the metal concentrate transported on the Road over the assumed lives of the projected four Ambler District mines. That aggregate road use toll is $82.40 per tonne of metal ore concentrate produced and transported.[34]

That FEIS cost per tonne of metal ore concentrate produced by all four projected mines can then be used as a crude estimate of the toll per tonne of metal ore concentrate transported on the Ambler Access Road that would cover the full costs of that road. That aggregate cost per tonne of metal ore concentrate produced by the four projected mines

[32]Op. cit. 2020 Arctic Feasibility Study, p. 21-12. That $449 million Ambler Access Road construction cost included $35 million in pre-construction expenditures on permitting, planning, etc. assumed to be provided by Ambler Metals. Removing that mining company contribution leads to a $414 million Ambler Access Road construction cost to AIDEA. That road cost is also close to the $412 million cost used in the FEIS Minimum Annual Assessment analysis. Op. cit. Ambler Access Road REIS, Appendix H, p. H-75, Table 3-6.

[33]Ambler Access Road FEIS. Table 2-5 Page H-20. 2020. The FEIS measures mine output in short tons; the Arctic Mine Feasibility Study measured mine output in metric tonnes. In the calculations, adjustments have been made for these different measures of mine output.

[34]This value was calculated using the FEIS life of the proposed Smucker Mine as 5 years. Some analysts have used a Smucker LOM as 6 years.

can be compared to the Road usage tolls estimated in the Arctic Mine Feasibility Study for just the Arctic Mine by itself.

Remember that what we have calculated immediately above is the total cost of the road divided by the total metal ore concentrate tonnes that are projected to come out of the four mines' concentrating mills that are projected in the FEIS to be transported on the Road. The Arctic Mine Feasibility Study, on the other hand, focused on the toll that Ambler Metals expected it would have to pay to cover just the Arctic Mine's share of the total cost of the Road.

For example, according to the information in the FEIS on the Arctic Mine, it will produce 550,000 short tons or about 500,000 metric tons of concentrate per year. That would require a yearly road use charge of about $41 million per year to cover all the costs. Over the 12-year life of the mine about $504 million dollars would be generated if we apply the $82.40 per tonne aggregate toll that we calculated above.

Remember also that we have calculated the annual levelized cost, or the cost that must be paid by the mines each year, so that AIDEA will not lose money on the loan that it has taken out in the form of its bond sales. The annual payment that must be made to the bondholders is $46.9 million (line 13 from Table 1). That is close to the $41 million annual levelized charge that we estimate the Arctic Mine should pay per year for use of the Road based on the information provided in the FEIS. From that point of view, it appears that Ambler Metals would be relatively close to paying the annual levelized road costs for the first 12 years of the Road's life, which is the length of time that the Arctic mine is projected to operate.[35] But the life of the road, the period over which the projected Ambler Mining District metal ore production would take place, and the term of AIDEA's bonds is 30 years, not 12 years.

We now must look to the Arctic Feasibility Study to see how its estimates of the tolls it would pay compares to the toll charge developed in the FEIS for all of the Ambler District mines and the total costs of the Road over its 30-year life.

The 2020 Arctic Mine Feasibility Study (FS) indicated that Ambler Metals expected to pay a toll of $20 million per year for the Arctic Mine's twelve-year life to cover what Ambler Metals, apparently, considered its share of the costs of the Road, including the ultimate removal of the Road. The FS calculated that the toll to generate the $20 million per year Ambler Metals said it would pay to AIDEA was $5.52 per tonne over the life of the mine. In addition, that Feasibility Study indicated that Ambler Metals would pay an additional toll that covered the annual road and associated infrastructure maintenance costs at $2.52 per tonne. The sum of those two per tonne road tolls would be $8.04 per tonne which the Arctic Mine would pay over the 12-year life of the mine.[36]

In the summary, immediately above, of the tolls that the FS projected Ambler Metals would pay for the Arctic Mine's use of the Road over the life of that mine, the unit of weight was stated simply as "tonnes." An important question to answer is "tonnes" of what?" Since we are trying to explore how much of a burden these tolls are likely to be on the mining companies using the proposed Ambler Road, it would be useful to express those tolls in term of the tonnes of metal ore concentrate produced and transported on the Ambler Road by the different projected mines, including the Arctic Mine.

But that is not what the 2020 Arctic Feasibility Study calculated. It described the metric being used primarily as "tonnes milled." It described the $2.52 toll to cover the road maintenance costs as "tonnes milled processed", a somewhat confused

[35]Ambler Access Road FEIS. Table 2-5 Page H-20. 2020.

[36]Trilogy. Arctic Feasibility Study, p. 21–12.

label.[37] The metric that is most directly associated with the different mines' **use** of the Road is the **output** of the mine and mill, namely the metal ore concentrate that the Road was intended to transport the Fairbanks' transportation hub. The "tonnes milled," on the other hand, is a measure of the raw ore that is the *input* that is processed by the concentration mills. The output of the concentration mills is what is loaded on trucks and hauled across the Ambler Road to the Fairbanks transportation hub. Given that the function of the mill is to concentrate the metal bearing raw ore to minimize the amount of waste rock that has to be transported hundreds or thousands of miles, the **input** to the mills can be expected to be much larger than the **output** of the mills.

The 2020 Arctic Feasibility Study indicated that the expected processing (concentrating) plant would have a design **input** capacity of 10,000 tonnes per day.[38] For the Arctic Mine, the raw ore processed by the concentrating mill was projected to be over seven times larger than the weight of the metal ore concentrate produced by the mill. If the costs are expressed as dollars per tonne of raw ore processed, those per unit costs will be somewhat less than one-seventh of the actual cost per unit weight of the metal ore concentrates that are produced and transported to market on the Ambler Access Road. See Table 2 below.

Table 2: Arctic Mine Tolls to Cover the Life of Mine Costs of the Ambler Access Road

Type of Cost	Annual Cost	Cost per tonne of Mill Throughput	Cost per tonne of Metal Ore Concentrate
Construction and Reclamation	$20,000,000	$5.52	$40.08
Road-Related Maintenance	$9,122,400	$2.52	$18.28
Sum of Road Costs	$29,122,400	$8.04	$58.37

Source: 2020 Arctic Feasability Study, Ausenco for Trilogy Metals Inc. Oct. 2, 2020. 21.2.5 Road Toll Cost Estimate, page 21-12

[37]Ibid. p. 14-41 of the FS says that the mill will have "a production rate of approximately 10,000 t/d." p, 17-1 presents the 10,000 t/d as the plant design. P. 17-0 gives the annual output of 3,650,000. The "process plant is designed to process 10,000 t/d." p. 21-8:" The processing plant throughput is designed to operate at approximately 10,000 t/d or 3,650,000 tonnes per annum, but when the ramp up and ramp down of the mill at the beginning and end of the 12-year life of the mine is included, the output of metal ore concentrates would be 3,620,000 tonnes processed per year. Total throughput is estimated to be 43,443,000 tonnes over the 12-year life of the mine.

[38]2000 Arctic Feasibility Study, p. 1–13.

The road tolls that the FS calculates for the Arctic Mine are shown in the third column of the table below: The toll to cover the Arctic Mine's share of the road construction cost is estimated to be $5.52 per tonne of mill throughput; the toll to cover the road maintenance cost was calculated to be $2.52 per tonne of mill throughput; and the total road toll, the sum of those two, was calculated as $8.04 per tonne of mill throughput. However, these FS tolls are not tolls that can be applied to the tonnes of metal ore concentrates being shipped on the Ambler Access Road. The toll per tonne of metal concentrate produced and shipped on the Road that would cover the costs associated with the road are shown in the last column of the table below, adjacent to the FS's toll per tonne of mill throughput.[39]

The estimated tolls per tonne of mill throughput are only a fraction, a little less that one-seventh, of the toll per tonne of metal ore concentrates that are the output of the mill and the mineral loads to be transported on the Ambler Access Road.

The Arctic Mine Feasibility Study estimated a Road toll of $8.04 per tonne.[40] Clearly, that $8.04 per tonne is not enough to cover the four-mine aggregate, ballpark, estimate that we calculated earlier for all four of the expected mines of $82.40 per tonne if all Road costs are to be covered by the tolls. However, in the same Feasibility Study on the proposed Arctic mine, Ambler Metals also indicated that it expected it would be paying $20 million per year in road construction tolls and an additional toll to cover road-related maintenance costs.[41] The $8.04 per tonne toll from the FS includes both the road construction cost toll ($5.52 per tonne) and the road-related maintenance cost ($2.52 per tonne).

