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Socioeconomic Effects Technical Report – 2020 Update

Resolution Copper Mine Environmental Impact Statement

REPORT

Report

September 14, 2020

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Resolution Copper Mine Environmental Impact Statement

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Overall Economic and Fiscal Effects

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Overall Economic and Fiscal Effects

Background

The proposed Resolution Mine presents a number of socioeconomic issues which required research, analysis and modeling. This report provides greater detail and documentation regarding the socioeconomic effects summarized in the Final EIS.

BBC used the IMPLAN regional economic input-output modeling system to help analyze the potential effects of Resolution Copper Company's (RCM's) proposed mine. Two IMPLAN analyses have previously been undertaken regarding the mine. Elliott Pollack & Company (EPC) conducted an analysis of the statewide effects of the proposed mine in 2011. Power Consulting, Inc. (Power) conducted an IMPLAN analysis of the effects of the mine focused on Arizona's Copper Triangle area in 2013. Both of the prior analyses can be considered advocacy analyses. The EPC work was funded by Resolution Copper Mine (RCM) and used to promote the proposed mine. The Power work was funded by the San Carlos Apache Tribe and used to critique the proposed mine. BBC's analysis provides an updated, independent third-party assessment.

In addition to the projected regional (and sub-regional) economic effects estimated using the IMPLAN model, this report also provides analysis and estimates regarding the geographic distribution of the workforce, the projected state and local fiscal impacts from the proposed mine, the potential vulnerability of the mine to operational cut backs or shut downs due to economic considerations, the potential impacts to local tourism and recreation economies, the potential impacts to amenity-based migration, and the potential impacts to property values and to the local economy from effects on livestock grazing. BBC's results and evaluations are compared to the previous socioeconomic studies identified above.

Changes Since Publication of the Draft EIS

A previous version of this socioeconomic effects technical report was produced in May 2019 and included as an appendix to the Draft EIS. This version responds to public comments on the Draft EIS and includes the following changes:

- Incorporates updated information from RCM regarding projected future workforce and non-labor expenditures over an updated life of mine schedule;
- Includes revised economic and fiscal impact modeling based on the most recent projections and updated local tax rates and other information;
- Presents a revised discussion of potential fiscal impacts (revenues and expenditures) on the Town of Superior based on new input from the Town and discussions between the Town, the Forest Service and RCM;

- Incorporates the most recent information on copper prices, and additional sensitivity analysis, in the analysis of the potential vulnerability of the proposed mine to "boom and bust" cycles based on fluctuations in prices;
- Explicitly recognizes the finite life of any copper mine and the potential impacts on Superior after the mine closes;
- Updates the comparison of this analysis with prior socioeconomic studies by others, and includes the latest information provided by Power Consulting in response to the DEIS;
- Expands on the previous discussion of effects on the tourism and recreation-related economy and incorporates recent information from other NEPA processes involving the Tonto National Forest and additional AGFD information regarding the Skunk Camp Tailings Storage Facility Alternative;
- Extends the previous analysis of the potential impacts on residential property values from the tailings storage facility alternatives to include effects on property tax revenues;
- Provides an analysis of the potential economic effects from reductions in available grazing land;
- Evaluates potential economic effects associated with changes in water quality and water quantity; and
- Adds a discussion regarding the potential social impacts associated with mining.

Study Area and IMPLAN Model Design

Study Area(s). For the purposes of the EIS, we are interested in quantifying and assessing effects at various geographic levels. Working outward from the location of the proposed mine, these include:

1. **Effects within the Town of Superior.** Given the limitations of IMPLAN geography, the best approximation of the mine's potential effects on employment, earnings and other economic metrics for jobs located within Superior are the projected effects within the ZIP code(s) that encompass Superior.

   A couple of items to note here. First, in contrast to the results reported in the Power study, all (or virtually all) of the direct RCM jobs will be located in or near Superior.[1] Direct effects in IMPLAN, like other employment-based economic data, reflect the location where the jobs are based – not where the workers live. RCM's answers to our questions confirmed they have no plans for satellite operations in Phoenix or elsewhere.

[1] Data provided by RCM indicates that approximately 21 of the more than 1,400 direct jobs associated with the proposed mine would be located at the tailings facility. Under the Skunk Camp TSF alternative, about half of these jobs could be located in Gila County — and potentially staffed by employees residing in nearby communities such as Winkelman, Kearny or Hayden — while the remainder would be located in Pinal County.

Where the workers would actually live is a separate issue, and is analyzed accordingly later in this report.

2. **Effects within the Copper Triangle.** The "Copper Triangle" is an unofficial term for the area, primarily within Pinal and Gila counties, which contains historic copper mining communities, including Superior, Globe, Miami and others. In the Power report, this area was defined to include nine ZIP codes, as follows:

   - Superior: 85173 and 85273
   - Globe: 85501 and 85502
   - Miami: 85539
   - Kearney: 85137
   - Winkelman and Dudleyville: 85192
   - Hayden: 85135, and
   - San Carlos: 85550

   BBC reviewed more recent maps of the ZIP code areas and the ZIP code data available from IMPLAN and made a couple of changes to the Power list.

   We added the following ZIP codes to fully capture the "Copper Triangle" and the region most likely to be affected by the proposed mine:

   - Queen Valley: 85118
   - San Carlos communities east of San Carlos: 85542

   We eliminated the following ZIP code which no longer appears to exist[2]:

   - Superior: 85273

   In 2016, the Copper Triangle (as defined for this analysis) included about 50,000 residents and 14,800 jobs (IMPLAN 2016).

3. **Broader study area.** Based on RCM's responses to our questions and other information, the vast majority of economic effects within Arizona are likely to take place within a five-county study area that includes Pinal County, Gila County, Maricopa County, Pima County and Graham County. Pima County was included because RCM indicated they have major suppliers located in the Tucson area, as well as the Phoenix area (RCM

[2] 85273 could not be found on a map of current zip codes in the area and does not exist in the 2016 IMPLAN zip code data files for Pinal County.

September 2017). Graham County is included because portions of the San Carlos Apache Tribe are located within that county.

Modeling design. Due to limitations in ZIP code level data and the IMPLAN modeling system, assessing impacts at these varied levels of geography required the development and use of multiple IMPLAN models.

- **County-based model.** Effects across the broader study area were assessed using a county-based model. Direct effects will occur in Pinal County. The Pinal County model was linked to models for Gila County, Maricopa County, Pima County and Graham County using IMPLAN's multi-regional input-output (MRIO) analysis capability. This allowed BBC to estimate trade flows between these counties. Aggregate results for the broader study area were obtained by exporting the results from each county's model and summing them in Excel.

- **ZIP-code based model.** Estimating more localized economic effects required the development and use of two models based on ZIP code level geography. The MRIO capability of estimating trade flows between different areas is not available at the ZIP code level, due to limitations on ZIP code level data and the corresponding inability to estimate trade flows between ZIP codes. However, IMPLAN does recommend a strategy for creating approximate MRIO analysis to estimate trade flows between areas using ZIP code data. BBC employed that strategy as follows:

    - We initially created a model for Superior alone, using the ZIP code that encompasses the town, and ran an impact analysis for that geography
    - We then created a model that also included the other ZIP codes within the Copper Triangle, and ran the same impact analysis on that geography
    - By subtracting the results from the first run from the results from the second run, we estimated the impacts on the remainder of the Copper Triangle (net of Superior)
    - By comparing the results from the second run to the results for Pinal and Gila counties from the county-based model, we estimated the approximate effects in the non-copper triangle portions of those two counties.

Direct Effects

In economic impact analysis, the term "direct effects" refers to output, employment, labor income and other economic metrics directly attributable to the proposed activity. In this case, direct effects refer to the output from the proposed mine, the workers and contractors who could be directly employed by the proposed mine, and the expenditures the mine could make to purchase goods and services.

As the proposed mine's employees spend their earnings on household goods and services, they would create "induced" economic effects in other sectors of the economy. Similarly, suppliers of goods and services to the mine would themselves purchase goods and services from their own

suppliers that could produce additional economic effects. These effects are referred to as "indirect" economic effects. Together, indirect and induced economic effects are sometimes referred to as "secondary" or "multiplier" effects.

Approach. BBC conducted the analyses by modeling the effects as a change in copper production or employment for the copper industry sector (IMPLAN 27 in 536 sector model; NAICS 212234). We modified the copper mining production function to more closely approximate the operations of the proposed Resolution Mine based on the employment, payroll and expenditure data that RCM provided.

Personnel costs. RCM provided the following information to us:

- The average salary for RCM employees will be $75,000 (Updated by RCM May 2020).
- This figure excludes benefits, at a "burden rate" of 35% (RCM October 2017).

