Economic contribution assessment of the Proposed Pebble Project to the US national and state economies

Final Report

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Executive summary

The transition to renewable energy sources disrupts the status quo. While the sources of renewable energy resources — such as wind and the sun — are omnipresent, ironically the critical minerals required to create solutions to capture and distribute renewable energy are in short supply. Copper is needed at every level of the expanded electrical grid. It is hugely important in the clean energy technologies needed to respond to the global climate agenda.

A new urgency in the understanding of what it means to make this energy transition vision a reality is emerging. And copper is center stage in the vision and the reality. Renewable energy systems may require five times more copper than conventional systems. Copper is integral to micro grids and smart grids; it is vital to energy storage technologies; electric vehicles require more copper than their conventional counterparts; and it helps collect, store, and distribute solar and wind energy. Indeed, a recent report issued by the International Energy Agency (IEA)[1] concluded that, in a scenario where the Paris Agreement goals are achieved, copper demand for power lines would more than double by 2040 and overall demand for copper would increase more than 40%. The same report also claims that current copper mines and projects under construction would only meet 80% of copper needs by 2030.

Future copper supply is at risk due to a lack of investment by mining companies over the past five years, meaning that there are few large-scale projects awaiting development. Almost all new capacity slated to come on-line in the next five years will be in areas of heightened political risk – Central Africa, Central Asia, or South America. Lack of investment by mining companies in the US is fuelled, in part, by the anti-mining sentiment of environmental groups and the resulting political pressure. Northern Dynasty Minerals (also referred to as NDM or Northern Dynasty in this report) is seeking to develop one of the world's most significant discoveries of copper, gold, molybdenum, silver, and rhenium.

Known as the Pebble Project, this poly-metallic prospect, located 200 miles southwest of Anchorage, Alaska, is the world's largest undeveloped copper deposit[2]. The measured and indicated resource estimates contain 57 billion pounds of copper; in addition to 71 million ounces of gold, 3.4 billion pounds of molybdenum, 345 million ounces of silver, and 2.6 million kilograms of rhenium[3]. Through its Pebble Partnership subsidiary, NDM has submitted a development plan (the "Proposed Project") for a mine that extracts 1.3 billion tons of resource, milling at a rate of 180,000 tons per day over a 20-year mine life. IHS Markit also reviewed preliminary investment, operation, and production schedules for five additional potential expansion scenarios that would extend the Proposed Project using combinations of expanded mining capacity (in Year 5 or Year 10) and/or the addition of a gold plant. While the same initial build-out of the Pebble Project (the "Initial Capital" phase) would occur regardless of the development scenario, each potential expansion scenario would require additional capital investment and be subject to further extensive permitting processes at the federal and state level before they can be implemented.

IHS Markit was commissioned to assess the potential contributions the Proposed Project could make to the economies of Alaska, Washington, Oregon, California, and the Rest of the United States. As the Proposed

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[1] The Role of Critical World Energy Outlook Special Report Minerals in Clean Energy Transitions, International Energy Agency, May 2021

[2] Top-10 undeveloped copper deposits (June 25, 2021) https://miningglobal.com/top10/top-10-global-copper-projects Kamoa-Kakula is no longer undeveloped; it began commercial production on July 1, 2021.

[3] Appendix C provides additional information on the mineral resource estimates in a report entitled "Preliminary Economic Assessment NI 43-101 Technical Report, Pebble Project, Alaska, USA" (also known as the "PEA"), effective date September 9, 2021. The PEA was developed in accordance with the guidelines established by National Instrument 43-101 and is filed under Northern Dynasty Minerals Ltd. as a technical report at sedar.com.

Project specifies the minimal (baseline) investment in and operating capacity of the Pebble Project, it would stimulate the minimum expected economic contributions from developing the Pebble Project. The most capital-intensive potential expansion scenario—one characterized by both expanded mine capacity and a gold plant being brought online in Year 5—would be expected to stimulate the maximum economic contributions. Thus, the Proposed Project and the Production Year 5 Potential Expansion Scenario with Gold Plant define the range of potential economic contributions that would be stimulated by developing the Pebble Project.

Note: for the remainder of this report, the "Production Year 5 Potential Expansion Scenario with Gold Plant" will be referred to as the "Year 5 Expansion."

IHS Markit assessed the annual average economic contributions to employment, gross state product, and other key metrics from the Proposed Project and the Year 5 Expansion. The results are presented for three time horizons:

- The Initial Capital Phase, which is common to both scenarios.
- Year 1 through Year 5. Differences in the economic contributions between the scenarios are due to the capital investments required to expand mine capacity and add the gold plant in the Year 5 Expansion scenario. For example, during this period, the Proposed Project would support 5,698 jobs across the United States; the Year 5 Expansion would support 13,763 jobs,
- Year 6 through Year 20, which allows for comparing the difference in "steady state" mining operations of both scenarios. For example, the Proposed Project would support 5,667 jobs across the United States, whereas the Year 5 Expansion would support 12,774 jobs.

Average Annual Economic Impact Summary		Initial Capital	Proposed Project Operations Phase		Year 5 Expansion Operations Phase	
Metric	Region	All Scenarios	Year 1 - Year 5	Year 6 - Year 20	Year 1 - Year 5	Year 6 - Year 20
Jobs	Alaska	6,166	4,087	4,018	9,738	7,621
	Washington, Oregon,and California	1,591	493	511	984	1,163
	Rest of US	4,811	1,117	1,138	3,041	3,989
	Total	**12,569**	**5,698**	**5,667**	**13,763**	**12,774**
Economic Activity (Output)	Value of Production (accrues to Alaska)		$1,813.0M	$1,759.0M	$2,285.7M	$3,688.2M
	Supply Chain and Induced Activity:					
	Alaska	$973.9M	$748.6M	$744.3M	$1,494.1M	$1,296.8M
	Washington, Oregon,and California	$392.0M	$159.5M	$165.5M	$294.6M	$371.6M
	Rest of US	$1,106.9M	$277.9M	$280.9M	$775.7M	$953.8M
	Total	**$2,472.8M**	**$2,999.0M**	**$2,949.7M**	**$4,850.1M**	**$6,310.5M**
Gross Domestic Product or Gross State Product (Value Added)	From Mine Production (accrues to Alaska)		$1,249.6M	$1,171.3M	$1,627.2M	$2,499.2M
	Supply Chain and Induced Activity:					
	Alaska	$513.3M	$422.1M	$419.4M	$806.6M	$692.6M
	Washington, Oregon,and California	$176.6M	$61.6M	$64.0M	$117.4M	$146.3M
	Rest of US	$510.1M	$124.8M	$126.5M	$348.6M	$441.8M
	Total	**$1,200.0M**	**$1,858.1M**	**$1,781.1M**	**$2,899.7M**	**$3,779.9M**
Labor Income	Alaska	$456.9M	$335.4M	$330.9M	$765.2M	$624.1M
	Washington, Oregon,and California	$119.4M	$43.2M	$44.8M	$81.5M	$101.0M
	Rest of US	$339.8M	$84.0M	$85.5M	$226.1M	$293.4M
	Total	**$916.1M**	**$462.7M**	**$461.1M**	**$1,072.8M**	**$1,018.6M**
Taxes (from operations and supply chian activity)	State Taxes					
	Alaska	$29.6M	$24.7M	$72.6M	$29.5M	$151.7M
	Washington, Oregon,and California	$17.3M	$5.7M	$5.9M	$9.6M	$13.7M
	Rest of US	$38.5M	$9.6M	$9.7M	$29.2M	$35.2M
	Extraction Taxes and Royalties		$37.8M	$85.9M	$44.8M	$173.0M
	Federal Taxes	$170.5M	$65.2M	$153.3M	$114.6M	$356.7M
	Total	**$256.0M**	**$143.1M**	**$327.4M**	**$227.8M**	**$730.3M**

Source: IHS Markit

Although IHS Markit utilized preliminary planning information provided by NDM as key inputs for the models that assess the potential long-term economic contributions of the Pebble Project, IHS Markit is exclusively responsible for all the analysis and content within this report. Additional comprehensive economic studies will be needed as the development plan is further refined and finalized.

Key findings / Key messages

- The Initial Capital Phase would support 12,569 jobs across the United States, almost half of which (49%) would be filled by Alaskans. While many of the remaining workers would migrate to Alaska during this 4.5-year period, much of the wages these workers earn are expected to be remitted back to their home states. This shifts some of the impacts from Alaska towards their home states.
- Sourcing of fuel and supply barge activity is expected to be centered in Washington State, which accounts for the relatively strong accrual of economic contributions in the west coast states, especially during the Initial Capital Phase. More detailed results for Washington, Oregon, and California are included in Appendix A.
- Purchases of specialized mining equipment is expected to flow towards midwestern states such as Illinois during the Initial Capital Phase, resulting in over 38% of the jobs supported during this phase accruing to this "Rest of the US" region.
- During the Operations Phase, operating expenditures and sustaining capital spending shifts towards supporting day-to-day operations in Alaska and purchases of consumables such as grinding media, reagents, and spare parts from the Rest of the US region. Thus, in the Proposed Project scenario, the jobs impacts would taper down to just under 5,700.

  This is not the case in the Year 5 Expansion. The build-out required to bring expanded capacity and the gold plant online would bring annual average employment contributions close to 13,800 in the Year 1 –5 period. In the Year 6 – 20 time horizon, the expanded output of the Pebble Project would annually support almost 12,800 jobs across the United States.
- Comparing both scenarios during the Year 6 – 20 time horizon, higher mine production levels coupled with the addition of the gold plant would result in a significant scaling up of the economic contributions. The employment contributions to Alaska would be about 90% higher under this development scenario, while the overall employment contributions to the US would be 125% higher. Contributions to GDP would more than double.
- Jobs supported during Year 6 – Year 20 of the Operations Phase would receive wages totaling $461.1 million annually under the Proposed Project and $1,018.6 million under the Year 5 Expansion. This indicates an annual average wage of about $80,000; almost 40% higher than the US annual average wage of $57,300. IHS Markit estimated direct workers in the mine would receive annual wages of $115,000[4].

[4] IMPLAN data for 2018, estimated annual wages of $114,159 for the copper, nickel, lead, and zinc mining sector. This was rounded to $115,000 as a conservative estimate of potential annual wages in 2021.

Introduction: Copper is vital to the New Energy Future

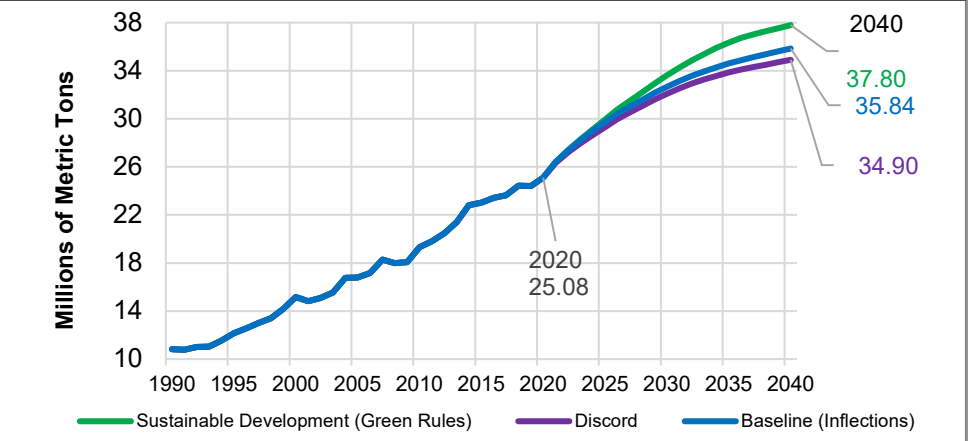
The transition to renewable energy sources disrupts the status quo. The sources of renewable energy resources — such as wind and the sun — are omnipresent, but have to be converted into electricity to be usable. Ironically, the critical minerals required to create solutions to capture and distribute renewable energy are in short supply. This threatens the ability to transition towards renewable energy in time to reach global climate change goals. This situation is further complicated by the fact that existing power infrastructures are rapidly deteriorating and in desperate need of modernization.