We will assume the Arctic Mine will pay $20 million per year to cover its share of the construction costs of the road *and* about $9.1 million per year for road-related maintenance costs.[42] That $29.1 million per year is about 62 percent of the annual levelized cost of $46.9 million per year that AIDEA needs to pay to clear its bond debt incurred to build the Ambler Access Road. That is the real crux of the problem that AIDEA is facing. There is only one mine that has completed a Feasibility Study, and it says that it will pay for 62 percent of the costs of the road for 12 of the 30 years that AIDEA has to pay back the bonds that it sold. If we look at the Arctic road use toll payments over Arctic's 12-year life [($20mm +$9.1mm)* 12 = $349.2 million]), and compare it to the total debt that AIDEA will have to repay over the 30-year term of the bonds [($46.9 mm *30) = $1,407mm], we see that the Arctic mine will pay for about 25 percent of the total cost that AIDEA needs to be paid.

If we assume that all of the projected Ambler District mines that are presented in the FEIS actually come into existence,[43] and that they produce the metal ore concentrates specified in the FEIS, and they pay usage tolls similar to the average across all four mines, then the total payment to AIDEA will be about $691 million, or about 49 percent of the $1.4 billion cost of the road. (See Table 1, line 14.) What becomes clear when we use the payments presented by the only mine that has been developed far enough to have a final Feasibility Study, is that the Ambler Access Road, as presented in the FEIS, cannot pay for

[39]If the relationship between the weight of metal ore concentrates being produced and transported to market on the Ambler Road and the weight of the raw ore throughput of the mill is fixed across mines and time, a toll for a mine's use of the Road could be based on the raw ore through-put of the mill. Such a relationship is empirically unlikely. In addition, it is unclear why one would state the road usage toll in those terms. In any case, the usage tolls estimated in the Arctic Mine Feasibility Study cannot be applied to the weight of ore being transported on the Road in order to indicate the distribution of Ambler Access Road costs among the four mines accurately.

[40]Trilogy. Arctic Feasibility Study. Page 1–20, table 1–8. 2020.

[41]Trilogy. Arctic Feasibility Study. Page 21-12. 2020.

[42]The Arctic Feasibility Study provides the road-related maintenance costs as $2.52 per tonne of raw ore fed into the concentration mill. The mill input capacity is assumed to be 10,000 tonnes per day or 3.65 million tonnes processed per year. Adjusted for ramping milling up and down at the beginning and end of the life of the mine, the annual milling rate would be 3,620,000 tonnes. That implies an annual road-related maintenance cost of $9.122 million.

[43]Ibid.

itself. There is a critical disconnect between the mining companies and what they are presenting to their investors, and AIDEA and the bonds that they are going to sell to their investors. If we accept AIDEA's story about potential Ambler District mines and their output, then the Arctic mine will have to pay more than twice the road toll that it currently says it expects to pay.

Because we have the Arctic Feasibility Study, we can look at how the road toll that the Arctic Mine expects to pay fits into its total mining costs. Table 21-6 of the Arctic Feasibility Study presents the Overall Operating Cost Estimate for the proposed Arctic mine.[44] That table has the road toll and road maintenance at 16 percent of the mine's operating budget. It is unclear if the level of the road toll were to double, and was instead 27 percent of their operating cost, if the mine would still be viable. What is clear is that the cost of the Road would then be on par with their mining costs at 31 percent, and processing/concentrating costs at 31 percent.[45] This type of dramatic change in operating costs would be something that investors in the Arctic mine and the purchasers of the AIDEA bonds would be keen to understand.

Conclusion

AIDEA would like to encourage metal mining in northwest Alaska by building the Ambler Access Road. The problem is that the full costs of the Road have not been carefully considered with respect to the financing of the Road or the repayment of the Road costs by the mining companies that AIDEA hopes will use the Road. The construction of the Ambler Access Road will cost $579.3 million. When the costs of financing and road-related maintenance are included, it will cost AIDEA $1.4 billion over the 30-year life of the road. Stated in terms of a levelized annual payment, Arctic will have to pay $46.9 million each year to cover the cost of the Road. (See Table 1, line 13). This is over 60 percent higher than the sum of the road tolls that Arctic Mine has indicated it expects to pay: $20 million per year plus $9.2 million annually for road-related maintenance costs,[46] for a total of $29.2 million.

The proposed Arctic Mine, which is the only mine in the Mining District with a Feasibility Study completed, estimates that it will pay $29.2 million in tolls per year. (See Table 1, line 11.) But the levelized annual cost of the Ambler Road construction debt would be $46.9 million. (See Table 1, lines 12 and 13). That is, AIDEA is projecting an annual toll on the Ambler Mining District mines that is over 60 percent larger than the toll that the Arctic Mine expects to pay.

[44]Trilogy. Arctic Feasibility Study. Table 21-6 Page 21-8. 2020.

[45]Note that all of the component percentages, like the mining costs, are changed if there is a doubling of the road toll because the total costs have changed.

[46]The Ambler Road FEIS estimates the annual road-related maintenance cost to be slightly higher than that implied by the Arctic Mine Feasibility Study. $9.2 million as opposed to $9.1 million per year. Appendix C, Chapter 2, p. C-4.

CHAPTER III

The Profitability and Risks of AIDEA's Ambler Access Road Project

AIDEA has presented the proposed investment in the Ambler Access Road as a "profitable" asset for AIDEA that will generate significant net revenues that will both support AIDEA's statewide activities to promote economic development and diversification as well as provide significant revenues for the Alaska state government to support important state government services. In addition, the proposed investment in the Ambler Access Road Project is presented as relatively risk-free for AIDEA and the Alaska state government. AIDEA asserts that the low risk will allow AIDEA to sell bonds to support the construction of the Access Road at a relatively low interest cost. This will make the Road even more of an economic bargain for Alaskans.

In this chapter we look closely at the claims of high profit and low risk for the Ambler Access Road. We conclude that the profitability of the Ambler Access Road is significantly exaggerated, and the risk is significantly understated.

1. Revenues to AIDEA from the Tolls Collected from Mining Companies Using the Road

AIDEA emphatically states that the full costs associated with the construction, operation, and closure of the Ambler Access Road will be fully recovered from cost-based tolls on users of the Road. Those tolls, in fact, will more than cover the costs associated with the Road, producing a net revenue for AIDEA that can be used to support other economic development activities as well as state government services.

As discussed above, AIDEA claims that the tolls paid by users of the Ambler Access Road will be designed to more than cover the full costs of the Road. This will be done by calculating a *Minimum Annual Assessment (MAA)*, the annual sum of all tolls that would have to be levied in order to both assure the repayments of the construction bonds sold as well as cover the full costs of the road over the 30-year term of the bonds. Given that it is AIDEA that is designing and financing the proposed Road and is likely to manage the Road's use and maintenance, AIDEA intends to set tolls so that AIDEA earns net revenues from the building and maintaining of the Road. It does this by including in the tolls a market interest rate that is higher than the interest rate AIDEA expects on the bonds it sells to finance construction of the Road.[47] Put simply, AIDEA is planning to charge the mining companies that use the Road a higher, market-based interest rate than AIDEA has to pay on the construction bonds it sells.

The difference between the market interest rate and the assumed lower interest rate on the construction bonds sold assures a net revenue to AIDEA (at least "on paper"). If the active life of the Road is longer than the term of the bonds, there could also be a higher net revenue during the years after the bonds are paid off and before the road is closed *if* AIDEA does not reduce the tolls that

[47]Ambler Access Road FEIS. Appendix H, p. H-95, Table 3-6. 2020.

would be collected during those "extra" years of the life of the Road.[48]

AIDEA considers this higher interest charge to those who use the Road reasonable compensation for the entrepreneurial, management, and financial services AIDEA will have supplied. AIDEA will require mining companies that use the Ambler Access Road to sign lease agreements committing them to paying the tolls based on MAA. "The major component of the lease payments would be a MAA which is a payment amount designed to entirely cover the project's debt service by marking up the interest rate at which AIDEA is able to bond."[49] Whether mining companies would accept tolls that went beyond AIDEA's actual costs and included a "profit" for AIDEA, especially in later years when the bonds have been paid off, is an open question.