After publication of the Draft EIS for use in the Final EIS, RCM also provided updated vectors of employment and personnel costs over the projected life of the mine (Figure I-1).

Expenditures on goods and services. RCM provided information on their anticipated personnel costs by year. They also provided information on their total anticipated expenditures by year, so BBC derived RCM's projected purchases of goods and services as:

Expenditures on goods and services = Projected total expenditures minus Total personnel costs (fully burdened)

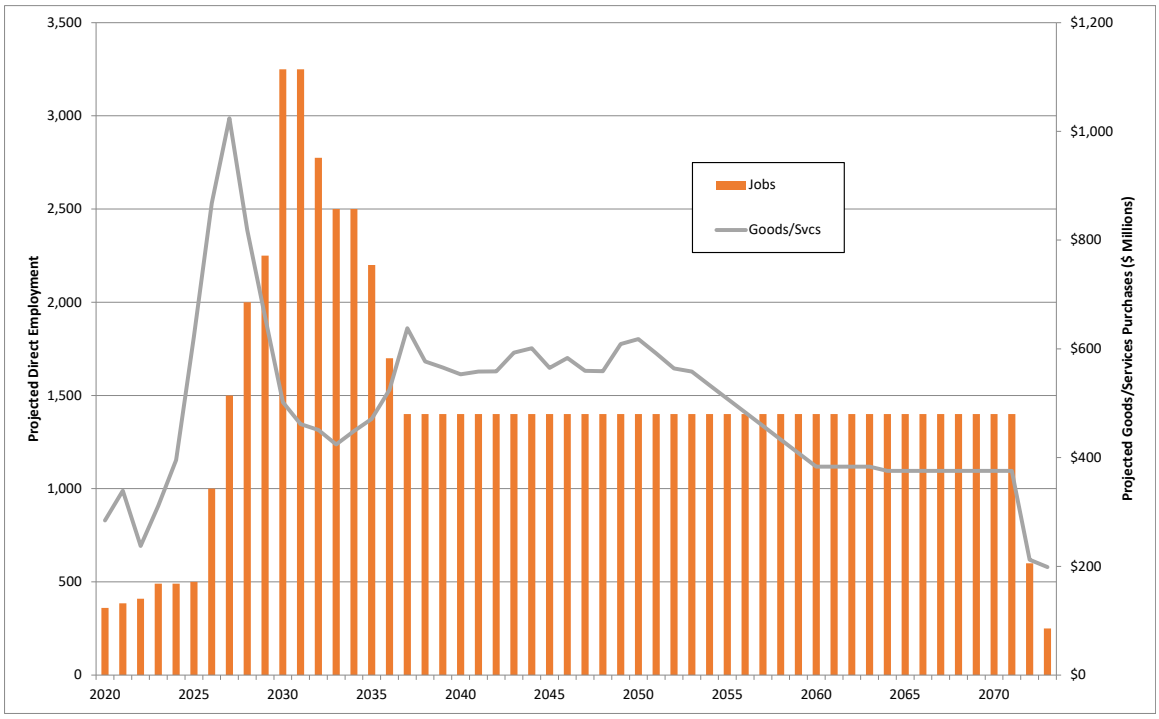
Figure I-1 depicts the updated profile of employment and goods and services purchases for the proposed mine. Key dates that may be worth focusing on for our analysis include:

- 2027 which is projected to be the peak year for goods and services purchases ($1,024 million in 2020 dollars) as construction ramps up.
- 2030-2031 which are projected to be the peak years for employment (3,250 jobs) as operations ramp up and construction is still near its peak.
- 2037 which is the first year of "steady state" operations, with employment at about 1,400 jobs and goods and services purchases averaging about $573 million per year.

For purposes of this initial IMPLAN analysis, BBC modeled effects based on the average annual activity level for the proposed mine over the 2020-2073 period. Those annual averages are:

- 1,434 direct jobs (construction and operations)
- $145 million per year in employee compensation
- $490 million per year in goods and services purchases

Figure I-1. Projected Annual Employment and Goods and Services Purchases over the Life of the Proposed Resolution Mine



Source: BBC Research & Consulting based on data provided by Resolution Copper Mine, May 2020.

Adjustments to IMPLAN copper mining industry profile to approximate proposed Resolution Mine. The IMPLAN models have a baseline industry profile for the copper mining industry from national input-output information, customized based upon regional data.

Figure I-2 depicts the baseline industry profile for the copper mining sector (IMPLAN 27) from the regional, county-based model which includes Pinal, Gila, Maricopa, Pima and Graham counties. Most of the regional values per worker (including employee compensation and other components of value-added, as well as intermediate purchases) are very similar to national averages for copper mining.

Figure I-2. Default IMPLAN Annual Copper Mining Industry Profile for Five-County Region

Industry Employment	4,899		
Industry Economic Metrics	Total	Per Worker	National per Worker
Output	**$2,311,218,000**	**$471,764**	**$470,910**
Value Added			
Employee Compensation	$438,276,400	$89,461	$91,368
Proprietor Income	$27,253,430	$5,563	$2,827
Other Property Type Income	$768,513,400	$156,868	$150,731
Tax on Production & Imports	$100,785,600	$20,572	$26,684
Total Value Added	**$1,334,828,830**	**$272,464**	**$271,610**
Intermediate Purchases	**$976,389,170**	**$199,300**	**$199,300**

Source: IMPLAN 2016 (5 county model based on 2016 data files).

Given the unusual proposed mining methods for the Resolution Mine, it is not surprising that the economic profile of the proposed mine differs from IMPLAN's default profile for copper mining in the region. The data provided by Resolution (summarized in Figure I-1) indicate a similar level of employee compensation per worker, but substantially larger purchases of goods and services (intermediate purchases) per worker than the regional industry average. These differences imply that the Resolution Mine would be less labor intensive, but more capital intensive, than more typical copper mining operations – which appears to be consistent with expectations concerning the mining methods anticipated for the proposed mine.

To better reflect the expected economic characteristics of the proposed mine, BBC made an adjustment to employee compensation per worker to include employee benefits based on the information provided by Resolution. We made a much larger adjustment (increase) to the output per worker in order to approximate the anticipated output of the proposed mine of approximately 40 billion pounds of copper over the 54-year projected life of the mine (including construction and post-production closure and reclamation years) and make the purchases of goods and services (intermediate purchases) correspond to Resolution's projections.

Figure I-3 depicts the customized industry profile specific to the proposed Resolution Mine. Total employment, expenditures for labor (employee compensation) and expenditures for goods and services (intermediate purchases) closely correspond to the annual averages over the life of the mine based on data provided by RCM. The total value of production (output) is consistent

with projected output from the mine provided by SWCA at a conservative projected copper price of $2 per pound (SWCA 2018).[3] The other components of value added (proprietor income, other property type income, and taxes) were estimated by BBC based on data provided by RCM (taxes) and to balance the sum of value added and intermediate purchases to the projected annual mine output. Given RCM's ownership, BBC assumed that none of the value-added from the mine would compensate self-employed proprietors (proprietor income), with all profits instead flowing to corporate owners (other property type income).

Figure I-3. Customized IMPLAN Annual Copper Mining Industry Profile for Proposed Resolution Mine

Mine Employment 1,434	Total	Per Worker	National per Worker
Output	**$1,481,481,481**	$1,033,458	**$470,910**
Value Added			
Employee Compensation	$145,143,750	$101,250	$91,368
Proprietor Income	$0	$0	$2,827
Other Property Type Income	$766,482,218	$534,686	$150,731
Tax on Production & Imports	$79,696,375	$55,595	$26,684
Total Value Added	**$991,322,344**	**$691,531**	**$271,610**
Intermediate Purchases	**$490,159,138**	**$341,927**	**$199,300**

Source: BBC Research & Consulting based on data provided by Resolution Copper Corporation, 2020 and MPLAN 2016 (5 county model based on 2016 data files).

Apart from the relatively low labor intensity and high capital intensity of the proposed mine, the customized profile summarized in Figure I-3 is also noteworthy in regard to the large share of value added attributed to "other property type income" or profit. Based upon the data provided by RCM in terms of projected costs for labor and intermediate purchases, as well as projected production, the proposed mine would appear to be more profitable than a typical copper mining operation in Arizona. BBC estimates that "other property type income" could account for about 52 percent of the total value of production for the proposed Resolution Mine. As shown in the previous baseline profile of the copper industry in southern Arizona (Figure I-2), the

[3] Projected copper production from the mine is described in more detail in the section of this memorandum entitled "Vulnerability to 'Boom-Bust' Cycles."

combination of "proprietor income" and "other property type income" accounts for about 34 percent of the total value of production of more conventional copper mines.