Copper is needed at every level of the new electrical grid and is hugely important in the clean energy technologies required to respond to the global climate agenda. Indeed, renewable energy systems utilize roughly five times more copper than conventional power generation systems. IHS Markit has identified three likely paths for the global economy as it transitions to the new energy future:

- **Inflections**: The base case scenario. Shifts in policy, social, and market forces drive change; the energy transition accelerates, but at different speeds and in different ways globally.
- **Green Rules**: A revolutionary shift in the energy transition with coordinated efforts to reach climate ambitions. Governments see these actions as strategic imperatives and economic opportunities.
- **Discord**: Recognition of climate change threats and opportunities sustain ongoing momentum, but action is constrained by determined political opposition and weak investment environments.

Shifting from the trajectory of the Inflections scenario to the Green Rules would increase annual global copper consumption by almost one million metric tons by 2030. Plus, Green Rules is on a steeper trajectory, meaning the additional copper consumption requirements would continue to accelerate. Unfortunately, copper mining capacity has been slow to expand during the last couple of decades. The prospect of thinning project pipelines at a time of rising demand for the metal would further complicate the impending global energy challenge.

World copper consumption under three energy transition scenarios



Source: IHS Markit

Overview of the Pebble Project

The Pebble Project is located approximately 200 miles southwest of Anchorage, Alaska. The deposit lies within the Lake and Peninsula Borough, which has approximately 23,782 square miles of land area and is home to some 1,500 people in 18 communities. NDM is focused on designing, permitting, building, and operating the Pebble Project. The company initiated federal permitting at the end of 2017.

Source: Northern Dynasty Minerals Ltd. ©2022 IHS Markit

The deposit contains an estimated 6.5 billion tonnes of Measured and Indicated mineral resources, containing[5]:

- 57 billion pounds of copper
- 71 million ounces of gold
- 3.4 billion pounds of molybdenum
- 345 million ounces of silver
- 2.6 million kilograms of rhenium.

In addition, there are an estimated 4.5 billion tonnes of Inferred mineral resources, containing:

- 25 billion pounds of copper
- 36 million ounces of gold
- 2.2 billion pounds of molybdenum
- 170 million ounces of silver
- 1.6 million kilograms of rhenium.

Palladium also occurs in the deposit.

The 2021 PEA reports gross revenue of $34.7 billion over the 20-year life of the Proposed Project. Metal production from this plan is projected to be 6.4 billion pounds of copper, 7.4 million ounces of gold, 300

[5] Appendix C provides additional information on the mineral resource estimates in a report entitled “Preliminary Economic Assessment NI 43-101 Technical Report, Pebble Project, Alaska, USA” (also known as the “PEA”), effective date September 9, 2021. The PEA was developed in accordance with the guidelines established by National Instrument 43-101 and is filed under Northern Dynasty Minerals Ltd. as a technical report at sedar.com and as a 6k filing on edgar.gov.

million pounds of molybdenum, 37 million ounces of silver, and 231,000 kilograms of rhenium. The equivalent gross revenue for the Year 5 Expansion Scenario over its 90-year life is $337 billion, with metal production of 61 billion pounds of copper, 65 million ounces of gold, 2.9 million pounds of molybdenum, 290 million ounces of silver, and 2.0 million kilograms of rhenium. NDM commissioned IHS Markit to assess the potential economic contributions that building and operating the Pebble Project could deliver to the economies of Alaska, Washington, Oregon, California, and the Rest of the US. NDM's Proposed Project would oversee the development of a mine capable of processing 180,000 tons of mineralized material per day for 20 years, utilizing about 10% of the total Mineral Resource. Presently, NDM is in the federal permitting process. In November 2020, the US Army Corps of Engineers (USACE) denied the federal permit, which the company is appealing.

IHS Markit reviewed and analyzed NDM's engineering plans for a 4.5-year Initial Capital Phase followed by a 20-year Operations Phase. The plans incorporate construction expenditures during the Initial Capital Phase and both operating costs and sustaining capital spending during the Operations Phase. These plans were used as the basis for developing inputs for the economic contribution assessment. IHS Markit developed inputs for the two phases and separately modeled the potential economic impacts of each phase.

Initial Capital Phase (Year -4.5 through Year -1): The first phase is characterized as a 4.5-year time horizon of significant capital expenditures for equipment, structures, and other capital inputs required to develop the mine and the core infrastructure that supports the Pebble Project's mining activities. During this phase, Alaska and the Lower 48 states would experience an increase in economic and employment activity from the capital-intensive outlays driven by the infrastructure build-out and the preparation of the mine for resource extraction. The Initial Capital Phase would be the same, regardless of which future development scenario is ultimately pursued.

NDM estimates the total costs of the Initial Capital Phase would be $6.048 billion. Under the Base Case assumptions, NDM would fund $4.368 billion. Third parties would spend an additional $1.680 billion to build infrastructure, including access roads, pipelines, and port facilities. In return, NDM would pay $181.8 million annually during the Operations Phase to lease the infrastructure. Over the 4.5-year Initial Capital timeline, an average exceeding $1.3 billion would be spent annually — $970.8 million by NDM and $373.2 million by third parties.

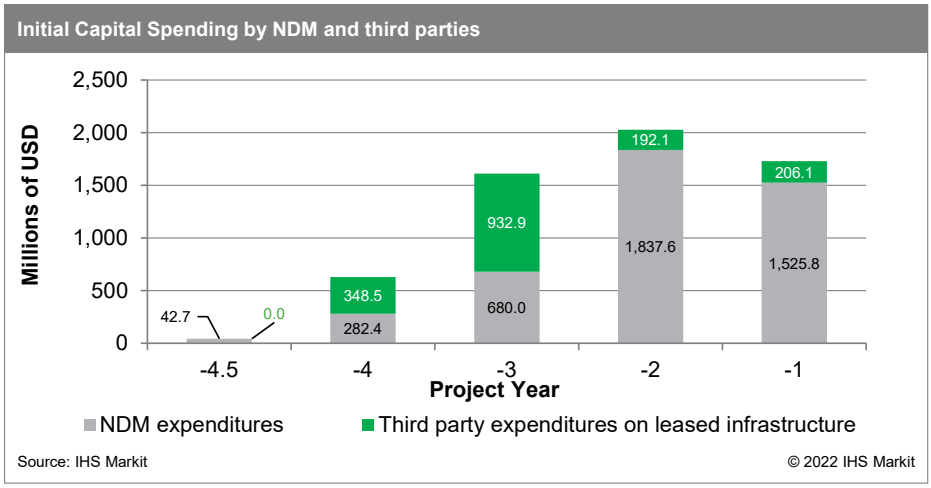
Operations Phase (Year 1 through Year 20): This 20-year period, which is limited to the duration of the first mining permit, includes the ramp-up to and the "steady-state" production levels of the Proposed Project mining operations. Other potential expansion scenarios that expand capacity and/or add a gold plant would require additional federal and state permitting. Direct spending would shift to expenditures associated with the day-to-day operation of the Pebble Project. As such, the employment impacts would scale back relative to the Initial Capital Phase.

Also included in this phase is sustaining capital, which encompasses all spending necessary to maintain the current mine production capacity. In addition, the capital expenditures associated with any potential expansion scenarios, including those involving the gold plant option, are included as part of sustaining capital. Under the Proposed Project plans, NDM would spend an annual average of $782.8 million on combined operating expenditures and sustaining capital, of which $528.6 million would accrue to Alaska. This is equivalent to approximately 1.06% of Alaska's 2020 gross state product.[6] Should any of the potential expansion scenarios be permitted and implemented, this combined spending could rise as high as $1.6 billion annually.

[6] IHS Markit's US Regional Service estimates Alaska's gross state product was $49.82 billion in 2020.

Proposed Project and potential expansion scenarios

IHS Markit reviewed the initial capital, operating expenditures, and sustaining capital schedules for the Proposed Project and five potential expansion scenarios.[7] Common to all six development scenarios is a 4.5-year Initial Capital Phase in which $6.05 billion would be spent to build the mine. Spending by third parties on infrastructure (access roads, pipelines, and a marine terminal) would initially dominate the Initial Capital phase, followed by the bulk of NDM's spending during the last two years.



Proposed Project

Under the Proposed Project scenario, NDM would establish a mine with a nameplate processing capacity of 180,000 tons of mineralized material per day, or 65.7 million tons processed annually. Thus, between Year 1 and Year 20, 1.29 billion tons of mineralized material would be processed. The annual average operating costs of the proposed mine would be $707 million with annual sustaining capital costs of $76 million.

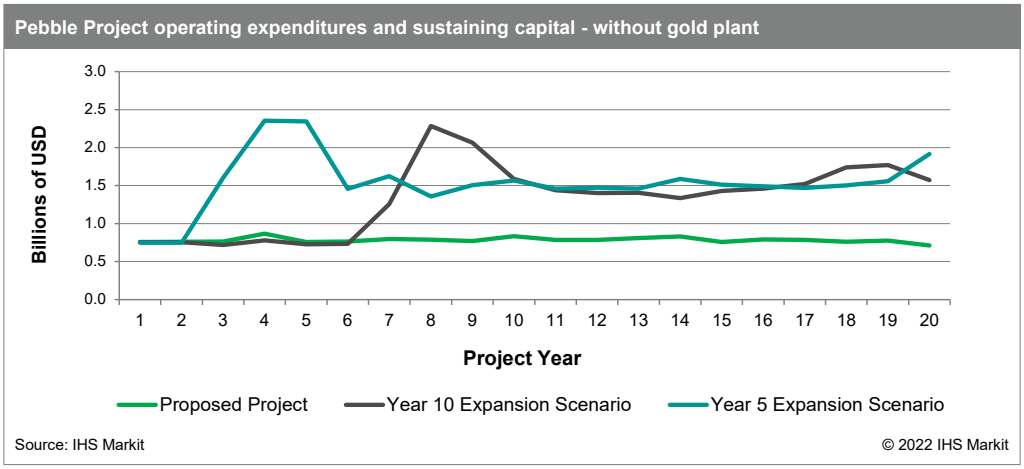
Potential expansion scenario 1: Year 5 Expansion (no gold plant)

In this scenario, the nameplate capacity of the potential mine would be expanded to 270,000 tons per day, or 98.5 million tons annually. The expansion would require $3.9 billion in capital investment during Year 3 through Year 6. The annual average operating costs of the mine after the expansion would be almost $1.2 billion with annual sustaining capitals costs of $341 million including the expansion.

[7] The proposed potential expansion scenarios are preliminary and based on several assumptions. These include open pit mining from the Proposed Project would continue and the market prices for base and precious metals would be as forecast. The potential expansion scenarios all utilize the same final open pit mine design, with forecast variations based on the year of expansion and expanded throughput rate. The gold plant included in the potential expansion scenarios was based on metallurgical testwork results for a specific gold recovery. Other technologies may be applicable for the Pebble deposit. Further, the addition of a gold plant under any scenario will require additional testwork and engineering, and will require the receipt of pertinent Federal and State permits prior to implementation. Each of the potential expansion scenarios would require additional permitting and environmental regulatory review, and there is no certainty that any of the potential expansion scenarios could be pursued. For further information, see Appendix C or the PEA technical report.