2. The Size of the Net Revenues AIDEA Could Earn. How "Profitable" Would the Road Be?

AIDEA hired the Australian-based consulting firm, Cardno, to carry out an "Ambler Mining Region Economic Impact Analysis" in 2015.[50] It estimated the sum of the toll payments that AIDEA would require the mining companies to collectively pay to use the Road. That was the gross revenue that AIDEA would receive from the mining companies through the payment of the tolls. The tolls would cover both the construction and maintenance of the Road and the assumed interest Road users would pay AIDEA over the 30-year life of the Road based on an assumed market loan rate of 6.5 percent and a municipal bond rate of 5 percent. Those tolls, over the life of the Road would total about one billion dollars.[51] The costs that would be incurred by AIDEA in building, operating, and closing the Road, including the interest on the bonds sold came to about $875 million (As discussed earlier, the 2020 FEIS Road costs were more than $500 million higher than these Cardno estimates).[52] Thus, the net revenue that AIDEA would receive by building and operating the Road would be about $148 million over the 30-year term of the bonds or about $5 million a year. That annual net revenue would be about one-half of one percent of total gross revenues over the life of the road. Expressed as a percent of the capital investment in the Ambler Access Road (assumed to be $875 million including the cost of money), the annual net revenue would be about 0.6 percent of the capital investment. Both represent relatively low returns on the investment despite the billion dollars of gross revenues collected in tolls. Over the last decade, the actual yield on relatively safe 30-year high quality market corporate bonds has been between 6 percent (January 2010) and 3 percent (April 2021). The rate on 30-year Treasury Constant Maturity bonds has been between about 5 percent (January 2010) and 2 percent (May 2021).[53]

The net revenues associated with the proposed Ambler Access Road also depend on what the actual cost of the Ambler Access Road turns out to be. Often the initial estimate of the cost of large transportation infrastructure projects is biased downward in order to make the projects look more attractive to government funders and taxpayers. This pattern of "underestimating costs of public works projects" is so prevalent

[48]Ibid. In the example provided in the Ambler Access Road FEIS, the total revenues from the MAA over the 50-year life of the Ambler Access Road would be $1.4 billion while the total payments associated with the bonds over their 30-year term would be about $800 million if the bond interest rate were 5 percent and the market interest rate was 6.5 percent.

[49]Ibid. The "markup" of the interest rate on the bonds was the adoption of the 6.5 percent interest rate in setting the tolls rather than using the 5 percent rate that AIDEA was expecting to pay on the bonds it sold.

[50]Cardno. Project Number E514004900, February 2, 2015.

[51]The range of gross revenues was $988 million and $1,060 million.

[52]Cardno provides both a high and low value. We have used the average of the high and low values.

[53]FRED Economic Data, St. Louis Federal Reserve Bank, https://fred.stlouisfed.org/series/HQMCB30YRP and https://fred.stlouisfed.org/series/GS30

that it has been the subject of considerable research interest."[54]

An article published in the Journal of the American Planning Association sought to determine whether this divergence between project cost at the time of approval and ultimate actual cost was the result of error in the cost estimation or was the result of purposeful misrepresentation. It concluded that:

> "...the cost estimates used to decide whether such [infrastructure] projects should be built are highly and systematically misleading. Underestimation cannot be explained by error and is best explained by strategic misrepresentation, that is, lying. The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers should not trust cost estimates and cost-benefit analyses produced by project promoters and their analysts."[55]

This pattern of infrastructure costs being underestimated at the time that construction decisions are made and significant cost overruns after construction is undertaken appears to characterize some important infrastructure decisions in Alaska, including AIDEA's investment in the Red Dog Mine access road and port facility, the Delong Mountain Transportation System (DMTS). AIDEA's initial investment in DMTS included $90 million in road construction and $70 million for port infrastructure, for an initial investment of approximately $160 million.[56] The mine began initial operations in 1989, and the first loads of metal ore concentrate were shipped from the DMTS port in 1990. At the same time, metal commodity prices began a multi-year decline undermining the economics of the Red Dog project. The mining company and AIDEA decided to pursue economies of scale and expand the throughputs of the mine by 75 percent to try to make the mine profitable. Although there were significant risks from uncertainty in the zinc and lead commodity prices and on the extent of available future ore reserves, AIDEA entered into a modified agreement with the mining company, Cominco (now Teck), to provide another $85 million of financing for port expansion and modifications.

In 1993 AIDEA and Teck commissioned an update to the original 1986 Economic Evaluation Report for the DMTS to evaluate the potential financing of an expansion of the port facilities in which AIDEA was being asked to increase its investment. That study explained the poorer than expected performance in the mine, road, and port facilities during the 1990s as due to:[57]

- The project not meeting the original projected throughput rates.
- Operational costs higher than originally projected.
- Market/commodity prices for both zinc and lead had decreased versus the 1986 projections, and
- The other port users, who were expected to share in the DMTS's operational costs, had not materialized as projected in 1986.

Note the overly optimistic assumptions that were made before construction and operations began: Estimated costs were too low, production levels were too high, expected zinc and lead prices were too high, and the expected "other users" who would help pay part of the costs never showed up.

[54]For a review of that literature see Bent Flyvbjer, et al. "Cost Underestimation in Public Works Projects: Error or Lie?," *Journal of the American Planning Association*, 68(3): 279-295, Summer 2002.

[55]Ibid. Abstract.

[56]AIDEA Delong Mountain Transportation System, Asset Management Review, December 2017, pp 2–3.

[57]Ibid. p.20. SRI Incorporated, 1993, "Economic Evaluation for the Project Expansion of Cominco's Red Dog Operations."

3. The Substantial Risks Associated with AIDEA's Proposed Ambler Access Road

The introduction to the part of the FEIS that discussed the "Mining Development Scenario in the Ambler Mining District" used language that did not indicate any certainty about what the impact of the proposed Ambler Access Road would be on mineral development in the Ambler District:

> "Development of a mine is primarily dependent on the economic feasibility of the endeavor...Economic feasibility *is still being determined* for specific mine developments [in the Ambler District], but it is anticipated that with development of the industrial access Road, mine development in the District would proceed...The road would provide surface transportation access to the District *to allow for* expanded exploration, mine development, and mine operations at mineral prospects throughout the District. AIDEA indicates that surface transportation access *would help to bring* the high-value mineral resource areas into production."[58]

Note that "expanded exploration" of the Ambler District requires that the Road be build. It is unclear that mining companies still engaged in exploration would sign leases *now* committing themselves to pay for the Ambler Access Road. AIDEA insists that it will not begin construction of the road until the mining companies that will use it have signed leases committing them to pay their share of the road's costs regardless of the outcome of their exploration and regardless of how high or low metal prices are at the time they must sign their leases with AIDEA. The statement quoted above also does not say anything about the *cost* of the road to mining companies that might use it. Assumedly, leasing access on the proposed Road will, in fact, depend on what AIDEA will charge mining companies for that use.

There is good reason for the relatively vague statements about how mineral exploration and development depend on the Ambler Access Road being built. There is considerable uncertainty and risk associated with the proposed Road. We discuss that below.

a. The Red Dog Mine and the access road and port facility that AIDEA built for that mine almost failed.

The Ambler Access Road Project is often presented by AIDEA as a relatively safe project similar to other AIDEA projects to encourage the development infrastructure in Alaska that has had substantial positive impact on economic development across the State. AIDEA's involvement in the development of the Red Dog Mine's access road and port facilities is often offered as a model of how AIDEA's support for transportation infrastructure can have a major positive impact on otherwise isolated natural resources. The suggestion is that with the Ambler Access Road, the successful intervention on behalf of the Red Dog Mine can be replicated in the Ambler Mining District. The lessons from AIDEA's intervention to build the access road to the Red Dog mine and that mine's port facilities should be the need for caution, not confidence in the success of the proposed Ambler Access Road. The Red Dog Mine infrastructure investment almost failed because of weak markets for the metal ore concentrates that the mine and mill produced.

Almost as soon as the Red Dog Mine began shipping zinc and lead concentrates in 1990, it faced financial problems. Zinc and lead commodity prices began a multi-year decline that stretched into the early 2000s, challenging the economics of the project. In 1997 metal market conditions continued to be bleak: "...zinc markets were consistently low for several years with an unclear future: the [Red Dog] mine had lost

[58]2020 Ambler Access Road FEIS. Section 2.1., page H-2. Emphasis added.

money since its opening."[59]

As the 2017 Asset Management Review of AIDEA's investment in the Red Dog Delong Mountain Transportation System put it: "Given the uncertainty in the future mine reserves at the time and an on-going downturn in commodity prices, the long-term success of the [Delong Mountain Transportation System] project was not assured."[60]

As will be discussed in detail below in Chapter V.2., metal prices are volatile, fluctuating significantly over time, leading the economic benefits associated with metal mining to fluctuate too, disrupting communities.

b. Investments in metal mining are riskier than investments in other industries and have a higher cost of debt associated with them.

Metal mining companies face a cost of debt 37 percent higher than the average American industry and over twice the cost of debt faced by the less risky segments of American industries.[61] In order to sell the bonds associated with the Red Dog transportation infrastructure, AIDEA had to insure its bond repayments by purchasing bond insurance as well as having the Alaska state government provide collateral in the form of state assets transferred to AIDEA.[62] AIDEA has asserted that it does not intend to ask the State of Alaska to assist in the funding of the Ambler Access Road. Without that state support, AIDEA's bonds will appear riskier than the bonds sold to support the Red Dog access road and port facilities.