While the high profit rate implies that a large share of the economic benefits of the mine could go to corporate headquarters and company shareholders, it also provides support for RCM's statements that the proposed mine could be less susceptible to shutdowns or closure than conventional copper mines due to adverse changes in copper prices.

IMPLAN Modeling Results

Figure I-4 summarizes the results from BBC's IMPLAN analysis of the proposed mine based on projected annual average employment and purchases of goods and services over the life of the mine. The IMPLAN results indicate that the proposed mine could create substantial "multiplier" effects in Arizona, supporting about 2,070 indirect and induced jobs and about $130 million per year in indirect and induced labor income.

Figure I-4 also indicates that most of the "multiplier" effects could occur outside of the "Copper Triangle." While all of the direct mine employment is expected to occur in the ZIP code encompassing Superior, only 14 percent of the "multiplier" effects are projected to occur within that ZIP code. An additional 18 percent of the "multiplier" effects are projected to occur within other portions of the "Copper Triangle" as defined based on the 10 ZIP codes identified on page 2 of this report. About 68 percent of the "multiplier" effects are projected to occur outside of the "Copper Triangle." The majority of "multiplier" effects could likely occur in Maricopa County, which is projected to receive about 56 percent of the indirect and induced economic benefits from the proposed mine based on BBC's IMPLAN analysis[4].

The geographic distribution of the projected "multiplier" effects from the proposed mine is not surprising given the location of the proposed mine. Superior and the other communities within the "Copper Triangle" are relatively small, but are located within relatively short commuting and transport distances from the Phoenix Metropolitan Area in Maricopa County. The actual distribution of future "multiplier" effects from the proposed mine could also change if companies providing mining inputs and services are drawn to the Superior area by development of the proposed mine.

[4] To summarize the results shown in Figure I-4, BBC reconciled the results from the zip code-based models focused on Superior and the Copper Triangle with the county-based MRIO models. The results from the county-based MRIO modeling alone indicate that Maricopa County could receive up to 81 percent of the "multiplier" effects, with multiplier effects in Pinal and Gila Counties representing about 13 percent of the total.

Figure I-4. Summary of IMPLAN Results based on Projected Average Annual Activity from Proposed Resolution Mine

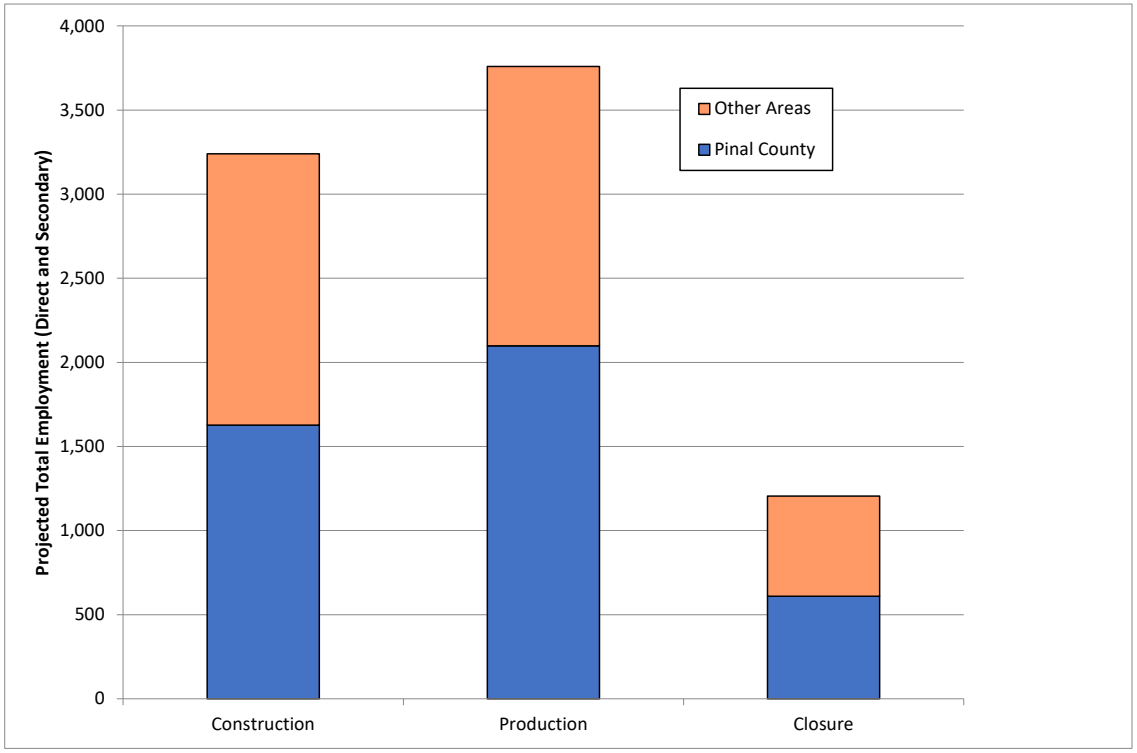
Geographic Area	Employment	Labor Income	Total Value Added	Output	Shares of "Multiplier" Jobs*
Superior (Zip Code 85173)					
Direct Effect	1,434	$148,862,798	$1,016,722,943	$1,567,776,714	
Indirect Effect	109	$4,303,597	$8,982,010	$21,277,544	
Induced Effect	191	$5,110,938	$12,175,909	$23,996,781	
Total Effect	1,734	$158,277,333	$1,037,880,862	$1,613,051,039	14%
Rest of Copper Triangle					
(Indirect and Induced Effects Only)					
Other Pinal County Areas	95	$3,244,360	$7,093,909	$15,768,380	5%
Gila County Areas	271	$9,910,537	$21,197,118	$45,439,684	13%
Graham County Areas	0	$0	$0	$0	0%
Total Rest of Copper Triangle	366	$13,154,897	$28,291,028	$61,208,065	18%
Effects Outside of Copper Triangle					
(Indirect and Induced Effects Only)					
Pinal County (Remainder)	129	6,990,981	9,638,479	10,762,388	6%
Gila County (Remainder)	0	$0	$0	$0	0%
Graham County (Remainder)	0	$0	$0	$0	0%
Maricopa County	1,163	$93,994,934	$145,564,824	$253,513,057	56%
Pima County	114	$7,431,631	$13,860,095	$30,329,516	6%
	1,405	$108,417,545	$169,063,397	$294,604,961	68%
Total Regional Effects					
Direct Effect	1,434	$148,862,717	$1,016,722,817	$1,567,776,458	
Indirect Effect	1,078	$89,291,018	$137,875,535	$261,212,252	
Induced Effect	994	$41,696,040	$80,636,936	$139,875,355	
Total Effect	3,506	$279,849,775	$1,235,235,287	$1,968,864,065	100%

Note: *Multiplier effects include indirect and induced effects. Percentages based on shares of indirect and induced employment.
Totals may not sum precisely due to rounding.

Projected regional economic effects by phase of activity. As shown in Figure I-1, projected employment and procurement activity associated with the proposed mine is anticipated to vary over the life of the project. The largest direct employment at the proposed mine is projected to occur during the approximately 40-year period of production (potentially 2031-2071). The smallest direct employment levels, and the lowest spending on goods and services, are projected to occur during the closure and reclamation period (potentially 2072-2073).

Figure I-5 depicts projected total regional employment supported by the mine during these three different phases of activity. All direct jobs at the mine are anticipated to be based near Superior, in Pinal County, with the potential exception of 21 jobs at the Skunk Camp Tailings Storage Facility under Alternative 6 – which would be based near the Pinal County/Gila County boundary. All of the projected jobs outside of Pinal County, and a portion of the projected jobs in Pinal County, reflect the projected multiplier effects from expenditures of mine workers and the mine's expenditures on goods and services within the region. Total regional employment effects are projected to vary from about 3,750 regional jobs (on average) during production to about 1,200 regional jobs (on average) during the closure of the facility. An annual average of about 3,240 regional jobs are estimated during the projected 11-year period of construction prior to production.

Figure I-5. Comparison of Projected Total Employment Effects During Different Phases of the Proposed Resolution Mine



Employee Residence Locations

Where the employees of the proposed mine would live was a topic of some dispute within the two prior socioeconomic effects analyses. Where the employees live is critical from the standpoint of assessing effects on Superior and the Copper Triangle area in terms of demographics, demands for public services and other social and economic effects.