Potential expansion scenario 2: Year 10 Expansion (no gold plant)

In this scenario, the potential mine's capacity is expanded to 270,000 tons per day in Year 10 rather than in Year 5. The expansion would require $3.8 billion in capital investment during Year 7 through Year 10. The annual average operating costs of the mine would approach $1.1 billion with annual sustaining capital costs of $338 million including the expansion.



Potential expansion scenario 3: Proposed Project with Gold Plant

This is similar to Scenario 1 but with the addition of a gold plant built for $199.5 million during Year 3 through Year 5. Once it comes on-line in Year 5, the gold plant would increase annual operating costs by $69.4 million, resulting in an annual average of $762 million from Year 1 to Year 20. Annual average sustaining capex would be $86 million.

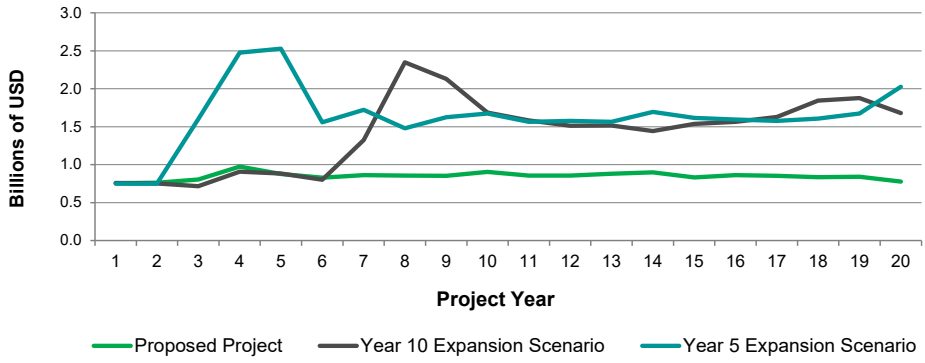
Potential expansion scenario 4: Production Year 5 Expansion with Gold Plant (Year 5 Expansion)

Similar to Scenario 2 with the addition of a gold plant being built for $203.7 million during Year 4 and Year 5. Once the expanded capacity and the gold plant come online in Year 5, annual average operating expenses and sustaining capital would increase by $854 million, relative to the Proposed Project. This translates to annual average operating expenditures of almost $1.3 billion from Year 1 to Year 20. Average annual sustaining capital would be $351 million, including the expansion capital.

Potential expansion scenario 5: Production Year 10 Expansion with Gold Plant.

Similar to Scenario 3 with the addition of a gold plant being built for $220.7 million during Year 4 and Year 5. The combination of the gold plant coming online in Year 5 and mining capacity expanding in Year 10 would result in annual operating expenditures and sustaining capital expenditures that are $848 million higher than the Proposed Project. Annual operating costs from Year 1 through Year 20 would average almost $1.1 billion with sustaining capex of $349 million, including the expansion capital.

Pebble Project operating expenditures and sustaining capital - with gold plant



Source: IHS Markit

The total spending of the Pebble Project during the Initial Capital Phase [Year -4.5 to Year -1] and the Operations Phase (Year 1 to Year 20) is summarized for each of the scenarios. The Proposed Project would require the least amount of total spending. The Year 5 Expansion option would require the most spending. Thus, assessments of these two scenarios frame the range of expected economic contributions from the Pebble Project.

Total Pebble Project Expenditures through Year 20 (millions of USD)

Without Gold Plant	**Proposed Project**	**Year 5 Expansion**	**Year 10 Expansion**
Initial Capital (Y -4.5 to Y -1)	6,048	6,048	6,048
Opex (Y1 to Y20)	14,133	23,933	19,981
Sustaining Capex (Y1 to Y20)	1,522	6,811	6,761
Grand Total	**21,703**	**36,793**	**32,790**
With Gold Plant	**Proposed Project**	**Year 5 Expansion**	**Year 10 Expansion**
Initial Capital (Y -4.5 to Y -1)	6,048	6,048	6,048
Opex (Y1 to Y20)	15,240	25,647	21,510
Sustaining Capex (Y1 to Y20)	1,721	7,015	6,981
Grand Total	**23,010**	**38,710**	**34,540**

Source: IHS Markit analysis of NDM data

The direct annual average spending on initial capital during -Year -4.5 through Year -1, as well as operating expenditures and sustaining capital (during Year 1 through Year 20), are shown in the following table. IHS Markit modeled the potential annual average economic contributions associated with the Proposed Project and Year 5 Expansion scenario as they capture the lower and upper expected economic contributions across the range of potential development scenarios.

Average Annual Pebble Project Expenditures (millions of USD)

Without Gold Plant	**Proposed Project**	**Year 5 Expansion**	**Year 10 Expansion**
Initial Capital (Y -4.5 to Y -1)	1,344	1,344	1,344
Opex (Y1 to Y20)	707	1,197	999
Sustaining Capex (Y1 to Y20)	76	341	338
Grand Total	**868**	**1,472**	**1,312**
With Gold Plant	**Proposed Project**	**Year 5 Expansion**	**Year 10 Expansion**
Initial Capital (Y -4.5 to Y -1)	1,344	1,344	1,344
Opex (Y1 to Y20)	762	1,282	1,076
Sustaining Capex (Y1 to Y20)	86	351	349
Grand Total	**920**	**1,548**	**1,382**

Source: IHS Markit analysis of NDM data

Value of production

NDM provided the estimated production volumes and pricing assumptions for the 20-year Operations Phase that were used in its PEA submission. Realization charges were deducted from the gross value to derive the value of production estimates for the Proposed Project. Over the 20-year Operations Phase, the annual value of production would average $1.8 billion. Copper would account for approximately 60.8%, while gold and molybdenum would account 27.4% and 9.4%, respectively.

Value of Final Production: Proposed Project, Year 1 - Year 5

Mineral	Total Production	Average Forecast price*	Total Value	Average Annual Value
Copper	1,649.0 M lb	3.50 $ / lb	$5,771.4M	$1,154.3M
Gold	1,894.7 k oz	1,600 $ / oz	$3,031.5M	$606.3M
Molybdenum	70.9 M lb	10.00 $ / lb	$708.8M	$141.8M
Silver	8,704.6 k oz	22.00 $ / oz	$191.5M	$38.3M
Rhenium	61.6 k kg	1,500 $ / kg	$92.4M	$18.5M
Gross value of production			$9,795.6M	$1,959.1M
Less Realization Charges**			$730.6M	$146.1M
Final value of production			**$9,795.6M**	**$1,813.0M**

* Average price assumptions NDM used in the PEA

** Treatment, refining, freight,and insurance costs

Source: IHS Markit

Value of Final Production: Proposed Project, Year 6 - Year 20

Mineral	Total Production	Average Forecast price*	Total Value	Average Annual Value
Copper	4,760.0 M lb	3.50 $ / lb	$16,660.1M	$1,110.7M
Gold	5,472.0 k oz	1,600 $ / oz	$8,755.2M	$583.7M
Molybdenum	229.0 M lb	10.00 $ / lb	$2,289.7M	$152.6M
Silver	27,906.5 k oz	22.00 $ / oz	$613.9M	$40.9M
Rhenium	169.4 k kg	1,500 $ / kg	$254.1M	$16.9M
Gross value of production			$28,573.0M	$1,904.9M
Less Realization Charges**			$2,187.9M	$145.9M
Final value of production			**$28,573.0M**	**$1,759.0M**

* Average price assumptions NDM used in the PEA

** Treatment, refining, freight,and insurance costs

Source: IHS Markit

Under the Year 5 Expansion, copper would account for 58.1% of the production value. Gold and molybdenum would account for 32.7% and 7.2% of the production value, respectively. Once the additional capacity and gold plant come online, the average annual value of production would increase from $2.3 billion to $4.0 billion.

Value of Final Production: Year 5 Expansion, Year 1 - Year 5

Mineral	Total Production Y1 - Y5	Average Forecast price*	Total Value Y1 - Y5	Average Annual Value
Copper	2,005.0 M lb	3.50 $ / lb	$7,017.4M	$1,403.5M
Gold	2,626.0 k oz	1,600 $ / oz	$4,201.5M	$840.3M
Molybdenum	72.5 M lb	10.00 $ / lb	$725.3M	$145.1M
Silver	10,894.0 k oz	22.00 $ / oz	$239.7M	$47.9M
Rhenium	61.5 k kg	1,500 $ / kg	$92.2M	$18.4M
Gross value of production			$12,276.0M	$2,455.2M
Less Realization Charges**			$847.5M	$169.5M
Final value of production			**$12,276.0M**	**$2,285.7M**

* Average price assumptions NDM used in the PEA

** Treatment, refining, freight,and insurance costs

Source: IHS Markit

Value of Final Production: Year 5 Expansion, Year 6 - Year 20				
Mineral	Total Production Y6 - Y20	Average Forecast price*	Total ValueY6 - Y20	Average Annual Value
Copper	9,308.0 M lb	3.50 $ / lb	$32,577.9M	$2,171.9M
Gold	13,596.3 k oz	1,600 $ / oz	$21,754.1M	$1,450.3M
Molybdenum	351.1 M lb	10.00 $ / lb	$3,510.8M	$234.1M
Silver	49,286.6 k oz	22.00 $ / oz	$1,084.3M	$72.3M
Rhenium	253.0 k kg	1,500 $ / kg	$379.6M	$25.3M
Gross value of production			$59,306.6M	$3,953.8M
Less Realization Charges**			$3,983.1M	$265.5M
Final value of production			**$59,306.6M**	**$3,688.2M**

* Average price assumptions NDM used in the PEA

** Treatment, refining, freight,and insurance costs

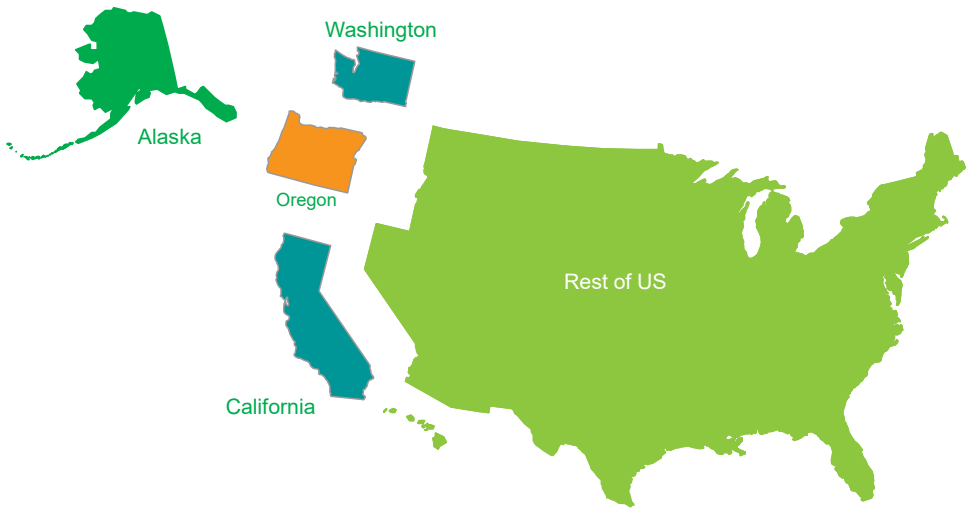
Source: IHS Markit

Assessing economic contributions

An economic impact analysis traces how a local economy responds to catalyst events such as:

- The on-going business operations of a company or industry
- New capital investment programs
- Changes that can potentially disrupt operating environments, including, but not limited to, new market entries, deployment of new technology, or regulatory changes.