Potential bond buyers, doing their due diligence, will distinguish the bonds being sold to support metal mining activity in the Ambler Basin from municipal revenue bonds associated with various other municipal infrastructure investments and business support loans across Alaska.

c. The Ambler Access Road and the development of mining in the Ambler Mining District are riskier than the Red Dog Mine, access road, and port facilities.

i. The Ambler Mining District is in the exploratory phase of mineral development. Three of the four projected mines have not yet finished feasibility studies. None have mining permits. For the last 20 years of the "extended" 50-year life of the Ambler Access Road proposed by the FEIS, there are no identified mines or mining companies that have been projected as using the Ambler Access Road.

ii. The Red Dog mine had a mining permit and mining plan. None of the potential Ambler District mines have mining permits.

iii. The Ambler District is significantly more remote in terms of distance to an ocean port from which it can ship its metal concentrates. The proposed Ambler Access Road would transport the metal concentrates produced in the Ambler Mining District 211 miles to the Dalton Highway, which then can carry

[59]Delong Mountain Transportation System: Asset Management Review, Final Report. December 2017. Page 7. Prepared for AIDEA by ARCADIS.

[60]Ibid. p. 8.

[61]http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html Aswath Damodaran, Professor of Finance at the New York University Stern School of Business, has, for many years, maintained and annually updated estimates of the cost of capital to United States firms in 94 different industrial groups, including "metals and metal mining" and, separately, "precious metals." A total of about 7,600 American firms are included in the data base. "Metals and Metal Mining" combined with "precious metals" included 145 American metal mining firms. This data base includes calculations of both the cost of debt and the cost of equity for American metal mining firms. The cost of debt is what is relevant to the question of the financing of the Ambler Access Road through AIDEA selling bonds into the U.S. municipal bond market.

[62]"Delong Mountain Transportation System: Asset Management Review, prepared for AIDEA by Arcadis, December 2017, pp. 17, 18, and 42.

the concentrates 161 miles to the rail hub in the Fairbanks area from which rail transport of 350 miles will be necessary to reach the ocean ports in the Anchorage area.[63] The road/rail distance from the Ambler Mining District to Anchorage ports would be 720 miles. On the other hand, the Red Dog DMTS road connecting the Red Dog Mine to its ocean port is only 52 miles long. Mineral production in the Ambler Mining District will face significantly higher transportation costs, putting it at an economic disadvantage in competition for global markets.

d. Conclusion on the level of risk associated with the Ambler Access Road

Investments not only vary in their potential for a return, they also vary in terms of the risk to which the investor is exposed. Often there is an inverse relationship between the level of expected return and the risk of loss to the investor. Higher risk investments require a higher return to compensate for that risk. Similarly, investments that are a "sure thing" have a lower return because the low risk attracts risk-adverse investors for whom the lower risk is sufficient compensation of the lower return.

This allows investors to consider a range of investment characteristics when choosing the mix of investments that allows them to meet their investment objectives. Government entities have to weigh different investment characteristics such as risk and return just as any other rational economic actor. Government entities ordinarily do not make high risk investments. "Gambling with the people's money" is not considered appropriate for most government entities. Most of AIDEA's investments in their economic development programs have been relatively safe investments with modest returns. For instance, AIDEA's "Loan Participation Program" made 316 loans to Alaska businesses over the July 1, 2010 to June 30, 2020 period. Those loans totaled $439 million or an average of $1.4 million per loan.[64] These loans were distributed across many different sectors of the economy. In contrast, the Ambler Access Road Project will involve AIDEA borrowing $579 million and expenditures of $1.4 *billion* on debt service and Road construction and maintenance costs over the 30-year bond term.[65] This Ambler Access Road Project will primarily serve the interest of one company, Ambler Metals, which is projected to produce 88 percent of the metal ore concentrates that will be transported on the Road.[66] This is a substantially riskier investment than AIDEA's typical business development activities.

It is important that the state government and its citizens consider carefully the risks associated with investments in mining.

e. Putting AIDEA's credit rating at risk

Since AIDEA's inception in 1967, it has sought to raise capital at a lower cost than that which is available to most businesses in Alaska. Initially AIDEA, as an arm of the Alaska state government, sold bonds the yield on which was not subject to federal taxation. In effect, AIDEA acted as a conduit agency that sold bonds with low interest rates and loaned that money to Alaska businesses. Changes in federal tax policy ultimately limited the amount of tax-free bonds state agencies could sell to provide private businesses with lower cost loans. AIDEA shifted its focus somewhat, setting up its Loan Participation Program that involves AIDEA buying the loans that existing Alaska financial institutions make to Alaska businesses, supporting lower cost loans by pooling risk and backing the loans with the loan repayments from a diverse set of Alaska businesses. Since its inception, AIDEA has purchased more than $1 billion in loans and

[63]Ambler Access Road FEIS. chapter 3, section 3.4.2, p. 3–115, Transportation and Access. 2020.

[64]AIDEA Response to Rep. Andy Josephson 4/12/2021, Attachment C, Loan Participation Program.

[65]See Chapter II: "Covering the Costs of the Ambler Access Road" including Table 1.

[66]See Section I.3. above.

issued more than $1.38 billion in conduit revenue bonds.[67] In doing so, AIDEA has been able to maintain a Standard and Poor credit rating of AA+, independent of the State of Alaska.[68]

This credit rating that supports AIDEA's ability to obtain lower interest rates for Alaskan businesses could be put at risk by AIDEA's investment in the Ambler Access Road. If the revenues from the tolls levied on mining companies in the Ambler Mining District shrink because international metal prices decline significantly or the mining companies AIDEA counted on using the Ambler Access Road reduce metal ore concentrate production or shut down completely, AIDEA could have difficulty making payments on the bonds it sold to fund the construction of the Ambler Access Road. That would significantly increase AIDEA's cost of debt and reduce or eliminate the interest savings it can currently provide to Alaska businesses. That could cripple one of AIDEA's most successful efforts to support local economic development and diversification.

Conclusion

AIDEA has presented the Ambler Access Road as a riskless endeavor. Under AIDEA's optimistic scenario, AIDEA will secure low-cost financing through bond sales that will allow it to build the Road. It will then charge the mining companies that use the road a higher cost than AIDEA paid, over a much longer period than the bonds it sells, and, in theory, will earn exceptionally large net revenues as a result. The problem is that even in their rosy presentation of these benefits, the annual net revenue is projected to be only 0.6 percent of the total investment in the Road. This relatively low return comes despite substantial risk. AIDEA often points to the Red Dog Mine as proof that this financing strategy can work. The problem with this model is that the Red Dog mine almost failed. The investment in the Red Dog project by AIDEA had to be doubled to keep the Red Dog project afloat and AIDEA is still owed hundreds of millions of dollars by Red Dog to repay AIDEA's investment in the port and road project that started in the 1980s. Metal mines are risky investments, and the potential purchasers of AIDEA bonds will recognize this. But the Ambler Access Road is far riskier. The Ambler District is still in the exploratory phase of its development while the Red Dog mine had a mining permit and a mining plan, and the Ambler District is significantly more remote from ports than Red Dog was. Instead of investing in the Ambler Access Road, AIDEA should consider continuing to focus on what it is good at and continue to invest in truly local projects that benefit Alaskan businesses and residents in place of helping multinational mining companies to earn larger but uncertain returns for their investors.

[67]http://www.aidea.org/About

[68]Alaska's Development Finance Authority, AIDEA Overview, John Springsteen, Executive Director, December 14, 2018. 121418AIDEAOverview.pdf p.2.

CHAPTER IV

The Distribution of the Benefits from the Ambler Access Road

1. Rural Alaskan Residents Are Unlikely to Benefit from New Metal Mines

The description of the economic impact of a mine on a local population or state initially starts with the workers that the mine hires. These are the "direct" impacts of the mine on the people that have been hired by the mine. When the mine purchases supplies or when the mine workers spend their pay, it creates "ripple" or "multiplier" impacts. In the lexicon of economic impact analysis, these are the "indirect" and "induced" impacts that, at least conceptually, can help geographically spread the benefits of the new metal mining. Beyond those hired directly by the mining company to operate the mine and ore concentrating facilities, these indirect and induced benefits are assumed, in a normal market setting, to reach a much broader part of the population.

However, if the new mine is in a relatively isolated rural area, as they are in the Ambler Mining District and many other mine sites in Alaska, there is unlikely to be much local commercial infrastructure where the mine could purchase the inputs it needs or where employees and their families could spend their mining wages to take care of their needs. New mines, like existing mines, need to import the supplies they need via public or private access or haul roads, airplanes, barges or transport ships, pipelines, etc. In the case of the Ambler Mining District, both mines and residents must obtain the supplies they need from large urban areas at some distance from the mine site, much of it, even, from outside of Alaska.[69]

In addition, the mining companies operating in relatively isolated locations are likely to build remote living facilities near the mine site, including lodging, food service, recreation, electricity, and health. In this situation there may be no possibility for local "induced impacts" associated with employees spending their income. Employees will be transported in and out and not allowed to leave the mine site to access services in local communities, even if such services were available in the relatively small villages. The potential Ambler Mining District developments would be such "fly-in, fly-out" operations with workers being at the mine site for two weeks and then off the mine site in their "home communities" for one week.[70]

[69]Of course, some mines are likely to be built within commuting distance of a large urban trade center. The mines in the vicinity of Fairbanks and Juneau are likely to have larger "multiplier" effects on the "local" economy than mines in more isolated areas with only very small villages in the vicinity of the mine.