The remainder of this section describes the information available to assess potential employee residence patterns and provides preliminary assumptions about where employees may choose to live. Combining those assumptions with the direct and secondary employment projections described earlier in this report provides estimates of the potential demand for worker housing by location. The extent to which that demand can be met by the available housing stock in Superior and the Copper Triangle is discussed later in this section.

Potential to hire from existing workforce. RCM had EPC assess the existing workforce in the region. That assessment is somewhat general in nature, in that it does not define the number of workers RCM will need by occupation or provide specific employability requirements.

Resolution indicated that the proportion of jobs requiring a bachelor's degree is expected to be somewhere between 33% (share of present workforce) and 15% ("conservative estimate"). Nearly all jobs will require at least a high school diploma or GED. Resolution also indicated that the top 15 mining occupations identified in the EPC workforce assessment are applicable to the proposed RCM mine (RCM October 2017).

Based on the available information regarding the educational requirements and occupational mix needed for the proposed mine, there would appear to be the potential to fill some of the positions from the existing workforce in the area. The EPC workforce evaluation indicates that Gila and Pinal Counties have a relatively large number of workers in mining, construction and manufacturing industries compared to the state as a whole, and that many of these workers may be qualified to work at the proposed mine. The absolute numbers may be a bit misleading, however, since Pinal is a large county and portions of the county are considerably more remote from the proposed mine than the eastern Phoenix suburbs. It is also worth noting that hiring currently employed mining employees from the region may just move the demand for new employees from the RCM mine to the mines those workers have left.

Current residence choices of RCM employees. Data provided by RCM in response to the initial set of socioeconomic questions provides information regarding the residence of existing RCM employees. From 2010 through 2019, RCM has employed an average of about 210 full-time equivalent (FTE) workers.[5] Approximately one-third of those workers appear to live in the Copper Triangle area (26% in Pinal County, 9% in Gila County), while approximately two-thirds live elsewhere in Arizona (likely predominantly in the eastern Phoenix suburbs).

[5] BBC estimate based on RCM payroll expenditures by worker residence county.

County-to-county commuting flows. Another potentially useful indicator is the county-to-county worker flows data provided by the Census Bureau. These data could be a bit misleading for Pinal County because of the geographic size of the county and the fact that the largest population and employment centers in the county are in the Casa Grande area, far from the Copper Triangle. The Gila County data may be a better indicator, though the potential to commute from the Phoenix area to Superior is likely greater than the potential to commute to the Gila County communities.

Figure I-5 summarizes the county-to-county commuting flows of Arizona workers to jobs in Pinal County and Gila County from the 2009-2013 5-year American Community Survey. These data indicate that about 80 percent of the jobs in Pinal County were filled by Pinal County residents during the five-year period. About 1/6 of these jobs were filled by commuters from Maricopa County. About 85 percent of the jobs in Gila County were filled by Gila County residents. Just under 6 percent were filled by residents from Maricopa County (U.S. Census Bureau 2017a.)

Figure I-5. Commuting Flows to Pinal and Gila Counties, 2009-2013

Source:
2009-2013 American Community Survey 5-year estimates.

Workers/Residences	Number	Share
Pinal County Workers		
Place of Residence		
Pinal County	64,496	80.5%
Maricopa County	13,346	16.7%
Pima County	1,754	2.2%
Remainder of AZ	479	0.6%
Gila County Workers		
Place of Residence		
Gila County	15,737	84.7%
Maricopa County	1,089	5.9%
Graham County	726	3.9%
Pinal County	610	3.3%
Pima County	107	0.6%
Coconino County	96	0.5%
Yavapai County	96	0.5%
Remainder	109	0.6%

The EPC workforce report also examined the commuting issue, using a different Census data source – the Longitudinal-Employer Household Dynamics Program (LEHD). BBC used the same source, which allows the user to define geographic areas on an interactive map, to examine commuting patterns specific to the Copper Triangle region.

Based on LEHD data, an average of 59 percent of the approximately 7,500 jobs in the Copper Triangle area were filled by residents from outside the region during the 2011-2016 period. The proportion of the approximately 2,400 "goods producing" jobs filled by commuters from outside

the region was slightly higher, averaging 62% over this same timeframe, as shown in the Figure I-6 (U.S. Census Bureau, 2017b).[6]

The LEHD data for the Copper Triangle area indicate much greater commuting into that area than the county-to-county data shown in Figure I-5. This result is not surprising, however, given the proximity of the Copper Triangle area to the Phoenix Metropolitan Area.

Figure I-6. Commuting Flows into the Copper Triangle 2011-2015

Source:
US Census Bureau 2017b.

Census LEHD Data for Copper Triangle Area -- All Jobs				
	Residence of Workers		Proportions of Jobs Filled By	
	In Area	Outside	Residents	Commuters
2011	2,718	3,490	44%	56%
2012	2,471	3,529	41%	59%
2013	2,572	3,474	43%	57%
2014	2,697	5,288	34%	66%
2015	2,939	3,277	47%	53%
Average	2,679	3,812	41%	59%

Census LEHD Data for Copper Triangle Area -- Goods Producing Jobs				
	Residence of Workers		Proportions of Jobs Filled By	
	In Area	Outside	Residents	Commuters
2011	851	1,033	45%	55%
2012	848	1,080	44%	56%
2013	790	1,076	42%	58%
2014	1,035	2,920	26%	74%
2015	999	1,181	46%	54%
Average	905	1,458	38%	62%

Recommended assumptions regarding worker residence choices. Based on the combination of the LEHD analysis and the actual residence patterns of RCM's workers over the past five years, it is reasonable to assume to assume that 30 to 40 percent of the future workforce of the mine could choose to reside in the Copper Triangle, while 60 to 70 percent of the workforce could choose to commute to jobs at the mine (primarily from Maricopa County). Based on the RCM actual workforce data, it also seems probable that approximately 25 percent of the workforce could seek to live in or near Superior, and about 10 percent could choose to live in or near other communities within the Copper Triangle.

Figure I-7 combines the foregoing assumptions regarding worker residence preferences with the projected direct and secondary employment estimates related to the mine summarized

[6] Goods producing jobs are defined as jobs in natural resources and mining, construction and manufacturing.

previously in Figure I-4. The resulting potential residence locations are termed housing "demand", since the availability of housing in Superior is an important consideration as well.

Figure I-7. Projected Housing Demand by Geographic Area related to Proposed Resolution Mine

	Place of Work				
	Employment Projections		Projected Housing Demand*		
Geographic Area	Direct Jobs	Secondary Jobs	Direct Workers	Secondary Workers	All Workers
Superior	1,434	300	359	75	433
Rest of Copper Triangle	0	366	143	158	302
Other Pinal County	0	129	0	103	103
Maricopa County	0	1,163	932	1,622	2,554
Pima County	0	114	0	114	114
Total	1,434	2,072	1,434	2,072	3,506

Note: *These numbers reflect potential housing demand, prior to consideration of available housing capacity and other potential constraints.
Totals may not sum precisely due to rounding.

Constraints in Superior. While the preceding analyses of potential economic effects and regional commuting patterns indicate the proposed mine could create substantial demand for housing in Superior, the actual number of mine-related employees that would live in the Town (at least over the first decade of mine construction and operations) is likely to be constrained by the size and condition of the available housing supply.

At present, there are approximately 1,631housing units within the Town of Superior. About 1,218 of those units are occupied. Of the remaining 413 units that are currently unoccupied, 75 are considered dilapidated, though only about 10 are considered beyond the possibility of being refurbished (Pryor, May 2018). Setting aside the housing units currently considered dilapidated (whether potentially refurbishable or not), there are approximately 340 unoccupied but inhabitable housing units in the Town. These homes likely span a fairly wide range in terms of their current condition.

Other constraints in attracting new workers to live in the Town include limited local services, retail and entertainment. Currently, Superior is primarily attracting the mining "transient" population, largely consisting of unmarried skilled trades workers on 3-to-4-year shifts. This demographic is typically looking for housing in RV parks or apartment rental housing. (Pryor, 2018). Some interviewees in Superior also indicated that the quality of local schools is also an issue in attracting young families to live in the community.

The limited housing stock and the other challenges in attracting new residents are likely to limit the number of mine-related workers that actually move to Superior, at least in the near term. While over 400 of the new workers projected to result from the proposed mine might prefer to live nearby, given current conditions in the Town, BBC anticipates it is more likely that these new workers could absorb about 160 vacant units from Superior's housing stock during the first decade of mine construction and operations. This level of absorption would bring Superior's housing vacancy rate down from about 25 percent to about 15 percent, which is consistent with

the statewide average in Arizona.[7] This implies about 160 new households could move to Superior in the relatively near term.