The economic impact analysis conducted for this study traced how the economies of Alaska, Washington State, Oregon, California, and the Rest of the United States would respond to the Pebble Project's annual average spending during the Initial Capital Phase plus the combined operating expenditures and sustaining capital of the Operations phase. As previously mentioned, the Proposed Project and Year 5 Expansion scenarios were assessed to establish the lower and upper bounds of the economic contributions from the Pebble Project. Also, the analysis of the Operations Phase was split into Year 1 – Year 4 and Year 5 – 20 to capture the effects of a significant production increase beginning in Year 5 for the Year 5 Expansion scenario.



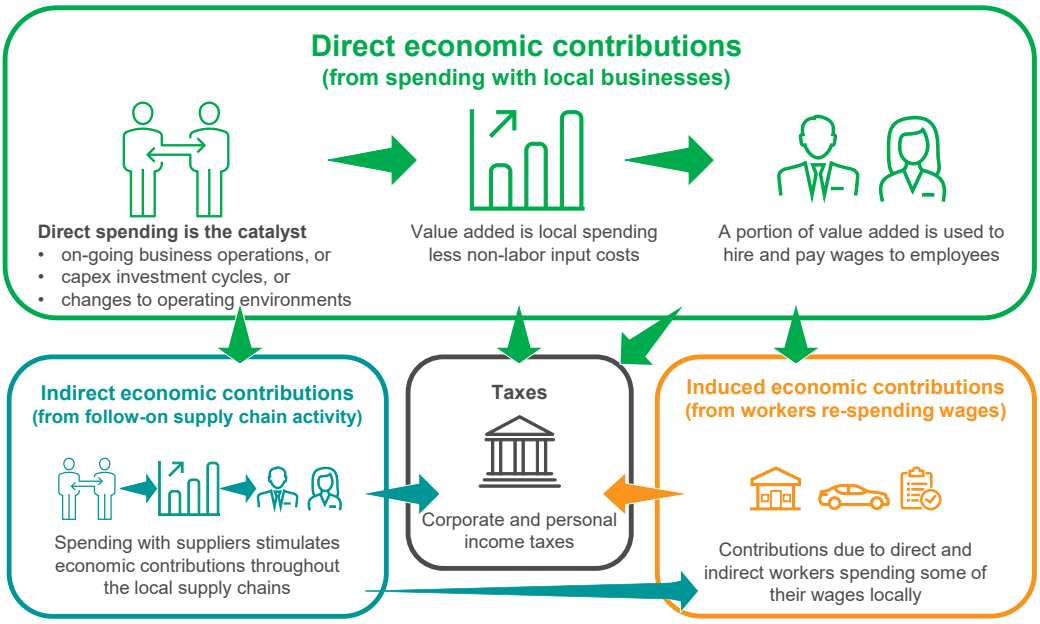
Source: IHS Markit

Economic impact assessment methodology

Starting with detailed breakouts of the subcategories of initial capital, operating expenditures, and sustaining capital spending, IHS Markit worked with NDM to determine the most likely sourcing location for each good or service. For example, fuel purchases would likely be sourced from Washington, the mining and process equipment primarily from the Rest of the United States. Any purchase from international sources were removed from the analysis as any follow-on economic impacts would not occur in the United States.

IHS Markit developed customized models for each of the five regions, based on data from IMPLAN. The IMPLAN models capture the economic activity for 546 industry sectors. The Pebble Project's spending was delineated by both region and industry, aligned to the appropriate IMPLAN industry, and processed through the models.

Three levels of economic impact were assessed. The first level, designated as **direct contributions**, encompasses economic contributions that result from the direct spending by the Pebble Mine with supply chains and service networks in Alaska, Washington, Oregon, California, and the Rest of the United States. The second level, **indirect or extended supply chain contributions**, captures follow-on contributions that ripple through the extended supply chain (i.e., suppliers' suppliers, etc.) in those regions. Finally, the third level, **induced contributions**, covers the economic contributions owing to the consumer activity of employees, direct and indirect workers, who spend significant portions of their wages locally.



Source: IHS Markit

The direct, indirect, and induced contributions are quantified for the following indicators:

- **Employment**. To produce their goods and services, companies must hire and retain employees. This indicator measures the number of workers required to support a given level of sales activity within a given economy.
- **Sales activity (output)**. In the context of an economic contribution analysis, output represents the value of initial and follow-on sales that occur in the local economy attributable to the direct activities and transactions.
- **Value-added contribution to gross domestic product (GDP)**. Value added is the difference between the revenue received for a product or service and its non-labor input costs. Typically considered as the broadest measure of the health of an economy, GDP is the sum of value added across an economy.
- **Labor income.** A subcomponent of value added, labor income captures the wages paid to workers.
- **Government revenues.** Direct, indirect, and induced firms pay corporate taxes. In addition, their employees pay personal taxes.

The downstream impacts of copper on the US economy

Copper is used in a range of "downstream" products, including wire, pipes, electrical systems, and construction materials. As such, components and intermediate products using copper are ultimately integrated into a broad spectrum of end use goods. IHS Markit gauged the economic output (sales activity) that copper enables for US downstream companies. The sales enabled for a given industry is simply its total sales multiplied by the ratio of its copper product purchases to total input purchases.

$$Sales\ enabled_{Industry\ x} = Total\ sales_{Industry\ x} \times \frac{Purchases\ of\ copper\ products}{Total\ input\ purchases}$$

IHS Markit reviewed the downstream linkages contained in the 2018 US IMPLAN input-output model and determined the copper rolling, drawing, extruding, and alloying sector sells to more than 125 industry sectors. The aggregate sales enabled across those sectors totalled $36.4 billion. This level of sales activity is sufficient to support about 90,000 jobs within those sectors.

To assess the role of the copper mining sector, one must go two steps further upstream: first to the smelting sector and then to the mining sector. The IMPLAN models aggregate all nonferrous metals except aluminum into these sectors, so the role of copper mining can only be approximated. Using the methodology outlined above, approximately 42.3% of the copper rolling, drawing, extruding and alloying sector's sales are enabled by the smelting sector. This implies $15.4 billion ($36.4 billion X 42.3%) of the downstream copper sales are enabled by the smelting sector. Likewise, the mining sector enables approximately 35.4% of smelter sales. This means that the mining sector ultimately enables $5.5 billion ($15.4 billion X 35.4%) in downstream copper sales, which supports about 13,500 downstream jobs.

To assess the potential contribution of the Pebble Mine, IHS Markit considered a scenario in which the mine comes online in 2027. In other words, 2027 is Year 1 of the Pebble Mine and the Permitting Period ends in 2046. Over this period, IHS Markit forecasts the US will consume an annual average of 2.3 million metric tons of copper. Over the Permitting Period, NDM anticipates the Proposed Project would produce an annual average exceeding 145 thousand metric tons of copper. For the Year 5 Expansion, the annual average production would surpass 256 thousand metric tons. This implies Pebble Project production could meet between 6.3% and 11.1% of US copper demand during the Permitting Period. This translates to annual contributions between $350 million and $610 million in downstream copper sales and 850 to 1,500 jobs. These contributions would be in addition to those presented elsewhere in this report.

Pebble Performance Dividend

NDM, through its Pebble Partnership subsidiary, created the Pebble Performance Dividend (PPD) as a means to share profits from mining operations with communities in southwest Alaska. Residents who are at least 18 years of age and have maintained a primary residence in the following Bristol Bay communities for a minimum of 12 months would be eligible to sign up during an enrollment window:

- Bristol Bay Borough: King Salmon; Naknek; South Naknek;
- Dillingham Census Area: Aleknagik; Clark's Point; Dillingham; Ekuk; Ekwok; Koliganek; Manokotak; New Stuyahok; Portage Creek; Togiak; Twin Hills;
- Lake and Peninsula Borough: Chignik; Chignik Lagoon; Chignik Lake; Egegik; Igiugig; Iliamna; Ivanof Bay; Kokhanok; Levelock; Newhalen; Nondalton; Pedro Bay; Perryville; Pilot Point; Pope-Vannoy Landing; Port Alsworth; Port Heiden; Ugashik.

Based on data from the 2020 US Census, there are approximately 5,100 residents of the Bristol Bay communities that would qualify to receive the PPD.

Estimating the potential size of the Pebble Performance Dividend participant pool

Borough/Census Area	Population	Percent 18+	Population, 18+
Bristol Bay Borough	844	82.2%	693
Dillingham Census Area	4,857	68.6%	3,331
Lake and Peninsula Borough	1,476	71.4%	1,053
Total	7,177		5,077

Source: IHS Markit analysis of 2020 US Census data

- Proposed Project: annual average PPD payments of $10.9 million. Assuming all eligible residents enroll, each beneficiary would receive approximately $2,175 annually; a household of three would receive close to $6,525 annually during the Operations Phase[8].
- Year 5 Expansion: annual average PPD payments of $39.1 million. Assuming all eligible residents enroll, each beneficiary would receive approximately $7,825 annually; a household of three would receive close to $23,475 annually during the Operations Phase. Over the potential 90-year lifetime of the mine, these annual payments could average $72.0 million or $14,400 per eligible beneficiary.

The following table summarizes how the PPD could affect personal income levels in the three communities during the Permitting Period (Year 1 through Year 20). The PPD would increase regional personal income by 5.5% in the Proposed Project scenario and 19.7% in the Year 5 Expansion scenario. The table assumes that 100% of eligible residents register for the PPD. For example, if only 50% of the residents in the regions register for the PPD, the PPD payments would be double the amounts distributed to each beneficiary.

[8] Based on an analysis of 2020 US Census data, the weighted average household size in the PPD-eligible communities is 3.07 persons.

Estimating the impact of the Pebble Performance Dividend on regional personal income (Year 1 - Year 20)					
Borough/Census Area	Avg Personal Income[1]	Proposed Project		Year 5 Expansion Scenario	
		PPD payment	Percent increase	PPD payment	Percent increase
Bristol Bay Borough	53,732	$2,138	4.0%	$7,706	14.3%
Dillingham Census Area	37,891	$2,138	5.6%	$7,706	20.3%
Lake and Peninsula Borough	34,784	$2,138	6.1%	$7,706	22.2%
Overall	$39,115	$2,138	5.5%	$7,706	19.7%

[1] Estimated average personal income of PPD-eligible residents

Source: IHS Markit analysis of 2020 US Census data

Economic impacts of PPD payments during the Operations Phase (Year 1 - Year 20)				
Scenario	PPD Payment	Sales Impact	Employment Impact	Wage Impact
Proposed Project	$10.9M	$3.7M	21	$1.2M
Year 5 Expansion Project	$39.1M	$13.4M	76	$4.4M

Source: IHS Markit

[9], the PPD payments could provide the borough with significant fiscal resources to further its economic development. In addition, the severance taxes collected by the Lake and Peninsula Borough would average $23.8 million annually—$476 million cumulatively—in the Proposed Project scenario. These figures rise to $45.2 million annually and $903.3 million cumulatively during the first 20 years of the Year 5 Expansion.

While the PPD and severance tax payments hold the potential of being economic stimulators in the region, an analysis of how these payments would be applied within the communities (and the follow-on economic impacts) was not conducted as part of this study.

[9] Source: Lake and Peninsula Borough Annual Proposed Budget Fiscal Year 2021

Economic impact assessment results

IHS Markit modelled the impacts of the Proposed Project and the Year 5 Expansion. The former reflects the least capital-intensive plan, while the latter reflects the most capital-intensive plan. Thus, comparing the results provides a range of expected economic contributions from developing the Pebble project.