[70]Work rotation schedules based on the potential mine furthest along in planning, the Arctic Mine, to indicate how other Ambler district mines would also operate. See Ambler Access Road FEIS. Appendix H, pages H-17 and H-69. 2020.

In this setting, the *local* "multiplier" impacts of the construction and operation of a new mine are likely to be near zero.[71] Effectively, that means that the economic impacts are shifted to those locations where the mine can purchase its supplies and worker households can shop for what they need. Through this "leakage" of payroll and other mine expenditures away from the local communities, the multiplier impacts shift to the larger and more densely settled areas such as the Anchorage or Fairbanks areas.

These long-distance mineworker commuting patterns from Alaska's urban areas and areas outside of Alaska to isolated rural areas shift the "economic impact" of the mining away from rural Alaska to urban centers both in and outside Alaska. As stated above, this can reduce the local economic impact of a mine in a rural area to near zero as well as limit the positive impact on Alaska as a whole. The FEIS for the Ambler Access Road recognized the way that what otherwise would be positive local impacts of local people getting mining jobs may then shift those workers to large urban areas: "Those [local residents] with mining jobs may move away from their communities, as some have done in association with the Red Dog Mine, to larger urban centers."[72]

Such low positive impacts on local employment and income are not just a metal mining phenomenon. The same is true of almost any industrial activity at an isolated geographic location, whether it be a mine, mill, or timber harvest and processing facility. A 2003 study of small forest communities in Southeast Alaska documented the absence of a reliable impact associated with the rise and fall in forest products production and other export-oriented activities. The impact of fluctuations in export industry employment and income in 15 small communities on locally oriented employment and income were studied to see if there was a reliable positive correlation between them. That is, to see if a positive multiplier effect could be detected. In general, there was no such positive multiplier effects from the extractive activity on the rest of the local economy when that economic activity took place in isolated locations. The primary explanation offered for this result was the one suggested above: "...an extremely high degree of income leakage in small communities means that impacts from changes in [export-oriented] employment and income may appear outside the local community in question."[73] That is, the indirect and induced multiplier impacts are felt outside of the area where the industrial facility and its jobs are located.

2. The Distribution of the Benefits of the Ambler Access Road

The creation of vast amounts of wealth in extremely remote, lightly populated areas is not a phenomenon that is unique to Alaska, but Alaska's vastness combined with low population *does* make it unique in the United States. Part of the uniqueness of Alaska is that there are other aspects of Alaskan law that facilitate the distribution of mineral wealth to people living in relatively remote locations. Section 7(i) of the Alaska Native Claims Settlement Act (ANCSA) requires regional corporations to distribute 70% of

[71]This is the assumption that was made in the "Economic Impacts of Ambler Mining District Industrial Access Project and Mine Development" report that the University of Alaska Center for Economic Development carried out for the U.S. Department of Interior, Bureau of Land Management, for use in the Ambler Access Road FEIS. That study estimated who was employed by the construction and operation of the Ambler Access Road and the construction and operation of the new mines in the Ambler Mining District that were assumed to be created as a result of the availability of the Ambler Access Road. That employment was broken into three categories: Non-Alaskan Residents, local residents (Northwest Arctic Borough and Yukon Koyukuk Census Area Residents), and "other Alaska Residents." The multiplier impact (indirect and induced employment as a result of the direct employment) was assumed to be zero. That is, besides local residents that were directly hired to construct and operate the Ambler Access Road and the new mines, there were no local hires as a result of local residents spending their wages in local businesses or the mines purchasing supplies locally. Those multiplier job impacts were felt instead by non-local Alaskan residents. Tables 9, 10, 13, 14, 15, 16, 17, 18, 19, 20.

[72]Ambler Access Road FEIS. Volume 2, Appendix H, p. H-88. 2020.

[73]"A Test of the Economic Base Hypothesis in the Small Forest Communities of Southeast Alaska," Guy C. Robertson, General Technical Report NSW-GTR-592, Summary, December 2003.

net revenues from resource development on ANCSA lands among all 12 regional corporations. Half of the Section 7(i) payments must then be distributed to the respective village corporations within each of the ANCSA regions. One of the potential mines in the Ambler district, the Bornite Mine, is on land held by the Alaska Native corporation NANA and, thus, could potentially share some of its wealth with Alaskan Native corporations statewide. The other three potential Ambler District mines, however, will surely see all but a tiny fraction of the wealth that is created leave the local area around the mine and flow to the multi-national mining companies that operate and supply the mines.

The problem with the potential Ambler mines is a familiar one. Large metal mines in extremely remote locations cannot and do not source most of their needs from the local areas where they are located, and they only source some of their needs from elsewhere in the state of Alaska. Much of the equipment and supplies the mines need to operate must be purchased outside of Alaska. Although Alaska is a large and diverse state, it does not, for example, make heavy mining equipment or the advanced technology that the miners rely on to efficiently produce metal ore concentrate. In the case of the Ambler Mining District, there are not even nearby villages that would be able to contribute the various supplies on which the workers might spend their incomes. The Ambler Access Road itself will be limited to largely mine use only and AIDEA will not be financing local access roads to reach villages from the Ambler Access Road. In that sense, the Ambler Access Road will not provide access to the villages located in the land the Road will cross. The FEIS briefly discussed the lack of access to local villages from the Ambler access road saying that down the line there is some potential for a "spur road or even a 4-wheeler trail" that could link the local villages to the Ambler Access Road. Although some of these villages (Bettles, Evansville, and Kobuk) are located within 10 miles of the Road, more are 30 to over one hundred miles away from the Road.[74]

Not only is there no access to the Ambler Access Road planned for the local villages, but if people from the local villages are hired by the mines, they may have to fly from their village to the transportation hub, Fairbanks, and then back to the mine:

> "As construction of each mine progresses, equipment and supplies would be transported primarily using the proposed road; however, the transport of employees to and from Fairbanks (the likely transportation hub for employees departing from and arriving at each of the mine sites in the Ambler District) would continue to be via airplane, as that is likely the most economical means of transporting people. Employees from local villages would either take scheduled flights to the Fairbanks hub to get to work or possibly would be picked up by mining company flights."[75]

As a result of how the Road is designed almost exclusively to serve the mining industry, it will not be possible for villages in the vicinity of the mines to have any direct contact with the mines or the mine workers' dormitories. This means that those local villages will not be able to directly provide any services to the mines and miners. In other words, there will be no grocery stores, cafes, bars, motels, gas stations, etc. that could potentially supply the mine and the miners with some of their needs, thus helping to keep some of the wealth that is created at the mine in the local area. In fact, all the wealth that is created at the mine, must at least initially, flow directly out of the local area to the larger regional hubs like Fairbanks and Anchorage.

However, there is some discussion in the Ambler FEIS about relaxing the restrictions on the use of the Ambler Access Road to only mining companies and AIDEA road maintenance activities.[76] AIDEA has kept open the possibility that the Road could be used to deliver supplies to staging points along the Road that are closest to regional villages. AIDEA would not build access roads to those

[74]Ambler Access Road FEIS. Appendix H, p. H-27, Table 2-11.

[75]Ambler Access Road FEIS. H-18.

[76]Ambler Access Road FEIS. Section 2.2.2, pp. H-25 to H-29.

villages but would allow delivery and storage of things like groceries and fuel oil at points on the Ambler Access Road for others to deliver to the local villages if the funding of such surface transportation links between the Ambler Access Road and the villages can be arranged.

The obvious problem is that there would be no links from the Ambler Access Road to the local villages. The FEIS discusses the possibility that "at least initially, fuel or freight likely would be delivered to staging areas where the communities could access it, probably in the winter."[77] The reason that it would be picked up and delivered to the villages in the winter is that the area between the Ambler Access Road and the local villages is tundra that is hard to travel over when it is thawed in the warmer months. The cost of road construction to the local villages is estimated to cost $3.4 million per mile for a 2-lane road because the area is "marshy, water-saturated soil typical of much of the NAB/YKA region [and] represents a considerable impediment to road construction."[78] Given that some of the villages, like Alatna, are 30 miles or more from the proposed Road,[79] the advantage that the road might provide the local communities in terms of cheaper deliveries would have to be weighed against the prospect of paying $100 million dollars for some of the local villages to have roads linking them to the Ambler Road.