The Town of Superior is well aware of the challenges it faces, and is actively working to reduce these constraints. The Town is in the early stages of creating a "land bank" designed to repurpose commercial buildings, reduce the number of dilapidated buildings and create more developable space. The Town is also considering potential annexations to increase the land available for new development, and is receiving approximately at least three inquiries from developers, and about one new development application, per week (Pryor, May 2018).

If the proposed mine is permitted and develops as planned, it appears likely that additional housing (and potentially additional retail, service and entertainment development) could occur as well and a larger number of mine-related workers could locate in the community during the projected 40-year period of mine operations. Longer-term, as many as 430 mine-related households may reside in the Town of Superior. Additional housing demand from mine-related workers is likely to provide upward pressure on home prices in Superior (which are currently very low), and could create affordability challenges for some existing Superior residents.

Projected Fiscal Effects

Another important dimension of the socioeconomic effects analysis is the impact of the proposed mine on the demand, cost and available revenues for public services, particularly in Superior. Given the uncertainty regarding the number of mine workers that could reside in Superior described above, the fiscal analysis considers three alterative scenarios for Superior's population. The scenarios are no net increase in Superior's population; a potential near-term increase of 150 new households in Superior; and a potential longer-term increase of 380 new mineworker households in Superior.

The following discussion beings with the direct and secondary state and local government revenues projected to result from the activities of the proposed mine. The proposed mine could also produce revenues for the federal government. While federal revenues have not been independently estimated for this EIS, RCM's economic consultants have previously projected annual federal revenues from corporate and employee federal income taxes of over $200 million per year (EPC 2011).

As illustrated in Figure I-8, operation of the proposed mine could produce both direct revenues to state and local governments (paid by RCM) and secondary revenues for those governments (which would be paid by employees and vendors). While there are numerous minor government revenues that could be generated by operation of the proposed mine, BBC estimates that more than 95 percent of the revenues that could accrue to the State of Arizona and the most affected local governments (those within Pinal and Gila counties) would stem from six revenue sources – some of which could produce revenues for both the State government and local governments:

[7] U.S. Census Bureau 2018.

- RCM Property Taxes (property taxes on the mine itself – paid to Pinal County and other local taxing entities)
- RCM Severance Taxes (paid to the State of Arizona, with a portion shared to local governments based on population)
- RCM Corporate Income Taxes (paid to the State of Arizona, with a portion shared to cities based on population through Urban Revenue Sharing Fund)
- Transaction Privilege Taxes (sales taxes paid to local governments and the State of Arizona – with a portion of the State revenues shared to local governments based on population)
- Employee Income taxes (paid to the State of Arizona, with a portion shared to cities based on population through Urban Revenue Sharing Fund)
- Employee Property taxes (paid to the jurisdictions in which the employees reside)

Figure I-8. Primary Sources of State and Local Government Revenues related to the Proposed Resolution Mine

Local Governments	State of Arizona
Direct Revenue Sources (Paid by RCM)	
RCM Property Tax	**RCM Severance Tax**
RCM Severance Tax	(excluding local share)
(local distribution share)	**RCM Corporate Income Tax**
RCM Corporate Income Tax	(excluding funds shared via URSF)
(share via URSF)	
Secondary Revenue Sources (Paid by direct and secondary employees and vendors)	
Transaction Privilege Tax (Sales Tax)	**State Transaction Privilege Tax**
(proceeds from City/County levies)	(excluding Local Govt. Distribution)
(share of State TPT)	**Employee Income Taxes**
Employee Income Taxes	(excluding sharing via URSF)
(share via URSF)	
Employee Property Taxes	

RCM property taxes. The largest single source of new government revenues from the proposed mine could be the property taxes that RCM would pay to Pinal County and other entities with property taxing authority over RCM's landholdings.

RCM currently owns 63 parcels of land in and around Superior. While 33 of the 63 parcels are located within the Town of Superior, these smaller parcels total only 88 acres out of the 3,211 acres RCM currently owns in the area (about 3 percent). With the land exchange, which would

add the 2,422-acre Oak Flat Parcel to RCM's landholdings outside of Superior, the Town's share of RCM's lands would decline to about 1.6 percent of the total.

Mining company landholdings in Arizona are valued at the individual parcel level. The value of producing mines, based on the methodology on the next page, is allocated to the lands located over the orebody itself. Consequently, the valuation of RCM's landholdings in Superior would be based on the current value for their specific type of use such as office space, warehouse space, etc. (Gibson, May 2018).

The larger portion of RCM's landholdings, located outside of Superior, would be subject to a current combined mill levy of 12.8760 mills from Pinal County and other entities with taxing authority. The smaller and less valuable portion of RCM's landholdings within Superior would be subject to a combined mill levy of 19.5883 mills, including the 6.7123 mills currently levied by the Town of Superior (Pinal County 2020).

In Arizona, the assessed value of operating mines is established by the State Department of Revenue. The primary method for valuing such properties is based on the present value of the net income stream produced by the mine. The assessed value is then set at 18 percent of the estimated "market" value of the mining property (AZ JLBC 2019). Based on the customized mining profile reflecting the projected characteristics of the proposed mine, BBC estimates that the assessed value of the proposed mine at a copper price of $2 per pound could average approximately $2.6 billion over the full 54 years of mine construction, operations, closure and reclamation. The assessed value during the 40-year period of actual copper production could be greater, while the assessed value during the pre-production and post-production years could be lower. At a copper price of $2.75 per pound (as used in the updated information provided by RCM to the Forest Service and EIS team in 2020), BBC projects the assessed value of the mine could average approximately $4.4 billion over the full 54-year period of mine-related activity.[8]

Based on the current local government mill levies (property tax rates) described above, BBC estimated the composite property tax bill for the proposed mine at a copper price of $2.00 per pound could average about $35 million per year. Annual property tax revenues during pre-production and post-production periods could be lower, while average annual property tax revenues during the projected 40-year production period could be greater. Assuming a $2.75 per pound price for copper, RCM estimated their annual property tax bill would average about $68 million per year.

Given that RCM has more knowledge of the potential profitability of their proposed mine, but BBC's estimate is more "conservative", BBC has used both estimates for purposes of this analysis. This range highlights the extent to which local government property tax revenues could be sensitive to variation in the price of copper. BBC's estimate of the average annual tax

[8] As discussed in Section II of this TM (Vulnerability to "boom-bust" cycles) the price of copper has been greater than $2/lb (in 2020 dollars) 70% of the time over the past 120 years. The price has been greater than $2.75/lb 40% of the time over this historical period.

bill based on a $2.75 per pound price of copper is within 10 percent of the RCM property tax projections using the same price.

Figure I-9, later in this section, depicts the projected distribution of annual property tax revenues from the proposed mine. Based on current tax rates, Superior Unified School District #105 could receive the most revenue from property taxes at a projected $16 to $31 million per year. However, it is important to note that school funding in Arizona is equalized on a per student basis across the state's school districts based on a foundation system initially established in 1980 (ATRA 2009). If the proposed mine develops and substantially increases the property tax base within the school district, the state's school finance system would likely lead to either a reduction in the school district's mill levy, a redistribution of the increase in the school district's property tax revenues to help fund other districts in Arizona, or a combination of both. It is likely that the actual impact on funding for the Superior Unified School District could be more related to a potential increase in the number of students in the district (due to direct and secondary mine-related workers and families moving into the district) than to the increase in the property tax base within the district. However, tax payers within the district could benefit from a reduced property tax rate due to the increase in the taxable value of property within the district.

Pinal County is projected to receive $10 to $20 million per year if the mine develops (based on its current mill levy), while the Pinal County Junior College could receive $6 to $12 million per year. The proposed land exchange – which would transfer ownership of about 2,422 acres encompassing Oak Flat and surrounding lands from the Tonto National Forest to Resolution Copper – would decrease the amount of revenue Pinal County receives from Federal Payments-in-Lieu-of-Taxes (PILT). From 2017 through 2019, Pinal County received an annual average of $2.34 per acre of federal land within the county – or approximately $5,700 per year for the lands encompassing Oak Flat (USDOI 2020).

Although BBC estimates the Town of Superior could receive an average of more than fifteen million dollars per year in property tax revenues if the mine orebody was located within the Town (and the Town did not revise its current mill levy), the Town expects to receive very little in property tax revenues from RCM (Pryor, May 2018). The Town has also indicated an interest in seeing the filter plant for the proposed mine be located within its municipal boundaries. Based on the projected full cash valuation of the plant and the current Town of Superior mill levy (6.7123 mills), if the filter plant were located within the Town it could produce annual property tax revenues for the Town of over $900,000 per year (RCM 2020; Pinal County 2020).