Key findings include:

- The Initial Capital Phase would support 12,569 jobs across the United States, almost half of which (49%) would be filled by Alaskans. While many of the remaining workers would migrate to Alaska during this 4.5-year period, much of the wages earned are expected to be remitted back to their home states. This shifts some of the impacts from Alaska to these home states.
- Sourcing of fuel and supply barge activity is expected to be centered in Washington, which accounts for the relatively strong accrual of economic contributions in the west coast states, especially during the Initial Capital Phase. More detailed results for Washington, Oregon, and California are included in Appendix A.
- Purchases of specialized mining equipment is expected to flow towards midwestern states such as Illinois during the Initial Capital Phase, resulting in over 38% of the jobs supported during this phase accruing to this Rest of US region.
- During the Operations phase, operating expenditures and sustaining capital spending shifts towards supporting day-to-day operations in Alaska and purchases of consumables such as grinding media, reagents, and steel from the Rest of the US region. Thus, in the Proposed Project scenario, the job impacts would taper down to just under 5,700. Annual spending on consumables and power would be approximately $300 million for the Proposed Project and $450 million for the expansion scenario.

  This is not the case in the Year 5 Expansion. The build-out required to bring expanded capacity and the gold plant online would bring annual average employment contributions close to 13,800 in the Year 1 – Year 5 period. In the Year 6 – 20 time horizon, the expanded output of the Pebble Project would annually support almost 12,800 jobs across the United States.
- Comparing both scenarios during the Year 6 – Year 20 time horizon, higher mine production levels coupled with the addition of the gold plant would result in a significant scaling up of the economic contributions. The employment contributions to Alaska would be about 90% higher under this development scenario, while the overall employment contributions to the United States would be 125% higher. Contributions to GDP would more than double.
- Across all jobs supported during Year 6 – Year 20 of the Operations Phase would receive wages totaling $461.1 million annually under the Proposed Project and $1,018.6 million under the Year 5 Expansion. This indicates an annual average wage of about $80,000, almost 40% higher than the US annual average wage of $57,300. IHS Markit estimated direct workers in the mine would receive annual wages of $115,000.

Average Annual Economic Impact Summary		Initial Capital	Proposed Project Operations Phase		Year 5 Expansion Operations Phase	
Metric	Region	All Scenarios	Year 1 - Year 5	Year 6 - Year 20	Year 1 - Year 5	Year 6 - Year 20
Jobs	Alaska	6,166	4,087	4,018	9,738	7,621
	Washington, Oregon,and California	1,591	493	511	984	1,163
	Rest of US	4,811	1,117	1,138	3,041	3,989
	Total	**12,569**	**5,698**	**5,667**	**13,763**	**12,774**
Economic Activity (Output)	Value of Production (accrues to Alaska)		$1,813.0M	$1,759.0M	$2,285.7M	$3,688.2M
	Supply Chain and Induced Activity:					
	Alaska	$973.9M	$748.6M	$744.3M	$1,494.1M	$1,296.8M
	Washington, Oregon,and California	$392.0M	$159.5M	$165.5M	$294.6M	$371.6M
	Rest of US	$1,106.9M	$277.9M	$280.9M	$775.7M	$953.8M
	Total	**$2,472.8M**	**$2,999.0M**	**$2,949.7M**	**$4,850.1M**	**$6,310.5M**
Gross Domestic Product or Gross State Product (Value Added)	From Mine Production (accrues to Alaska)		$1,249.6M	$1,171.3M	$1,627.2M	$2,499.2M
	Supply Chain and Induced Activity:					
	Alaska	$513.3M	$422.1M	$419.4M	$806.6M	$692.6M
	Washington, Oregon,and California	$176.6M	$61.6M	$64.0M	$117.4M	$146.3M
	Rest of US	$510.1M	$124.8M	$126.5M	$348.6M	$441.8M
	Total	**$1,200.0M**	**$1,858.1M**	**$1,781.1M**	**$2,899.7M**	**$3,779.9M**
Labor Income	Alaska	$456.9M	$335.4M	$330.9M	$765.2M	$624.1M
	Washington, Oregon,and California	$119.4M	$43.2M	$44.8M	$81.5M	$101.0M
	Rest of US	$339.8M	$84.0M	$85.5M	$226.1M	$293.4M
	Total	**$916.1M**	**$462.7M**	**$461.1M**	**$1,072.8M**	**$1,018.6M**
Taxes (from operations and supply chian activity)	State Taxes					
	Alaska	$29.6M	$24.7M	$72.6M	$29.5M	$151.7M
	Washington, Oregon,and California	$17.3M	$5.7M	$5.9M	$9.6M	$13.7M
	Rest of US	$38.5M	$9.6M	$9.7M	$29.2M	$35.2M
	Extraction Taxes and Royalties		$37.8M	$85.9M	$44.8M	$173.0M
	Federal Taxes	$170.5M	$65.2M	$153.3M	$114.6M	$356.7M
	Total	**$256.0M**	**$143.1M**	**$327.4M**	**$227.8M**	**$730.3M**

Source: IHS Markit

Taxes

NDM shared with IHS Markit the models used for its PEA submission that estimated the taxes, fees, and royalties generated by the various Pebble Project development scenarios. The results for the Proposed Project and the Year 5 Expansion are summarized below. As these two scenarios represent the lowest and highest investment and production activity, these results provide an expected range of taxes that would be generated by the Pebble Project: $43.9 million to $51.6 million annually, on average, during the Year 1 – Year 5 time horizon. As expanded capacity and the gold plant come online, the total taxes generated by the Year 5 Expansion rise to $469.0 million versus $225.6 million for the Proposed Project. The state and local taxes would average $135.3 million and $277.0 million.

Taxes generated from operations	Proposed Project				Year 5 Expansion			
Millions of USD	**Y1 to Y5**	**Annual Average**	**Y6 to Y20**	**Annual Average**	**Y1 to Y5**	**Annual Average**	**Y6 to Y20**	**Annual Average**
Corporate income taxes								
Federal income taxes	$19.8	$4.0	$1,355.1	$90.3	$21.8	$4.4	$2,880.0	$192.0
State income taxes	$10.7	$2.1	$739.7	$49.3	$11.8	$2.4	$1,558.8	$103.9
Total, Corporate Income Taxes	**$30.5**	**$6.1**	**$2,094.9**	**$139.7**	**$33.6**	**$6.7**	**$4,438.8**	**$295.9**
Extraction taxes and royalties								
Alaska Mining License	$44.4	$8.9	$641.2	$42.7	$46.8	$9.4	$1,272.8	$84.9
Municipal Severence Tax	$121.7	$24.3	$354.3	$23.6	$153.2	$30.6	$750.1	$50.0
Alaska State Royalty Taxes	$19.6	$3.9	$283.3	$18.9	$20.7	$4.1	$562.4	$37.5
Borough Taxes	$3.5	$0.7	$9.8	$0.7	$3.5	$0.7	$10.5	$0.7
Total, extraction taxes and royalties	**$189.1**	**$37.8**	**$1,288.7**	**$85.9**	**$224.2**	**$44.8**	**$2,595.7**	**$173.0**
Grand total, taxes	**$219.7**	**$43.9**	**$3,383.6**	**$225.6**	**$257.8**	**$51.6**	**$7,034.6**	**$469.0**

Source: IHS Markit

NDM's spending with local suppliers and the induced activity of workers re-spending wages also generates tax revenues. During the Initial Capital Phase, the taxes amount to $256.0 million annually, with about 1/3 flowing to state economies and 2/3 flowing to the federal government. During the Operations Phase, the state and local taxes generated by supply chain and induced activity during Year 1 - Year 5 would range from $37.9 million (Proposed Project) to $65.9 million (Year 5 Expansion). During the Year 6 – Year 20 time frame, the generated state and local taxes would rise slightly to $38.9 million for the Proposed Project; the Year 5 Expansion would see taxes increase 47% to $96.6 million.

Annual average taxes from supply chain and induced impacts	Proposed Project				Year 5 Expansion			
	Year 1 - Year 5		Year 6 - Year 20		Year 1 - Year 5		Year 6 - Year 20	
Millions of USD	State & Local	Federal	State & Local	Federal	State & Local	Federal	State & Local	Federal
Alaska	$22.6	$40.9	$23.3	$42.2	$27.1	$53.1	$47.8	$93.6
Washington	$5.0	$4.9	$5.2	$5.2	$8.4	$9.3	$12.4	$13.7
Oregon	$0.2	$0.5	$0.2	$0.5	$0.4	$0.9	$0.5	$1.1
California	$0.5	$0.7	$0.5	$0.7	$0.8	$1.3	$0.8	$1.2
Rest of US	$9.6	$14.3	$9.7	$14.4	$29.2	$45.6	$35.2	$55.1
Total	**$37.9**	**$61.3**	**$38.9**	**$62.9**	**$65.9**	**$110.3**	**$96.6**	**$164.7**

Source: IHS Markit

Combining the taxes generated from the Pebble Mine with the taxes generated by supply chain and induced activity during Year 6 – Year 20 yields annual state and local taxes of $174.2 million for the Proposed Project and $373.6 million for the Year 5 Expansion.

Looking Beyond the Initial Permitting Period

Though the initial Permitting Period is 20 years, the potential life of any of the potential expansion scenarios is significantly longer. The Year 5 Expansion scenario assessed in this study is expected to have the potential to process 270,000 tons per day through Year 90[10]. Open pit mining is expected to cease in Year 70, after which lower grade material, which will have been stockpiled, will be processed through Year 90. The initial phase of mine closure will commence during that 20-year period and continue after the stockpiles have been exhausted.

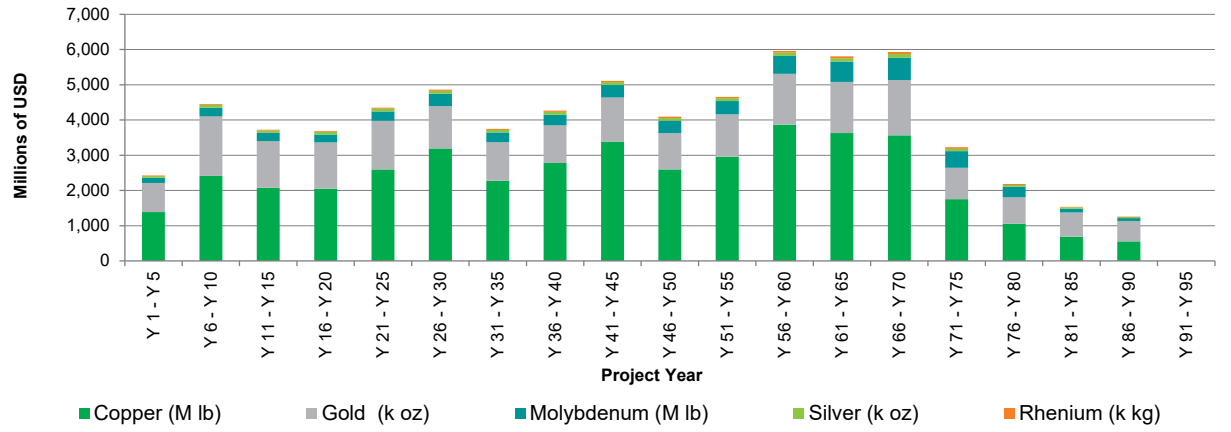
Assuming permits were granted that allow the mine to continue operating at 270,000 tons per day, the operating expenditures and sustaining capital would remain relatively stable. Indeed, the combined annual average operating expenditures and sustaining capital for Year 21 through Year 70 of $1.65 billion is nearly the same as the $1.64 billion for the Year 5 through Year 20 period. This implies that the expected economic contributions to employment and wages would remain relatively stable around 12,800 jobs and $1.1 billion, respectively.