Even if we assume that the spur road is built to the local communities, and that they do not have to pay for it, the cost advantages are unclear. For example:

- With regards to the cost of fuel: "However, on a per-pound, maximum-load basis, road travel is typically less efficient than travel via barge when shipping large quantities of fuel over long distances (Northern Economics 2010)."[80]
- With regards to the cost of electricity: "However, these savings may not directly lead to lower residential costs for electricity, as the State of Alaska subsidizes residential electricity costs in all the study area communities through the Power Cost Equalization program."[81]
- With regards to the cost and possible continuation of mail: "Trucking freight would result in savings for the U.S. Postal Service due to the lower bypass mail volume, but it is uncertain how much it would lower the prices of household goods for community residents. Residents are already paying a rate below cost for bypass mail delivery... Should a spur road to a given community be constructed, it is uncertain if the U.S. Postal Service would choose to continue bypass mail service to that community."[82]

Although there is quite a bit of discussion in the Ambler FEIS about the potential benefits of the Road to the local area, the benefits, upon a closer examination, appear geared towards the mines and not the local people. A spur road that would connect the Ambler Access Road to the local communities would be extremely expensive to construct and the cost of fuel, electricity, and mail might actually rise because of it. The proposed Ambler Access Road will be a benefit for the multinational mining companies that use it, but it will provide only limited benefits to the local communities in the vicinity of the Road.

The way that the Ambler FEIS obscures the limited local positive economic impacts of the Access Road is that it analyzes the impacts of the Ambler Access Road on the state of Alaska as a whole, ignoring local or regional impacts. While the Bornite Mine on NANA lands may provide economic benefits to NANA and its shareholders, the local areas around the mine will see few if any economic benefits for at least three of the four prospective mines.

[77]Ambler Access Road FEIS. H-78. 2020.

[78]Ambler Access Road FEIS. H-78. 2020.

[79]Ambler Access Road FEIS. H-78. 2020.

[80]Ambler Access Road FEIS. H-78. 2020.

[81]Ambler Access Road FEIS. H-79. 2020.

[82]Ambler Access Road FEIS. H-80. 2020.

As we already discussed, the local communities in the vicinity of the mines will not be linked to the mine. While it is possible that some of the local people will be hired as direct employees of the mine, the very act of hiring them may help to destabilize the local communities. The reason for this is that those Alaska Native workers may move away from the local areas near the mines. While this may seem paradoxical, it is recognized in the Ambler FEIS, and it makes sense.

> "On the other hand, some mine employees from NAB/YKCA communities may not continue to reside in the region after they are hired. Mining has high average wages and allows workers to live where they prefer and commute to the work site on a rotating schedule (DOWL 2016). About half the NANA [Alaska Native] shareholders recruited to work at Red Dog decided to move their families and live outside the NAB [Northwest Arctic Borough] for lifestyle and/or economic reasons (Tetra Tech 2009)."[83]

One reason local residents might move is that to work at the mine from one of the local villages, they would have to fly from the local village to Fairbanks, and then fly back to the mine. While the salary associated with the mines may "allow workers to live where they prefer," the commute to and from work, even on a rotating schedule, would be significantly longer from a local village than from a regional hub.

Another reason local residents who are hired by the mines might move their residences to Alaska's more densely settled areas is that the schedule of a miner at these proposed mines may be inconsistent with a lifestyle that includes subsistence activities. The mine schedule that is reported in the Ambler Access Road FEIS is a two-week on, one-week off schedule. This schedule can be particularly disruptive to indigenous northern peoples and their more subsistence-based lifestyles.

> "Participation in the mine economy can also alter the subsistence lifestyle. For people employed by the mine, who work long daily hours and a two week on/off schedule, less time can be spent on the land hunting and fishing. A study of the Slave Lake Metis community found 71% of workers employed by the mine reported spending less time on the land (North Slave Metis Association, 2002)."[84]

If we assume that the same pattern holds for the potential mines associated with the Ambler Access Road as was found at the Red Dog Mine, we would expect that half of the locally hired miners would move away from the local villages. Since we were only starting with 20 percent of the hires being local,[85] this now only leaves 10 percent of the hires to bring their mining wages back to the local villages. If we add up the average employment at each mine, the number of years that the mine will operate, and then spread that over the thirty years that the road will operate, we can estimate the average number of local village residents employed during any given year. The average direct mine employment on any given year is 219. Given that 20 percent are initially assumed to be local residents, there will be 44 locals hired in any given year by the mines. Assuming, as we did above, that half of those locals move to a larger transportation hub, then there would be 22 locally employed miners working at one of the four mines in any given year during the 30-year period.

In conclusion, the Ambler Access Road has been presented in the FEIS as having the potential to create massive wealth. While the projected mines are assumed to create more than $26 billion dollars in economic value, the local area through which the Ambler Access Road would pass would see no ripple or secondary impacts from this projected economic value. While the multi-national mining companies may see substantial positive economic impacts from the proposed

[83]Ambler Access Road FEIS. H-81. 2020.

[84]Gibson, G. Canada's Resilient North: The Impact of Mining on Aboriginal Communities. *Pimatisiwin: A Journal of Aboriginal and Indigenous Community Health* 3(1).

[85]Ambler Access Road FEIS. Page 3–130. 2020.

Ambler Access Road mines, the local people and local economies will see little of those projected economic benefits for the simple reason that the small, isolated villages cannot supply either the inputs the projected mines will need to operate or the goods and services on which employees at the mines are likely to want to spend their mining paychecks. In addition, the cost of building the infrastructure to link the Ambler Access Road to the local villages may be cost-prohibitive for any but the closest villages.

CHAPTER V

The Volatility of Copper Prices, Production, and Employment

1. Introduction

Alaska's history since European-American settlement is replete with a dependence on boom-and-bust industries. Beginning with the fur trade, then gold rushes, a boom of military base building in WWII, and continuing with the current oil boom/bust cycle, Alaska has had to cope with the disruption associated with reliance on volatile national and international markets. In each of these different cycles, national policies and global forces and demands brought large influxes of people, large amounts of wealth produced, and then, just as quickly, the industries and the capital associated with them were gone again. The impact of these boom-and-bust cycles is society-wide and affects the services that the state government can provide and the pay and livelihoods that residents lose when the booming industry goes bust.

One suggested partial solution to the most recent boom and bust, the oil-related set of economic problems, has been that Alaska should more aggressively diversify the commercial minerals on which its economy depends, so that "all of Alaska's economic eggs are not in one mineral basket," namely oil.[86] In particular, it has been pointed out that Alaska has substantial metal ore deposits many of which have not been developed.

An analysis of the potential opportunity that expanded metal ore mining offers for supplementing or replacing the shrinking oil-based economy of the recent past requires a careful review of the economic potential represented by metal mining in Alaska. In a recent overview of "Metal Mining in Alaska" by the Alaska Department of Labor and Workforce Development (DLWD), Alaska's metal mining was characterized as a "small, high-value industry with a long history [in Alaska that] is growing."[87] Because the Arctic Mine is the most developed of the various metal ore mining proposals in the Ambler Mining District and because it will be primarily focused on developing copper ore concentrates,[88] we will turn to a discussion of some of the characteristics of the copper mining industry.

[86]Defining "mining": In the economic data collected by various government agencies, "mining" sometimes means the removal of any material from the earth. In that broad meaning, oil and natural gas would be considered part of mining. The Alaska Department of Labor and Workforce Development (DLWD), for instance, includes the oil and gas industry in its "mining category." On the other hand, the Division of Geological and Geophysical Surveys (DGGS) within the Alaska Department of Natural Resources, does not include oil and gas in the category "mining." The more common definition of "mining" excludes the removal of liquid and gaseous fossil fuels from the "mining" category and reports that extractive activity separately, simply labeled "oil and gas" or "petroleum." The solid fossil fuel, coal, is included in mining. Mining also does not focus exclusively on valuable metals such as gold, silver, or platinum. It also includes extracting building materials such as sand, gravel, and rock. In this report, we will use the Alaska DGGS mining definition, treating oil and gas extraction separately from "mining." The Alaska Division of Geological & Geophysical Survey (DGGS) annually produces a report on "Alaska's Mineral Industry" that, among other things, "serves as the authoritative historical record of mining in the State." (Alaska's Mineral Industry 2018, p. 5.)

[87]*Alaska Economic Trends*, Metal Mining in Alaska, Vol. 39, No. 5, May 2019, pp. 4–10. Sara Teel, p. 4. Emphasis added.

[88]The Arctic Mine Feasibility Study, 2000, shows that 57 percent of the metal ore value that would be recovered as concentrates would be copper, 26 percent would be Zinc, and 4 percent would be Lead. P.22-3.