RCM severance taxes. The State of Arizona collects severance taxes on operating mines and distributes a portion of those revenues to local governments (cities and counties) based on their shares of the statewide population. The State currently levies a 2.5 percent severance tax on 50 percent of the difference between the mine's annual gross revenues and its annual operating costs. As was the case with property tax revenues, BBC has developed a "conservative" estimate of total annual severance tax revenues from the proposed mine based on a $2/lb price of copper, which differ from the estimates provided by RCM using a $2.75/lb price of copper. Based on the customized mining profile reflecting the projected average annual characteristics of the

proposed mine, BBC estimates the mine could produce about $525 million in cumulative severance tax revenues over its entire life, while RCM estimated $648 million in cumulative severance taxes over the life of the mine.[9] As in the property tax revenue analysis, BBC has chosen to report the implications from both severance tax estimates as a potential range of future revenues.

Severance taxes could produce substantial revenues for the State of Arizona, estimated to average between $4.6 million per year and $5.7 million per year (based on BBC and RCM estimates described previously, using alternative prices of copper). Annual severance tax revenues could be higher during the actual 40-year production period.

While the total amount of severance tax revenues distributed to local governments could also be substantial (averaging approximately $5.1 to $6.3 million per year), the State's distribution mechanism would result in most of those revenues being distributed to the larger population areas (such as Maricopa County, Pima County and the cities of Phoenix and Tucson). BBC estimates that the total distribution to the cities located in the "copper triangle" (including Superior) could be less than $7,000 per year. Pinal, Gila and Graham county governments could receive more revenue from the severance tax distribution, at a project annual average of about $230,000 to $284,000 per year for the three counties combined.

RCM corporate income taxes. Data provided to the Forest Service and the NEPA study team indicates that in 2020 RCM estimates the proposed mine would pay approximately $1.4 billion in corporate income taxes over its anticipated life. This figure would correspond to an annual average of about $26 million.

A portion of corporate income tax revenues in Arizona are distributed to municipalities through the Urban Revenue Sharing Fund (URSF). This distribution is based on shares of the total municipal population within the state. Consequently, the distribution of corporate income tax revenue to the Town of Superior could be modest, at about $15,000 per year. Including Globe and Miami, total corporate income tax distributions to cities within the "copper triangle" could be a little less than $60,000 per year.

Transaction privilege taxes. In addition to property taxes, the other primary source of local government revenues is sales taxes, which are termed transaction privilege taxes (TPT) in Arizona and are levied on the seller (though the tax is commonly passed through to purchasers). The State of Arizona also levies a state TPT on goods and services purchases at the rate of 5.6 percent. A portion of the state TPT is distributed to local governments (cities and counties) according to a population-based formula.

[9] Data provided by Resolution Copper Mine, May 2020.

TPT may be levied against some of the purchases of goods and services by the proposed mine, though there are numerous exemptions from the tax.[10] TPT could also be obtained from sales to employees of the proposed mine and employees whose jobs could be indirectly supported by the mine's activities. In 2016-2018, the state TPT averaged about $1,750 per job in Arizona (AZ JLBC 2019 and BEA 2019). Including applicable local TPT in the jurisdictions where the direct and secondary workforce from the proposed mine is projected to reside, and adjusting for the higher average compensation of these workers, BBC has estimated that the state and local jurisdictions could collect an average of about $2,500 in TPT per worker.

For purposes of this analysis, we have assumed the geographic distribution of TPT collections would primarily follow the projected residence distribution of the workforce, although Superior could collect some TPT from employees commuting to mine jobs from outside of the town.[11] Consequently, we have provided three estimates for the Town of Superior – an estimate reflecting no net increase in the population of the Town, a potential near-term estimate which adjusts for the housing capacity constraints in Superior described previously, and a potential long-term estimate assuming those constraints could be overcome by additional development if the mine is permitted and developed. Composite state and local TPT rates in areas where the workforce is expected to reside range from a high of 11.2 percent in Superior to a low of 6.3 percent in Maricopa County.

In total, BBC estimates that TPT on sales resulting from the proposed mine could generate about $9 million per year in revenues for state and local governments. The state could retain about $7.3 million in TPT revenue, while local governments could receive the remaining revenues from locally levied TPT and the state distribution to cities and counties. Pinal County is projected to receive between $116,000 to $244,000 in TPT revenue (including the county's 1.6 percent TPT and the county's share of the state distribution). Gila County and the cities of Globe and Miami are projected to receive about $248,000 per year in TPT. The Town of Superior is projected to receive between $37,000 per year in TPT revenue from in-commuting employees alone if there is no net increase in the Town's population due to the mine and about $366,000 per year if additional development in the longer-term allows up to 380 mine workers to reside in the Town. In the near term, given existing housing constraints but assuming 150 mineworkers are able to find housing in Superior, the Town could receive about $167,000 per year, primarily from the 4.0 percent city TPT.

Employee income taxes. Employees of the proposed mine, of its suppliers based in Arizona, and of the Arizona-based suppliers of goods and services to their households would also be subject to state income tax. Like the corporate income taxes on RCM described earlier, 15 percent of these state tax revenues are distributed to Arizona cities through the Urban Revenue Sharing Fund.

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[10] For example, the sale of chemicals, machinery and equipment used in mining is exempt from transaction privilege taxes (AZ JLBC 2019).

[11] Per agreed upon assumptions between RCM and the Town of Superior, 50% of all in-commuting employees were assumed to each spend $5 per workday on taxable expenditures within the Town. Draft Cost-Benefit Table, 06/17/2020.

Based on state personal income tax collections and the total compensation paid to Arizona workers over the past six years, BBC estimates the effective personal income tax rate on direct and secondary employees supported by the proposed mine could be approximately 2.1 percent (AZ JLBC 2019, BEA 2020). Incorporating the projected total labor compensation of the direct and secondary workforce of the proposed mine (Figure I-4), annual Arizona personal income tax collections on the direct and secondary workforce are projected to be about $5.9 million. The state would retain 85 percent of this revenue, with the remainder distributed across all of the cities in Arizona. Given their relatively small populations, cities in the "copper triangle" could receive relatively little of this revenue, totaling about $13,000 in aggregate. Superior could likely receive about $3,500 per year in distributions of employee income taxes.

Employee property taxes. The final major source of government revenues related to the proposed mine could be the property taxes paid by employees to the jurisdictions in which they reside. Employees who own their own homes would pay these taxes directly, while employees who rent their homes would pay them indirectly through their rental payments to landlords.

Given the uncertainty regarding the specific jurisdictions in which the direct and indirect workforce of the proposed mine could reside, BBC has limited the employee property tax analysis to potential tax revenues within the Town of Superior. While BBC estimated that about 430 workers could like to live in Superior (as shown in Figure I-7), our previous analysis of the limited housing capacity in Superior and other issues suggests that employees directly and indirectly related to the mine could more likely absorb about 160 available housing units in Superior – at least during the early years of mine development and operations. Since these would be existing housing units, there would be no increase in property tax revenues to the Town of Superior apart from those resulting from potential increases in overall home values in the Town due to additional housing demand.

Longer-term, the proposed mine could spur new development in Superior. For purposes of this analysis, BBC assumed the direct workers (RCM employees) that reside in Superior would own their homes, while the secondary workers would rent their homes. The average assessed value of primary residential (owner occupied) homes in Superior in 2020 was about $4,200, while the average assessed value of rental residences in Superior was about $3,200 (AZDOR 2020). BBC applied these average assessed values, multiplied by the projected number of resident workers, to the current property tax mill levies in Superior to estimate the annual property tax revenues the Town (and other taxing entities) could receive from the resident workforce.

On average, property taxes on the portion of the mine's direct and indirect workforce that is projected to live in Superior are estimated to produce up to $225,000 in new annual property tax revenue (under the potential long-term scenario with new housing development) across all of the entities that levy property taxes within Superior. The Town of Superior is projected to receive about $77,000 per year with additional housing development. Other substantial beneficiaries from employee property taxes with new development could include the Superior Unified School District #105 (about $68,000 per year), Pinal County ($44,000 per year) and Pinal County Junior College ($25,000 per year).

State and local government revenue summary. Combining estimated revenues from the six primary revenue sources just described, the proposed mine is projected to generate an average of between $80 and $120 million per year in state and local tax revenues, as shown in Figure I-9.

The State of Arizona could be the largest recipient of tax revenues from the proposed mine, with projected average receipts of between $33 and $39 million per year. In addition (and not reflected in Table I-9), the Arizona State Land Department (ASLD) could also receive royalty payments from the proposed mine for a small area of ASLD lands which could be mined. The minimum ASLD royalty payment is 2 percent of the gross value of the minerals produced from their lands, but ASLD royalties average between 5 and 6 percent of the value (ASLD 2019). With ASLD owning the rights to approximately 2 percent of the overall copper resource, average annual royalty payments to ASLD over the life of the proposed mine are projected to be between $0.5 and $1.5 million.