The following chart shows the expected annual average value of production for the Year 5 Expansion scenario in five-year intervals for the entire life of the mine, based on the average mineral process NDM

[10] The potential expansion scenarios, which are based on extraction via an optimized open pit, recover approximately 8.6 billion tons of measured, indicated, and inferred mineral resources. The total measured, indicated, and inferred resources are approximately 12 billion tons. Future analysis may indicate the potential to mine the remaining mineral resources, which would extend the mine life beyond that estimated in the potential expansion scenarios. Other zones of mineralization have been identified but insufficient analysis has been completed to determine if these zones might be converted to mineral resources.

used in its PEA submission. Approximately 80% of the cumulative value of production would occur after Initial Permitting Period ends in Year 20.

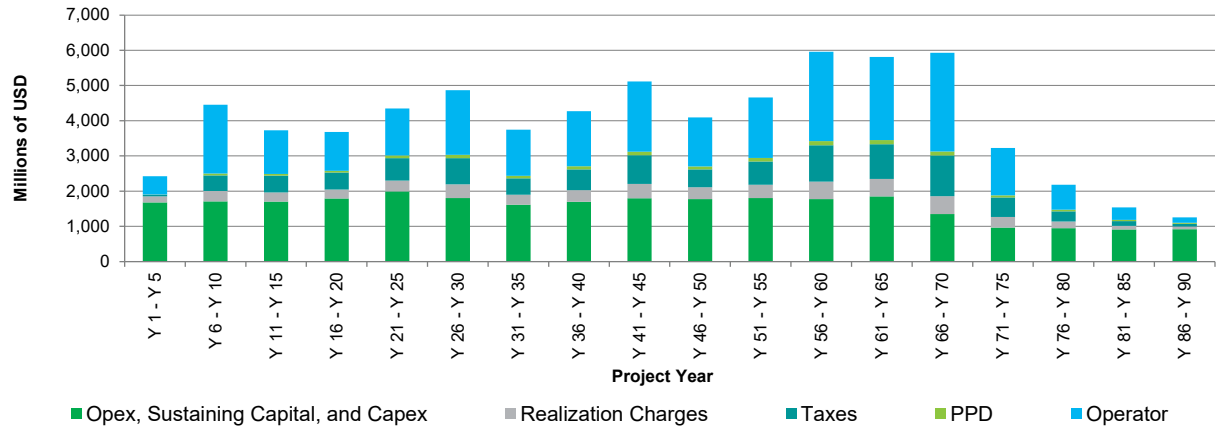
Average annual value of production (annual average, $M)



Source: IHS Markit

The value of production would flow to the Pebble Mine's key stakeholders, including state and local tax authorities, Bristol Bay residents (via the PPD), suppliers, and investors (through dividends and distributions paid by the operator). An analysis of these flows shows that about 86% of the cumulative tax payments and PPD distributions and 82% of the operator's take would occur after the initial Permitting Period. Over the life of the mine, 47.2% of the value would flow to suppliers, 16% to taxes payments and PPD distributions, and 36.8% to the operator.

Distribution of value of production (annual average, $M)



Source: IHS Markit

Appendix A: Detailed results

Economic Impact Summary: Proposed Project		Initial Capital	Operations Phase (opex plus sustaning capital)	
Region	**Metric**	**All scenarios**	**Year 1 - Year 5**	**Year 6 - Year 20**
Alaska	**Jobs**	**6,166**	**4,087**	**4,018**
	From Mine Operations		794	828
	Direct Supply Chain	3,718	1,434	1,345
	Indirect Supply Chain	904	580	575
	Induced Activity	1,544	1,279	1,270
	Economic Activity (Output)	**$973.9M**	**$2,561.6M**	**$2,503.4M**
	From Mine Operations		$1,813.0M	$1,759.0M
	Direct Supply Chain	$536.6M	$405.1M	$402.2M
	Indirect Supply Chain	$183.3M	$137.7M	$138.0M
	Induced Activity	$254.0M	$205.9M	$204.1M
	GDP/GSP (Value Added)	**$513.3M**	**$1,671.7M**	**$1,590.6M**
	From Mine Operations		$1,249.6M	$1,171.3M
	Direct Supply Chain	$258.8M	$228.9M	$227.3M
	Indirect Supply Chain	$100.1M	$73.6M	$73.8M
	Induced Activity	$154.5M	$119.5M	$118.3M
	Labor Income	**$456.9M**	**$335.4M**	**$330.9M**
	From Mine Operations		$91.3M	$95.1M
	Direct Supply Chain	$312.8M	$131.4M	$123.6M
	Indirect Supply Chain	$59.3M	$40.4M	$40.3M
	Induced Activity	$84.9M	$72.4M	$72.0M
Washington	**Jobs**	**1,106**	**302**	**313**
	From Mine Operations		53	56
	Direct Supply Chain	513	61	59
	Indirect Supply Chain	318	91	97
	Induced Activity	275	97	101
	Economic Activity (Output)	**$313.9M**	**$138.4M**	**$144.3M**
	Direct Supply Chain	$185.4M	$93.6M	$96.9M
	Indirect Supply Chain	$77.5M	$26.8M	$28.5M
	Induced Activity	$51.0M	$18.1M	$18.8M
	GDP/GSP (Value Added)	**$132.9M**	**$50.4M**	**$52.6M**
	Direct Supply Chain	$58.5M	$25.7M	$26.6M
	Indirect Supply Chain	$42.3M	$13.8M	$14.7M
	Induced Activity	$32.1M	$10.9M	$11.3M
	Labor Income	**$82.4M**	**$26.1M**	**$27.1M**
	From Mine Operations		$6.1M	$6.3M
	Direct Supply Chain	$39.5M	$6.8M	$6.9M
	Indirect Supply Chain	$26.1M	$7.0M	$7.5M
	Induced Activity	$16.9M	$6.2M	$6.4M
Oregon	**Jobs**	**355**	**106**	**110**
	From Mine Operations		53	56
	Direct Supply Chain	194	4	4
	Indirect Supply Chain	53	1	1
	Induced Activity	108	47	49
	Economic Activity (Output)	**$50.5M**	**$8.6M**	**$8.7M**
	Direct Supply Chain	$24.2M	$0.8M	$0.7M
	Indirect Supply Chain	$9.5M	$0.3M	$0.2M
	Induced Activity	$16.7M	$7.5M	$7.7M
	GDP/GSP (Value Added)	**$27.4M**	**$4.7M**	**$4.8M**
	Direct Supply Chain	$12.2M	$0.4M	$0.4M
	Indirect Supply Chain	$5.2M	$0.1M	$0.1M
	Induced Activity	$10.0M	$4.1M	$4.3M
	Labor Income	**$25.4M**	**$9.3M**	**$9.6M**
	From Mine Operations		$6.1M	$6.3M
	Direct Supply Chain	$16.0M	$0.4M	$0.4M
	Indirect Supply Chain	$3.8M	$0.1M	$0.1M
	Induced Activity	$5.7M	$2.8M	$2.9M

Source: IHS Markit

Economic Impact Summary: Proposed Project		Initial Capital	Operations Phase (opex plus sustaining capital)	
Region	**Metric**	**All scenarios**	**Year 1 - Year 5**	**Year 6 - Year 20**
California	**Jobs**	**130**	**85**	**88**
	From Mine Operations		32	34
	Direct Supply Chain	56	7	7
	Indirect Supply Chain	33	13	12
	Induced Activity	42	33	34
	Economic Activity (Output)	**$27.7M**	**$12.5M**	**$12.5M**
	Direct Supply Chain	$13.8M	$3.2M	$3.1M
	Indirect Supply Chain	$6.1M	$2.9M	$2.9M
	Induced Activity	$7.8M	$6.4M	$6.5M
	GDP/GSP (Value Added)	**$16.4M**	**$6.5M**	**$6.6M**
	Direct Supply Chain	$7.8M	$1.4M	$1.3M
	Indirect Supply Chain	$3.7M	$1.4M	$1.4M
	Induced Activity	$4.9M	$3.8M	$3.9M
	Labor Income	**$11.5M**	**$7.8M**	**$8.0M**
	From Mine Operations		$3.7M	$3.8M
	Direct Supply Chain	$6.3M	$0.8M	$0.8M
	Indirect Supply Chain	$2.6M	$1.0M	$1.0M
	Induced Activity	$2.7M	$2.4M	$2.4M
Rest of US	**Jobs**	**4,811**	**1,117**	**1,138**
	From Mine Operations		85	89
	Direct Supply Chain	1,646	263	271
	Indirect Supply Chain	1,302	301	303
	Induced Activity	1,863	467	476
	Economic Activity (Output)	**$1,106.9M**	**$277.9M**	**$280.9M**
	Direct Supply Chain	$417.2M	$98.6M	$99.2M
	Indirect Supply Chain	$360.5M	$95.5M	$96.3M
	Induced Activity	$329.2M	$83.8M	$85.3M
	GDP/GSP (Value Added)	**$510.1M**	**$124.8M**	**$126.5M**
	Direct Supply Chain	$161.8M	$37.2M	$37.7M
	Indirect Supply Chain	$163.6M	$41.3M	$41.7M
	Induced Activity	$184.7M	$46.3M	$47.1M
	Labor Income	**$339.8M**	**$84.0M**	**$85.5M**
	From Mine Operations		$9.7M	$10.1M
	Direct Supply Chain	$134.8M	$24.4M	$24.9M
	Indirect Supply Chain	$100.0M	$23.0M	$23.1M
	Induced Activity	$105.0M	$26.9M	$27.4M
Total	**Jobs**	**12,569**	**5,698**	**5,667**
	From Mine Operations		1,017	1,063
	Direct Supply Chain	6,127	1,771	1,686
	Indirect Supply Chain	2,610	986	988
	Induced Activity	3,832	1,924	1,929
	Economic Activity (Output)	**$2,472.8M**	**$2,999.0M**	**$2,949.7M**
	From Mine Operations		$1,813.0M	$1,759.0M
	Direct Supply Chain	$1,177.2M	$601.3M	$602.2M
	Indirect Supply Chain	$636.9M	$263.2M	$266.1M
	Induced Activity	$658.8M	$321.6M	$322.5M
	GDP/GSP (Value Added)	**$1,200.0M**	**$1,858.1M**	**$1,781.1M**
	From Mine Operations		$1,249.6M	$1,171.3M
	Direct Supply Chain	$499.0M	$293.6M	$293.4M
	Indirect Supply Chain	$314.7M	$130.3M	$131.6M
	Induced Activity	$386.2M	$184.6M	$184.8M
	Labor Income	**$916.1M**	**$462.7M**	**$461.1M**
	From Mine Operations		$116.8M	$121.7M
	Direct Supply Chain	$509.3M	$163.8M	$156.5M
	Indirect Supply Chain	$191.8M	$71.5M	$71.9M
	Induced Activity	$215.1M	$110.6M	$111.0M