2. The Volatility in the Copper Market

Where once U.S. copper mines only competed with other U.S. mines in places like Montana or Arizona, the world is now the arena in which all copper producers compete. When one region of the world, like Chile, now the world leader in copper production, reduces output, as it did in 2019 because of "lower grade ores, strikes, and weather-related disruptions,"[89] other places in the world sought to capitalize on the resultant supply shortage. At the same time, as copper prices were rising and U.S. copper mines were trying to ramp up their production, "75% of unionized workers at a mining company with mines and plants in Arizona and Texas voted to go on strike.

The company announced that it would temporarily close its smelter and refinery but did not address the status of its Arizona mines...Production of refined copper in the United States fell by an estimated 7% as a result of the strike..."[90] This is a good example of how dynamic and competitive world copper supply and demand can be. It shows that even when companies desire to expand their production due to global price increases, they can be thwarted by savvy miners' desire for better compensation or other changes and adjustments in the market. In fact, there are now so many factors that go into determining the price and volume of copper produced that, although the global appetite for copper is certainly increasing, production in any one region of the world or any one individual mine, is anything but assured.

It should be immediately apparent from Figure 1 on page 36 that primary copper production in the U.S. has been anything but stable since 1900, despite an upward trend in copper production over that time period. While the trend is certainly towards increased copper production in the U.S., there were large swings in production on a year-to-year and decade-to-decade basis. It was precisely this instability in copper price and production that eventually reduced or stopped copper production in places like Butte, MT, and Arizona's "Copper Triangle" in the 1980s as copper production increased in other places in the world copper economy, like Chile.

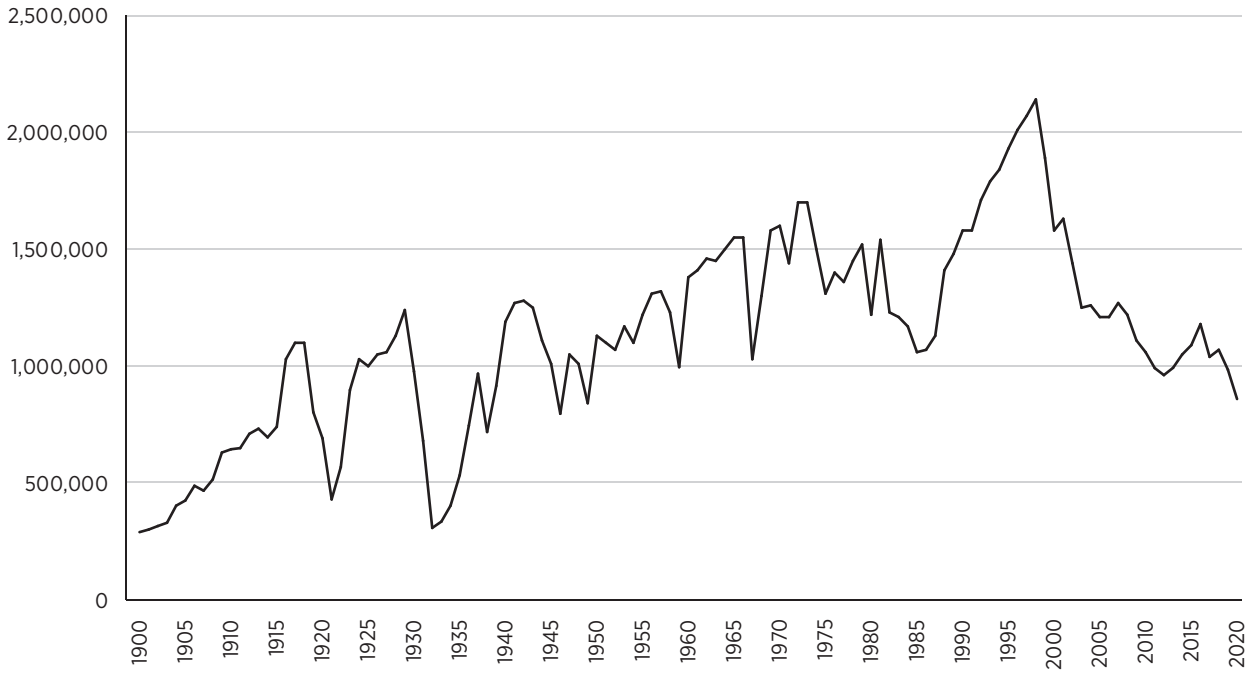
There has not been substantial copper mining in Alaska since the five Kennecott copper mines in the McCarthy area of what is now the Valdez-Cordova Census area shut down in 1938. The ore deposits were discovered in the early years of the twentieth century, but the mining potential was limited by the lack of surface or water access to the mining area. In 1911 the Copper River and Northwestern Railway reached the mining area connecting it with port locations in the Valdez-Cordova coastal area and the production of very high-grade copper ore expanded substantially. The outbreak of the First World War, 1914-1918, created a huge demand for copper for the manufacturing, among other things, of brass casings for ammunition. This created a boom in copper production but also set up the "bust" in the demand for copper that followed the end of the First World War and into the 1920s. The worldwide Great Depression of the 1930s suppressed demand for copper and many copper mines, including the Alaskan Kennecott mines, shut down for periods. The Second World War would pull the copper industry out of that slump, but the Alaskan Kennecott operations did not survive that long. In 1938, they were permanently shut down and the McCarthy-Kennecott towns became "ghost towns." The quality of the copper ore had deteriorated as the mining had proceeded and the rising operating cost of the mines had made them non-competitive with operations elsewhere in the Americas and around the world.

That end of substantial copper production in Alaska was over 80 years ago. To look at a more contemporary view of the volatility of copper mining, we need to be able to look at the per unit value or price of copper and how it has fluctuated. For that, we also have to look beyond Alaska to other copper producing areas, since Alaska was

[89]USGS. Mineral Commodities Survey 2020. 2020. Page 53.

[90]USGS. Mineral Commodities Survey 2020. 2020. Page 53.

Figure 1: US Primary Copper Production (metric tonnes)



Source: USGS. Historical statistics mineral and material commodities in the United States.

not producing substantial copper since 1938. Figure 2, on page 37, provides just such a view of copper prices over the most recent 30 years.

Again, what we see over this much shorter time frame is how truly dynamic the international market for copper is. While the overall trend of the price of copper was trending unstably downward from 1989-2002, the price of copper then shot up over ten-fold during the decade 2002-2012. Copper prices then collapsed by 55 percent. Since then, prices have continued to fluctuate substantially. Copper prices have been anything but stable. In fact, over relatively short time periods, like 2008-2011, copper lost more than 60 percent of its value and then turned around and tripled its value. If a copper mine on which a community has become dependent is an inframarginal supplier of copper (neither too cheap nor too expensive to produce), then that copper producer would have had to ride this price-driven rollercoaster over the last 30 years. When the price was up, if the mining company could, it would increase local output and help to saturate the market. When the price was down, if the mining company could, it would decrease the local output in hopes that the price would rebound soon. This simplistic view of things assumes that there are no factors at play like those that were discussed above in the last few years: weather, ore grades, striking labor forces, and technology all play important roles in how profitable an individual mine can be year to year.

In the first third of the 20th century, Alaska's Kennecott copper mines rode the copper industry roller coaster from an early boom as one of the most productive copper mines in the world through a variety of busts and recoveries tied to world copper markets.

For Alaskan *metal* mining, the 20th century was "a century of ups and downs."[91] Mining employment peaked in Alaska in 1916 at 8,590. Alaska has not seen this level of metal mining employment in the full century that has passed since then.

[91]"Alaska's Mining Industry," Mali Abrahamson, *Alaska Economic Trends*, May 2013, p. 4.

Figure 2: Historical Copper Prices from 1988–2021 in dollars/lb

Source: Trading Economics. Historical Copper Prices (nominal).
https://tradingeconomics.com/commodity/copper