Pinal County and Pinal County Junior College could also receive large amounts of tax revenues, primarily from property tax revenues on the proposed mine. While the Superior Unified School District could receive the largest amount of property tax revenue based on its current mill levy, the Arizona school finance equalization system would likely require the District to either reduce its mill levy, or would distribute the additional tax revenues across other districts throughout the state, or a combination of both. Although the Town of Superior is by far the closest municipality to the proposed mine, the Town is projected to receive a relatively small share of the total direct and secondary tax revenues (less than $60,000 per year if there is no new development to about $500,000 per year with potential future development.)

Property taxes on the mine (and to a much lesser extent potential new homes developed to house workers) make up between 44 and 55 percent of the projected total revenues for state and local governments shown in Figure I-9. In some cases, including the Superior School District and Pinal County Junior College, all of the projected revenues associated with the proposed mine would come from property taxes. Due to statutory limits on annual increases in property tax revenues in Arizona, the primary benefit from these revenues would be to reduce the property tax rates for other taxpayers (Lincoln Institute 2016).

Figure I-9. Projected Average Annual State and Local Government Revenues related to the Proposed Resolution Mine

	Direct Revenues from RCM					Taxes on Employees**				
	Property Tax*		Severance Tax*		Corporate Income	Transaction Privledge	Personal Income	Employee Property	Totals by Jurisdiction	
Location	BBC est.	RCC est.	BBC est.	RCC est.	Tax	Tax	Tax	Tax****	Low Est.	High Est.
Town of Superior										
With No New Development	$0	$0	$864	$1,065	$15,578	$37,530	$3,526	$0	$57,498	$57,699
With Existing Housing Constraints	---------- Same as Above ----------					$167,559	Same as Above	$0	$187,526	$187,728
With Future Development	---------- Same as Above ----------					$413,311	Same as Above	$77,457	$510,736	$510,937
Superior School Dist.*****										
With No New Development	$16,255,627	$31,018,041	$0	$0	$0	$0	$0	$0	$16,255,627	$31,018,041
With Existing Housing Constraints	---------- Same as Above ----------					$0	$0	$0	$16,255,627	$31,018,041
With Future Development	---------- Same as Above ----------					$0	$0	$68,071	$16,323,697	$31,086,112
Pinal County Jr. College	$6,098,926	$11,637,615	$0	$0	$0	$0	$0	NA	$6,098,926	$11,637,615
Pinal County										
With No New Development	$10,444,121	$19,928,864	$185,392	$228,622	$0	$154,597	$0	NA	$10,784,109	$20,312,083
With Existing Housing Constraints	---------- Same as Above ----------					$215,193	$0	NA	$10,844,705	$20,372,679
With Future Development	---------- Same as Above ----------					$303,573	$0	NA	$10,933,086	$20,461,059
Gila County	$0	$0	$26,414	$32,574	$0	$71,077	$0	NA	$97,491	$103,651
Graham County	$0	$0	$18,363	$22,645	$0	$5,235	$0	NA	$23,598	$27,880
Other AZ Jurisdictions***										
With No New Dev. In Superior	$2,683,781	$5,121,035	$4,868,747	$6,004,054	$3,821,748	$2,450,638	$865,072	NA	$14,689,986	$18,262,547
With Existing Superior Constraints	---------- Same as Above ----------					$2,260,014	Same as Above	NA	$14,499,361	$18,071,922
With Future Superior Development	---------- Same as Above ----------					$1,925,881	Same as Above	NA	$14,019,701	$17,592,263
State of Arizona	$0	$0	$4,631,138	$5,711,040	$22,125,637	$5,795,075	$5,008,248	NA	$32,551,850	$38,639,999
Totals	$35,482,454	$67,705,556	$9,730,054	$11,998,935	$25,947,385	$8,514,152	$5,876,845	NA	$80,559,084	$120,059,516

Note: *BBC estimates of potential RCM property tax and severance tax payments are based on $2/lb copper price, RCM estimates assume $2.75/lb copper price.
** Includes direct, indirect and induced employment from proposed mine.

*** Includes all Arizona municipalities other than Superior; all Arizona counties other than Pinal, Gila and Graham; and all property taxing entities in Pinal County other than those identified in table.

**** Property taxes on homes of projected employees only estimated for potential Superior residents due to uncertainty regarding specific residence locations for other workers outside of Superior.

*****School district revenues based on current mill levy. Arizona school finance equalization formula could likely result in either a reduction in the mill levy, a redistribution of revenues to other districts, or both.

Totals may not sum precisely due to rounding.

Additional indirect revenues for the Town of Superior. While the government revenue estimates shown in Figure I-9 account for the state and local revenues that could be directly paid by the mine and its employees, they do not account for additional revenues that the Town of Superior could receive from the State of Arizona's revenue sharing formulas due to increases in its population. The State shares revenues with its municipalities from four primary sources: state income tax, state transaction privilege taxes, the Highway User Revenue Fund and vehicle license taxes.

As shown in Figure 1-10, the Town of Superior received approximately $1,045,000 in intergovernmental revenues from these sources in 2019. Assuming that mine-related households have the same average size as existing households in Superior (about 2.6 residents per household), state revenue sharing could increase by about $142,000 per year in the near term (while available housing constrains the number of mine-related households that live in Superior) and by over $380,000 if future development relieves the current housing constraint. If there is no new development or redevelopment in Superior, and no increase in the Town's population due to the mine, there would be no increase in these shared revenues.

Figure I-10. Projected State of Arizona Revenue Sharing with Superior Based on Future Population Growth

Source:
2019 Arizona Tax Handbook; 2019 Arizona Population Estimates

Source	Pre-Project	No New Residents	Housing Constrained	With Development
Income Tax (URSF)	$406,177	$406,177	$461,342	$555,467
TPT (City Sharing)	$282,896	$282,896	$321,318	$386,874
HURF (City Sharing)	$232,904	$232,904	$264,536	$318,507
Vehicle License Tax	$123,169	$123,169	$139,897	$168,439
Totals	$1,045,146	$1,045,146	$1,187,092	$1,429,287
Increases from Greater Population		**$0**	**$141,946**	**$384,141**

Potential impacts on property tax revenues from tailings disposal alternatives. As described in Section VI of this report, the anticipated large tailings piles that could be developed as part of the proposed mining operation could have adverse impacts on residential property values in proximity to the proposed tailings storage location. Figure I-11 summarizes the potential impacts on annual property tax revenues that could result from each of the tailings alternatives for the Town of Superior, Pinal and Gila counties and other county-wide taxing entities in Pinal County. These estimates are based on the projected reduction in residential property values for each tailings alternative, 2020 residential property tax assessment rates in Arizona, and 2020 property tax mill levies for each jurisdiction. The potential impact on property tax revenues is largest for the Near West and Silver King alternatives because of their proximity to a large number of residential properties in Superior. Potential property tax impacts from the Peg Leg and Skunk Camp alternatives are much smaller because of their remote locations and few nearby residential properties.

Figure I-11. Potential Impacts on Annual Property Tax Revenues from Tailings Disposal Alternatives

Source:

Section VI. Effects on Property Values, AZDOR 2020., and Pinal County 2020.

	Taxing Entity				
Tailings Alternative	Town of Superior	Superior School District	Pinal County	Pinal County Jr. College	Gila County
Near West	-$20,536	-$18,047	-$11,595	-$6,771	NA
Near West Modified	-$20,536	-$18,047	-$11,595	-$6,771	NA
Silver King	-$36,732	-$32,281	-$20,740	-$12,111	NA
Peg Leg	NA	NA	-$262	-$153	NA
Skunk Camp	-$193	-$170	-$109	-$64	-$121

While the potential tailings facilities could adversely impact revenues from property taxes on nearby residential properties, the facilities themselves could provide additional tax revenues to local taxing entities. RCM has estimated that the "Full Cash Value" of the proposed Skunk Camp tailings facility would be about $207 million, including $6 million in construction cost and about $201 million in equipment value. Based on that estimate, this facility would produce about $5.7 million per year in annual property tax revenues – which would be roughly split between applicable taxing entities in Pinal and Gila counties (RCM 2020). The other tailings facility alternatives would likely produce similar levels of property tax revenues, but those revenues would only occur in Pinal County. Since none of the proposed tailings storage facilities would be located within municipal boundaries, neither the Town of Superior or any other municipality in the Copper Triangle would receive property tax revenues associated with those facilities.