Source: IHS Markit

Economic Impact Summary: Year 5 Expansion		Initial Capital	Operations Phase (opex plus sustaning capital)	
Region	**Metric**	**All scenarios**	**Year 1 - Year 5**	**Year 6 - Year 20**
Alaska	**Jobs**	**6,166**	**9,738**	**7,621**
	From Mine Operations		928	1,672
	Direct Supply Chain	3,718	4,858	2,559
	Indirect Supply Chain	904	1,196	976
	Induced Activity	1,544	2,756	2,414
	Economic Activity (Output)	**$973.9M**	**$3,779.8M**	**$4,985.1M**
	From Mine Operations		$2,285.7M	$3,688.2M
	Direct Supply Chain	$536.6M	$776.2M	$658.2M
	Indirect Supply Chain	$183.3M	$269.9M	$251.0M
	Induced Activity	$254.0M	$448.0M	$387.6M
	GDP/GSP (Value Added)	**$513.3M**	**$2,433.8M**	**$3,191.8M**
	From Mine Operations		$1,627.2M	$2,499.2M
	Direct Supply Chain	$258.8M	$395.9M	$335.6M
	Indirect Supply Chain	$100.1M	$144.9M	$133.2M
	Induced Activity	$154.5M	$265.8M	$223.8M
	Labor Income	**$456.9M**	**$765.2M**	**$624.1M**
	From Mine Operations		$106.7M	$192.3M
	Direct Supply Chain	$312.8M	$423.7M	$225.6M
	Indirect Supply Chain	$59.3M	$80.9M	$69.2M
	Induced Activity	$84.9M	$153.9M	$137.1M
Washington	**Jobs**	**1,106**	**713**	**775**
	From Mine Operations		62	112
	Direct Supply Chain	513	259	187
	Indirect Supply Chain	318	187	235
	Induced Activity	275	204	241
	Economic Activity (Output)	**$313.9M**	**$259.6M**	**$331.9M**
	Direct Supply Chain	$185.4M	$171.8M	$219.4M
	Indirect Supply Chain	$77.5M	$49.7M	$67.5M
	Induced Activity	$51.0M	$38.1M	$44.9M
	GDP/GSP (Value Added)	**$132.9M**	**$99.5M**	**$124.7M**
	Direct Supply Chain	$58.5M	$49.7M	$62.4M
	Indirect Supply Chain	$42.3M	$26.4M	$35.0M
	Induced Activity	$32.1M	$23.4M	$27.3M
	Labor Income	**$82.4M**	**$58.0M**	**$66.1M**
	From Mine Operations		$7.1M	$12.8M
	Direct Supply Chain	$39.5M	$23.6M	$19.7M
	Indirect Supply Chain	$26.1M	$14.4M	$18.3M
	Induced Activity	$16.9M	$12.8M	$15.3M
Oregon	**Jobs**	**355**	**152**	**225**
	From Mine Operations		62	112
	Direct Supply Chain	194	18	10
	Indirect Supply Chain	53	8	3
	Induced Activity	108	64	100
	Economic Activity (Output)	**$50.5M**	**$16.2M**	**$18.4M**
	Direct Supply Chain	$24.2M	$4.5M	$1.9M
	Indirect Supply Chain	$9.5M	$1.7M	$0.6M
	Induced Activity	$16.7M	$10.1M	$15.9M
	GDP/GSP (Value Added)	**$27.4M**	**$8.3M**	**$10.1M**
	Direct Supply Chain	$12.2M	$1.8M	$1.0M
	Indirect Supply Chain	$5.2M	$0.9M	$0.3M
	Induced Activity	$10.0M	$5.6M	$8.7M
	Labor Income	**$25.4M**	**$12.9M**	**$19.8M**
	From Mine Operations		$7.1M	$12.8M
	Direct Supply Chain	$16.0M	$1.5M	$0.9M
	Indirect Supply Chain	$3.8M	$0.6M	$0.2M
	Induced Activity	$5.7M	$3.7M	$5.9M

Source: IHS Markit

Economic Impact Summary: Year 5 Expansion		Initial Capital	Operations Phase (opex plus sustaining capital)	
Region	**Metric**	**All scenarios**	**Year 1 - Year 5**	**Year 6 - Year 20**
California	**Jobs**	**130**	**119**	**164**
	From Mine Operations		38	67
	Direct Supply Chain	56	18	14
	Indirect Supply Chain	33	19	17
	Induced Activity	42	44	65
	Economic Activity (Output)	**$27.7M**	**$18.8M**	**$21.4M**
	Direct Supply Chain	$13.8M	$6.0M	$4.8M
	Indirect Supply Chain	$6.1M	$4.4M	$4.0M
	Induced Activity	$7.8M	$8.4M	$12.5M
	GDP/GSP (Value Added)	**$16.4M**	**$9.6M**	**$11.5M**
	Direct Supply Chain	$7.8M	$2.5M	$2.2M
	Indirect Supply Chain	$3.7M	$2.1M	$1.9M
	Induced Activity	$4.9M	$5.0M	$7.4M
	Labor Income	**$11.5M**	**$10.6M**	**$15.1M**
	From Mine Operations		$4.3M	$7.7M
	Direct Supply Chain	$6.3M	$1.7M	$1.4M
	Indirect Supply Chain	$2.6M	$1.5M	$1.4M
	Induced Activity	$2.7M	$3.1M	$4.7M
Rest of US	**Jobs**	**4,811**	**3,041**	**3,989**
	From Mine Operations		99	179
	Direct Supply Chain	1,646	819	1,159
	Indirect Supply Chain	1,302	877	1,032
	Induced Activity	1,863	1,245	1,620
	Economic Activity (Output)	**$1,106.9M**	**$775.7M**	**$953.8M**
	Direct Supply Chain	$417.2M	$290.6M	$347.4M
	Indirect Supply Chain	$360.5M	$263.5M	$317.7M
	Induced Activity	$329.2M	$221.5M	$288.8M
	GDP/GSP (Value Added)	**$510.1M**	**$348.6M**	**$441.8M**
	Direct Supply Chain	$161.8M	$110.0M	$142.7M
	Indirect Supply Chain	$163.6M	$115.1M	$138.6M
	Induced Activity	$184.7M	$123.5M	$160.5M
	Labor Income	**$339.8M**	**$226.1M**	**$293.4M**
	From Mine Operations		$11.4M	$20.5M
	Direct Supply Chain	$134.8M	$76.6M	$102.6M
	Indirect Supply Chain	$100.0M	$67.3M	$77.8M
	Induced Activity	$105.0M	$70.8M	$92.4M
Total	**Jobs**	**12,569**	**13,763**	**12,774**
	From Mine Operations		1,189	2,142
	Direct Supply Chain	6,127	5,972	3,928
	Indirect Supply Chain	2,610	2,287	2,263
	Induced Activity	3,832	4,314	4,441
	Economic Activity (Output)	**$2,472.8M**	**$4,850.1M**	**$6,310.5M**
	From Mine Operations		$2,285.7M	$3,688.2M
	Direct Supply Chain	$1,177.2M	$1,249.2M	$1,231.8M
	Indirect Supply Chain	$636.9M	$589.1M	$640.8M
	Induced Activity	$658.8M	$726.1M	$749.7M
	GDP/GSP (Value Added)	**$1,200.0M**	**$2,899.7M**	**$3,779.9M**
	From Mine Operations		$1,627.2M	$2,499.2M
	Direct Supply Chain	$499.0M	$559.8M	$543.8M
	Indirect Supply Chain	$314.7M	$289.4M	$309.0M
	Induced Activity	$386.2M	$423.4M	$427.8M
	Labor Income	**$916.1M**	**$1,072.8M**	**$1,018.6M**
	From Mine Operations		$136.5M	$246.1M
	Direct Supply Chain	$509.3M	$527.2M	$350.3M
	Indirect Supply Chain	$191.8M	$164.8M	$166.9M
	Induced Activity	$215.1M	$244.3M	$255.3M

Source: IHS Markit

Annual average taxes from supply chain and induced impacts	Proposed Project				Year 5 Expansion			
	Year 1 - Year 5		Year 6 - Year 20		Year 1 - Year 5		Year 6 - Year 20	
Millions of USD	State & Local	Federal	State & Local	Federal	State & Local	Federal	State & Local	Federal
Alaska	$22.6	$40.9	$23.3	$42.2	$27.1	$53.1	$47.8	$93.6
Washington	$5.0	$4.9	$5.2	$5.2	$8.4	$9.3	$12.4	$13.7
Oregon	$0.2	$0.5	$0.2	$0.5	$0.4	$0.9	$0.5	$1.1
California	$0.5	$0.7	$0.5	$0.7	$0.8	$1.3	$0.8	$1.2
Rest of US	$9.6	$14.3	$9.7	$14.4	$29.2	$45.6	$35.2	$55.1
Total	**$37.9**	**$61.3**	**$38.9**	**$62.9**	**$65.9**	**$110.3**	**$96.6**	**$164.7**

Source: IHS Markit

Taxes generated from operations	Proposed Project				Year 5 Expansion			
Millions of USD	**Y1 to Y5**	**Annual Average**	**Y6 to Y20**	**Annual Average**	**Y1 to Y5**	**Annual Average**	**Y6 to Y20**	**Annual Average**
Corporate income taxes								
Federal income taxes	$19.8	$4.0	$1,355.1	$90.3	$21.8	$4.4	$2,880.0	$192.0
State income taxes	$10.7	$2.1	$739.7	$49.3	$11.8	$2.4	$1,558.8	$103.9
Total, Corporate Income Taxes	**$30.5**	**$6.1**	**$2,094.9**	**$139.7**	**$33.6**	**$6.7**	**$4,438.8**	**$295.9**
Extraction taxes and royalties								
Alaska Mining License	$44.4	$8.9	$641.2	$42.7	$46.8	$9.4	$1,272.8	$84.9
Municipal Severence Tax	$121.7	$24.3	$354.3	$23.6	$153.2	$30.6	$750.1	$50.0
Alaska State Royalty Taxes	$19.6	$3.9	$283.3	$18.9	$20.7	$4.1	$562.4	$37.5
Borough Taxes	$3.5	$0.7	$9.8	$0.7	$3.5	$0.7	$10.5	$0.7
Total, extraction taxes and royalties	**$189.1**	**$37.8**	**$1,288.7**	**$85.9**	**$224.2**	**$44.8**	**$2,595.7**	**$173.0**
Grand total, taxes	**$219.7**	**$43.9**	**$3,383.6**	**$225.6**	**$257.8**	**$51.6**	**$7,034.6**	**$469.0**

Source: IHS Markit

Appendix B: Pebble Project definitions

Term	Definition
Northern Dynasty	Shortened form for Northern Dynasty Minerals Ltd., ultimate owner of the Pebble Project.
Pebble Partnership	Shortened form for Pebble Limited Partnership, the subsidiary of Northern Dynasty that actually holds the Pebble claims through subsidiaries and would be the entity that builds and operates the project.
Pebble Project	The full range of the Pebble project, including the resource, mining, processing, site and transportation infrastructure, construction, operations, and closure.
Proposed Project	The development plan submitted by Pebble Partnership for permitting. This plan envisions the extraction of 1.3 billion tons of the resource, milling at a rate of 180,000 tons per day over a 20-year mine life.
Base Case	Proposed Project, incorporating infrastructure and precious metal streaming partners, as assessed in the 2021 PEA.
Full Capital Case	Proposed Project, with no infrastructure and precious metal streaming partners, as assessed in the 2021 PEA.
USACE	US Army Corps of Engineers.
FEIS	Final Environmental Impact Statement issued by USACE following their NEPA review of the Proposed Project.
NI 43-101	National Instrument 43-101 Standards of Disclosure for Mineral Properties (“NI 43-101”) is a rule developed by the Canadian Securities Administrators that establishes standards for all public disclosure an issuer makes of scientific and technical information concerning mineral projects, including any estimates of mineral reserves and resources. As a primary issuer in Canada, Northern Dynasty is subject to NI 43-101.
2021 PEA	Preliminary Economic Assessment completed in accordance with 43-101, evaluating the Proposed Project and Potential Expansion Scenarios. Effective date Sept 9, 2021.
Potential Expansion Scenarios	Scenarios to the Proposed Project evaluated in the 2021 PEA. Included expansions to 270,000 tons per day processing rate in Years 5 and 10 and to 250,000 tons per day in Year 21. The Potential Expansion Scenarios were tested with and without a gold plant installed in Year 5, as was the Proposed Project.
NPI	Net Profits Interest, in the case of Pebble, applied to instruments into which Pebble pays based on the definition of net profits, but typically including initial and sustaining capital costs, operating expenditures, taxes, royalties, etc.
Teck NPI	Net Profits Interest held by Teck Resources Limited (Teck) incorporated in the agreement by which Northern Dynasty acquired the Pebble Project.
Pebble Performance Dividend Fund NPI	Net Profits Interest which defines funds contributed by the Pebble Project into the Pebble Performance Dividend Fund, which is available to residents of southwest Alaska who have enrolled in the fund.