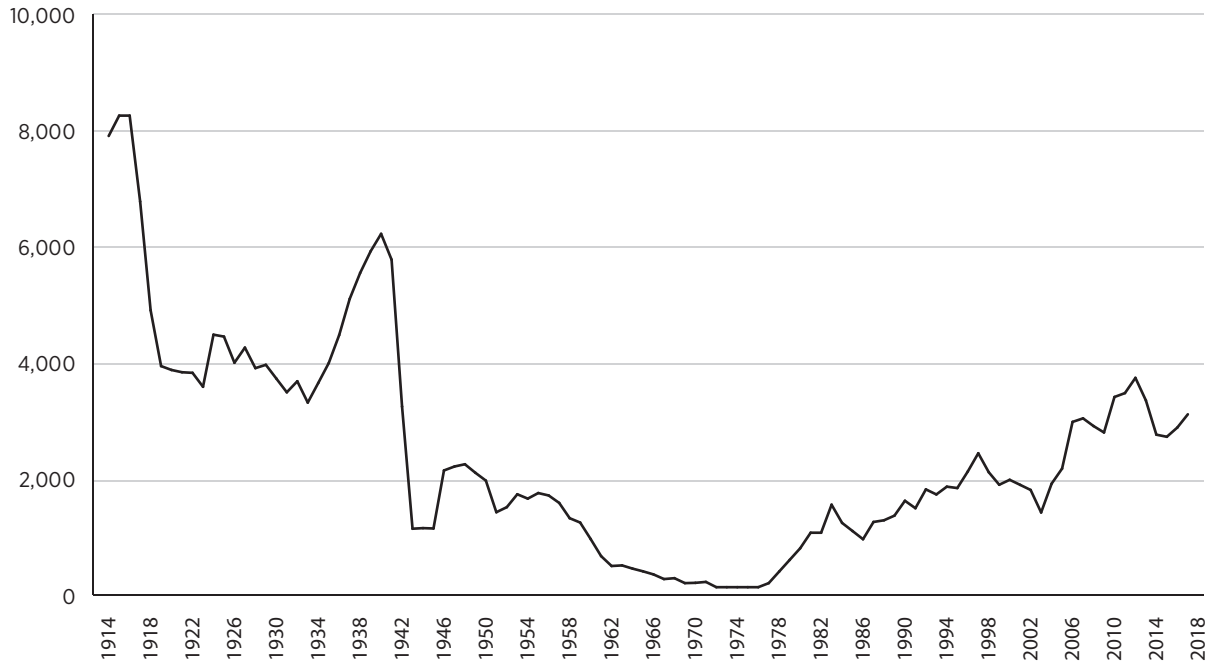
By 1919 the demand for metals sparked by the First World War had disappeared and Alaska metal mining employment dropped below 4,000. See Figure 3 below.

By 1923 employment had fallen to 3,600, a loss of about 60 percent of the 1916 jobs. With some volatility, Alaska metal mining jobs continued at about that level until 1933 when President Roosevelt raised the price at which the Federal Reserve System would purchase gold to $35 per ounce from the previous level of approximately $21 per ounce. That increase in the price of gold spurred an expansion in gold mining in Alaska. Between 1933 and 1940 metal mining employment almost doubled in Alaska, from 3,300 to 6,200. Since 1980, metal mining in Alaska has experienced an ongoing disruptive "flicker" effect with rapid growth in metal mining jobs and then significant and sudden declines of 500 to 1,000 metal mining jobs. This ongoing "flicker" in metal mining jobs is tied to international metal market conditions that led metal prices to fluctuate widely, gaining or losing 50 percent or more of their value over relatively short periods of time, undermining or enhancing profitability and disrupting communities and households.

The impact of this type of variation in copper prices, production, and consumption is that copper mines very rarely operate at a constant output level over any appreciable length of time. It simply does not make economic sense to continue to produce a commodity at the same level when the price changes so significantly.[92] It is the impact of a large number of different global factors that helps to make copper prices unpredictable. Recently it has been things like increased use of copper in electronics and a new "greener" energy economy, e.g. wind turbines, the slowdown of the

[92]This is not to suggest that the level of mining varies day-by-day depending on market commodity price. There are costs associated with significantly raising and lowering the level of production. The point is that production levels do, ultimately, adjust to the commodity price and production costs and how the mining company expects those to change going forward.

Figure 3: Metal Mining Employment in Alaska 1914–2017



Sources: 1914–1958, Alaska Department of Mines, Report of the Commissioner of Mines for the Bienneum Ended December 31, 1958, Table III, total of all mining less coal and non-metal mines; 1959–1972, U.S. Geological Survey, Mineral Yearbook, total mining less non-metal mining; 1973–1981 authors estimates; 1982–2000 U.S. BEA REIS metal mining; 2002–2017, AK DGGS estimates of metal mining including exploration, development, and contract services.

world economy due to the global pandemic, or the restarting of the global economy and supply shortages associated with the "just in time" manufacturing and supply chain of the economy,[93] and a host of other factors that influence the supply, demand, and price of copper. Other factors, like the energy intensive nature of copper production, influence copper prices so that they fluctuate with energy costs.[94]

The copper mining industry is volatile and influenced by a host of different complex factors. This volatility has implications for the local economies dependent on that copper mining and processing. In the case of the Ambler Access Road, mining companies and AIDEA will face the need for repayment of the fixed construction bonds that would fund the building of an access road to incentivize the production of copper and other metals in the Ambler Mining District where copper ores have been the focus of exploration for decades. Alaska's earlier historical experience with copper mining warns us that copper mining cannot be counted on to provide a predictable stream of income and employment. But that experience ended with copper in Alaska ended in 1938. Alaska has not had much historical experience with copper mining since then.

[93]Goodman, P., Chokshi, N. How The World Ran Out of Everything. New York Times. 6.1.2021. https://www.nytimes.com/2021/06/01/business/coronavirus-global-shortages.html?searchResultPosition=1

[94]EIA. Energy commodity prices rose more than other goods in 2019. 1.6.2020. https://www.eia.gov/todayinenergy/detail.php?id=42395

Conclusions

- AIDEA would like to encourage metal mining in northwestern Alaska by building the Ambler Access Road. The problem is that the real costs of the road, although presented in the FEIS, have not been carefully considered with respect to the financing of the Road or the repayment of the Road costs by the mining companies that AIDEA hopes will use the Road. The construction of the Ambler Access Road will cost $579.3 million dollars. When the costs of financing and road maintenance are included, it will cost AIDEA $1.4 billion over the 30-year life of the Road. Stated in terms of a levelized annual payment, AIDEA will have to pay $46.9 million per year to cover the cost of this road. The proposed Arctic Mine, which is the only mine in the Ambler District with a Feasibility Study completed, estimates that it will pay $20 million a year in Road use charges to cover road construction costs etc. during the twelve years that it operates as well as $9.2 million per year in road and road-related maintenance. AIDEA therefore either needs four Arctic-like mines, or a little more than twice the mines that are presented in the Ambler FEIS in order to pay for the rest of the Ambler Access Road. Currently, there are not enough mines and metal ore concentrate production projected to pay for the Road.

- AIDEA has presented the Ambler Access Road as a riskless endeavor. AIDEA will secure low-cost financing through bond sales that will allow it to build the Road. It will then charge the mining companies that use the road a higher cost than it paid, over a much longer period than the loan, and, in theory, will earn additional net revenues as a result. The problem is that even in their rosy presentation of these benefits, the annual net revenue is projected to be only 0.6 percent of the total investment in the Road. This relatively low return comes with substantial risk. AIDEA often points to the Red Dog Mine as proof that this financing strategy can work. The problem with this model is that the Red Dog mine almost failed. The investment in the Red Dog project by AIDEA had to be doubled to keep the Red Dog project afloat, and the mining company still owes AIDEA hundreds of millions of dollars. Metal mines are risky investments, and the potential purchasers of AIDEA bonds will recognize this. Moreover, the Ambler Access Road is far riskier than Red Dog. The Ambler District is still in the exploratory phase of its development while the Red Dog mine had a mining permit and a mining plan, and the Ambler District is significantly more remote than Red Dog, facing higher transportation costs to market.

- The “local” area through which the Ambler Access Road will pass and in which the Ambler Mining District is located is too rural to capture and circulate money produced by the proposed mines. The villages, in general, are quite small and do not have the commercial infrastructure to provide either the mines or the mine workers with the goods and services they need. Although the mines may produce wealth in the local area, the mines will have to import all their supplies and almost all their workers, and they will export all the wealth out of the local area. While the mining is projected to generate more than $26 billion dollars in revenue, only 22 local people are predicted to be employed annually in the mines, representing about one percent of

the jobs AIDEA projects will be created by the Road. While the Road has the potential to help local villages get the supplies that they consume, AIDEA will not pay for spur roads or other local infrastructure that allows local villages to access the Ambler Road. The FEIS indicates that it will cost $100 million dollars, for instance, to build a spur road from the Ambler Road to Kobuk. If such spur roads are completed, the FEIS states that the price of fuel delivered on the road may increase, the cost of electricity may increase, and the current subsidized postal delivery may cease operations.

- The Ambler Mining District, which is predominately a copper mining area, will be dependent on the global copper market, which, like other metal markets, has a long and volatile history. Since 2000, copper has been valued as low as $0.53/lb. and as high as $4.52/lb., an 8.5-fold change in the price. As international metal prices fluctuate, so do metal mining payrolls and spending. In addition, the amount of copper that an individual miner can produce has increased by about three percent every year since the mid-1800s in the U.S. The cumulative impact of that rising labor productivity has been huge. While this rising worker productivity is good for the bottom line of the mining companies, it also means that every year fewer copper miners are needed to produce any given amount of copper. At the same time, copper prices and copper output around the globe are intricately linked to one another but are controlled, at least to some degree, by forces that are outside of the copper companies' control like weather, technology changes, worker strikes, ore grades, and global demand. With those unpredictable changes in world metal markets come economic disruption in other businesses, households, and communities.

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