Appendix C: Key data from the PEA

The analysis conducted by IHS Markit for this study relied upon mine plans and forecasts described in the report entitled "Preliminary Economic Assessment NI 43-101 Technical Report, Pebble Project, Alaska, USA," effective date September 9, 2021, by Robin Kalanchey, P.Eng., Ausenco, Hassan Ghaffari, P.Eng., Tetra Tech, Sabry Abdel Hafez, P.Eng., Tetra Tech, Les Galbraith, P.Eng., P.E., Knight Piesold, J. David Gaunt, P.Geo., Hunter Dickinson Services, Eric Titley, P.Geo., Hunter Dickinson Services, Stephen Hodgson, P.Eng., Hunter Dickinson Services and James Lang, P.Geo., JM Lang Professional Consulting (2021 PEA). Stephen Hodgson, P.Eng., a qualified person who is not independent of NDM, reviewed and approved the technical information. The PEA posted on the NDM website: www.northerndynastyminerals.com.

The 2021 PEA is based on an August 2020 mineral resource estimate[11] at a 0.30% copper equivalent cut-off:

- 6.5 billion tonnes in the combined **Measured and Indicated** categories at a grade of 0.40% copper, 0.34 g/t gold, 240 ppm molybdenum, 1.7 g/t silver and 0.41 ppm rhenium (containing 57 billion pounds of copper, 71 million ounces of gold, 3.4 billion pounds of molybdenum, 345 million ounces of silver and 2.6 million kilograms of rhenium), including 0.53 billion tonnes of **Measured** at a grade of 0.33% copper, 0.35 g/t gold, 178 ppm molybdenum, 1.7 g/t silver and 0.32 ppm rhenium and 5.9 billion tonnes of **Indicated** at a grade of 0.41% copper, 0.34 g/t gold, 246 ppm molybdenum, 1.7 g/t silver and 0.41 ppm rhenium, and
- 4.5 billion tonnes in the **Inferred** category at a grade of 0.25% copper, 0.25 g/t gold, 226 ppm molybdenum, 1.2 g/t silver and 0.36 ppm (containing 25 billion pounds of copper, 36 million ounces of gold, 2.2 billion pounds of molybdenum, 170 million ounces of silver and 1.6 million kilograms of rhenium).

U.S. dollars, U.S. standard units and long-term metal prices (US$):

- copper $3.50/lb
- gold $1,600/oz
- molybdenum $10/lb
- silver $22/oz
- rhenium $1,500/kg are used in the 2021 PEA unless otherwise indicated.

The Proposed Project evaluated in the 2021 PEA is a compact open pit mine feeding a conventional 180,000 tons per day (Tpd) copper flotation concentrator. It would be capable of processing 1.3 billion tons of mineralized material over 20 years of mining at a strip ratio of 0.12:1. The Proposed Project reflects industry-leading tailings, waste and water management strategies proposed by the Pebble Partnership, as evaluated by the USACE in the Pebble Environmental Impact Statement, as well as power and transportation infrastructure necessary for developing operating and closing the proposed mine.

[11] David Gaunt, P.Geo., is responsible for the mineral resource estimate. Copper equivalent (CuEQ) calculations use metal prices: US$1.85/lb for copper, US$902/oz for gold and US$12.50/lb for molybdenum, and recoveries: 85% copper, 69.6% gold, and 77.8% molydenum (Pebble West zone) and 89.3% copper, 76.8% gold, 83.7% molydenum (Pebble East zone). Contained metal calculations are based on 100% recoveries. A 0.30% CuEQ cut-off is considered to be appropriate for porphyry deposit open pit mining operations in the Americas.

The three potential expansion scenarios examined in the 2021 PEA were modeled on a concept identified by the Pebble Partnership in a request for information submission to the USACE during the federal permitting process. The first Potential Expansion Scenario evaluated would expand the Pebble process plant from 180,000 to 250,000 Tpd following the 20-year project life envisioned in the Proposed Project, with subsequent mining and processing of an additional 6.3 billion tons of mineralized material. The second and third evaluated Potential Expansion Scenarios would expand the Pebble process plant to 270,000 Tpd in Production Year 10 and Production Year 5 of open pit production under the Proposed Project, respectively. All three Potential Expansion Scenarios process the same volume of mineralized material over the life of mine – 8.6 billion tons. Any future expansion would require separate federal and state permitting.[12]

All cases include infrastructure outsourcing and gold streaming. Infrastructure outsourcing, gold streaming and the addition of an onsite gold plant have been examined in the 2021 PEA because Northern Dynasty believes this to be the most likely development outcome for the Pebble Project over time. Although Northern Dynasty does not have any arrangements or commitments for infrastructure outsourcing or gold streaming in place, it is considered to be a realistic potential outcome.

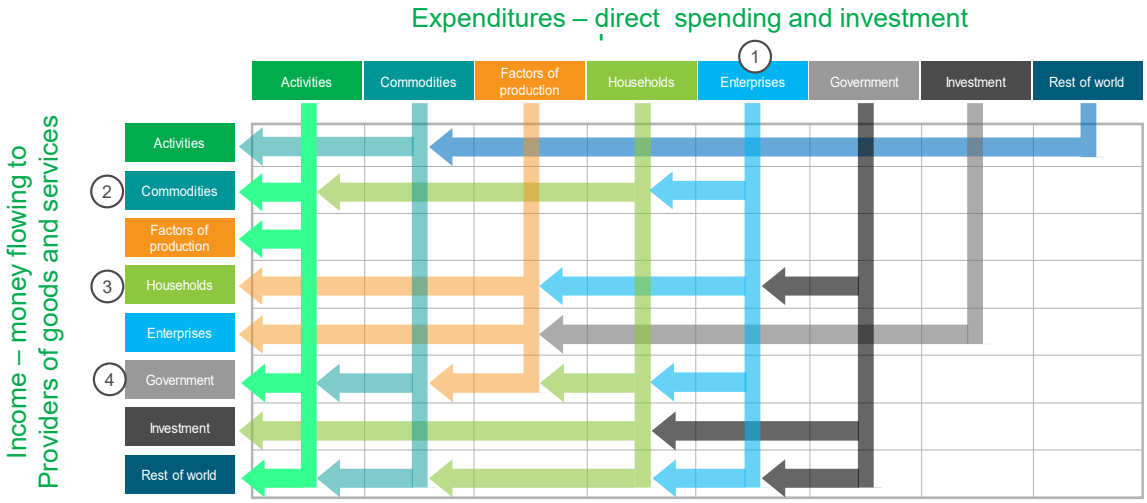
[12] The proposed potential expansion scenarios are preliminary and based on several assumptions. These include open pit mining from the Proposed Project would continue and the market prices for base and precious metals would be as forecast. The potential expansion scenarios all utilize the same final open pit mine design, with forecast variations based on the year of expansion and expanded throughput rate. The gold plant included in the potential expansion scenarios was based on metallurgical testwork results for a specific gold recovery. However, other technologies may be applicable for the Pebble deposit. Further, the addition of a gold plant under any scenario will require additional testwork and engineering, and will require the receipt of pertinent Federal and State permits prior to implementation. Each of the potential expansion scenarios would require additional permitting and environmental regulatory review, and there is no certainty that any of the potential expansion scenarios could be pursued. For further information, see Appendix C or the PEA technical report.

Appendix D: Input-output economic impact analysis

For this study, input-output data from IMPLAN was used to create customized economic impact models within the EViews modelling environment. Using this approach, the base models could be enhanced with data from IHS Markit's proprietary US Economic Service and the US Regional Service.

At the core of the IMPLAN data, inter-industry sales activity is organized into an Input-Output (IO) table. This is essentially a matrix that organizes the transactional activity within and between 546 local industry sectors. Each sector plays a dual role as either: (a) a producer of a final product or service (the "Activities" box in the graphic below), or (b) a consumer of inputs from other sectors (the "Commodities" box in the graphic below). The IO table traces the flow of money within and across industry sectors.

When the input-output tables are extended to include household expenditure data, a social accounting matrix (or SAM) is created. Based on techniques that ultimately earned economist Wassily Leontief the 1973 Nobel Prize in Economics, a SAM captures the transformation of expenditures by one set of economic actors (the columns) into income for other entities (the rows). For example, direct spending could flow as (1) expenditures from an enterprise as they (2) make intermediate purchases of commodities, (3) pay workers' salaries, (4) pay taxes, etc.



The SAM provides details on the proportion of each industry sector's economic output (e.g., sales revenue) that is transformed into value added contribution to GDP, labor income, and indirect business taxes. The SAM used for this study was supplemented with industry productivity statistics (economic output per worker) to derive employment effects.

Appendix E: Glossary of economic impact analysis terminology

Capital expenditure (capex)	This includes the investments made by establishments operating in a sector during a certain year, net of fixed assets sold.
Corporate income tax	The tax levied on a corporation's income.
Direct impacts	The first-order responses throughout the economy due to direct sales transactions.
Economic impact analysis	A study that examines the direct, indirect, and induced impacts of the independent operators' production activities and supply chain spending.
Employment	Includes wages, salaries, and self-employment jobs within the economy.
Extended supply chain	The network of suppliers who provide goods and services to the first tier of a supply chain. This is a subset of the indirect economic contributions.
Fiscal analysis	The estimation of the impacts of tax and non-tax contributions of an entity to the government in which it is currently operating.
Government revenues	The streams of revenues paid to a government agency.
Gross domestic product (GDP)	The sum of value added across all products and services produced within an economy. It is also called national output.
Indirect impacts	The follow-on supply chain or purchasing network activities that are initiated by direct spending.

Induced impacts	The response of the economy to marginal changes in consumer spending from employees of the direct and indirect businesses.
Input-output analysis	The analysis utilizes an input-output table that represents an economy and depicts the flows of related economic transactions that take place within an economy. It also shows the economic interconnections that exist between different components of the economic system, i.e., production activities, the government, and supplier enterprises.
Labor income	This captures all forms of employment income, including employee compensation (wages and benefits, employer-paid payroll taxes, unemployment taxes, etc.) and proprietor income (payments received by self-employed individuals and unincorporated businesses).
Operating expenditures	This captures purchases of inputs and suppliers.
Output	The total value of all goods and services produced within an economy.
Personal income tax	The tax levied on an individual's income.
Value added	The difference between the revenue received for a product or service and its non-labor input costs. It is also understood as the difference between the value of sale and the cost of its required non-labor inputs.