Mine-related demands and costs for public services. Development and operations of the proposed mine could generate additional demands for public services, and additional costs to provide such services. Based on the location of the proposed mine in Pinal County, just outside the municipal boundaries of the Town of Superior, those two jurisdictions and the Superior School District could be the most affected by additional service requirements and costs.

In the Draft EIS (DEIS) published in 2019, the study team developed estimates of Superior's potential additional costs based on an "effective service area" measure of the population it could serve, including non-residents who would commute to work at the proposed copper mine. Subsequent to the DEIS, the study team continued to work with the Town of Superior to refine the fiscal impact estimates and produced revised estimates based on the most recent Town of Superior budget for 2020 and input from the Town in September 2019 and February 2020. The Forest Service and the EIS team also engaged in a discussion regarding these estimates in October 2019 and June 2020.

Subsequent to these revised estimates and discussions, the Town of Superior and RCM worked together to develop agreed upon estimates of the effects of the proposed mine on Superior's costs and revenues. Depending on the number of new residents who live in Superior as a result of the proposed mine, the projected impact on the Town's costs at the peak of construction was estimated to be between approximately $1.0 and $1.2 million per year. Those costs are projected

to be offset by between $340,000 and $640,000 per year in offsetting revenues plus contributions from RCM of approximately $725,00 per year.

During operations, the Town's costs are projected to increase by between $0.8 and $1.3 million per year. Those cost increases could be offset by additional revenues of between $0.2 and $1.2 million – depending on the number of mine workers residing in Superior – as well as contributions from RCM of about $654,000 per year.

Further detail regarding these estimates is provided in Appendix A to this technical memorandum. The Town and RCM are continuing to work on the details of RCM's contributions to offset the fiscal impacts of the mine.

Pinal County would also provide services to the proposed mine, including road maintenance, additional public safety services and other county government activities. Relative to the scale of overall county government activities, the proposed mine is not likely to create a substantial burden for the County.

As shown earlier in Figure I-4, the proposed mine is projected to directly and indirectly support a little less than 2,000 new jobs in Pinal County. This could represent about a two percent increase in overall county employment. The projected residence locations for the workforce, shown previously in Figure I-7, indicate that as many as 600 or more of those workers could ultimately reside in Pinal County. Based on the current average household size in Pinal County of about 2.8 residents, the total effect of the proposed mine on the County's population could ultimately be an increase of almost 1,700 residents. This could be an increase of about 0.36 percent based on the current county population of approximately 463,000 residents.

Based on these projected increases in Pinal County population and employment, and current Pinal County general government expenditures of about $150 million per year, the proposed mine could increase the costs of county service provision by about $540,000 per year. As shown in Figure I-9, the proposed mine is projected to increase Pinal County's revenues by an annual average of between $11 and $20 million, which is likely to substantially exceed the increase in the costs of service provision for the county.

To the extent that employees directly or indirectly supported by the proposed mine choose to live in or near Superior and have school age children in their households, development and operation of the proposed mine could also increase the demand for K-12 education services and the cost for the Superior School District to provide those services. Given the nature of school funding in Arizona, which is based on school and district enrollment, these costs are likely to be offset by additional revenues that would be provided through the Arizona school foundation system.

Schools in the Superior School District are currently operating well below their designed capacity. The elementary school in Superior currently has about 170 enrolled students, but has a capacity to educate about 350 students. The combined middle and high school currently have about 175 students, but have the capacity to educate up to 400 students (Estatico, May 2018).

SECTION II.

Vulnerability to Boom-Bust Cycles

SECTION II.
Vulnerability to Boom-Bust Cycles

Another socioeconomic concern that received considerable attention in the Power report was the potential for the proposed Resolution Mine to be subject to "boom-bust" cycles, primarily due to fluctuations in the price of copper. As described in the Power report, copper production in the U.S. (and copper employment and wages in Arizona) have historically been quite variable (Power 2013). Substantial cut backs, or complete suspensions, in mine operations can have considerable socioeconomic impacts on smaller communities that are highly dependent on mining employment and revenues.

BBC evaluated the potential vulnerability of the proposed Resolution Mine to potential cutbacks or suspensions in operations due to fluctuations in the price of copper. The unusual economic characteristics of the proposed mine are considered in this context.

Economic considerations. Standard microeconomic theory holds that firms should operate as long as their revenues exceed their variable costs — the costs they can control by changing the scale of their operations, such as payroll and operational purchases of goods and services. Even if the firm is operating at a loss relative to their total costs (including fixed costs like debt service), as long as their operational revenues can cover their variable costs and contribute anything towards the payment of their fixed costs, they are better off than if they shut down and have to pay all of their fixed costs while receiving no revenues from their operations (Krugman and Wells 2008).[1]

Projected variable costs for Resolution. SWCA has developed estimates of the annual levels of copper production from the proposed mine over a 40-year production period (SWCA 2018). Based on those estimates, it is useful to think about the proposed mine in terms of three production phases:

- *Ramp up to full production*. During the first ten years of production, the annual copper output from the proposed mine is projected to average approximately 0.8 billion pounds of copper per year.
- *Full production*. During the following twenty years, annual copper output from the proposed mine is projected to average approximately 1.3 billion pounds of copper per year.
- *Declining production*. During the final ten years of production, annual copper output is projected to average about 0.5 billion pounds of copper per year.

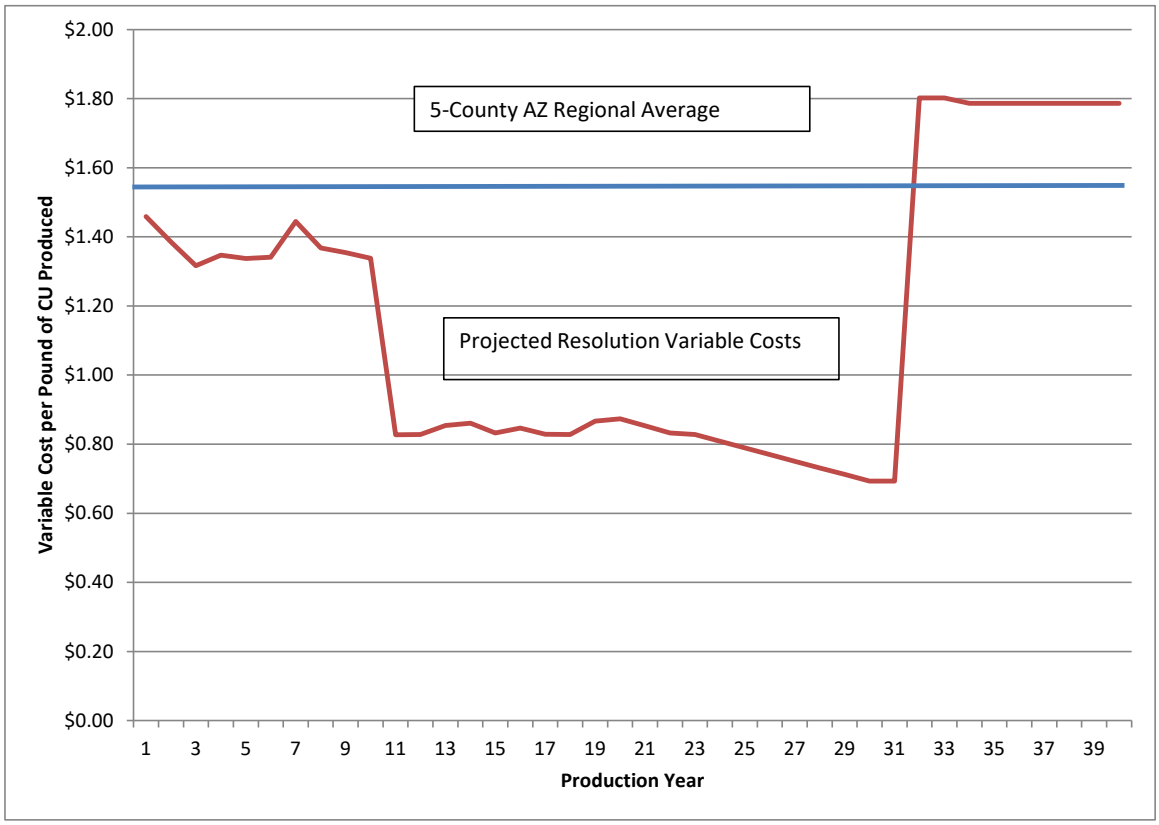
[1] Exceptions to this concept would situations where a firm could reduce or eliminate its fixed costs through bankruptcy or closing its operations and selling its assets.

By overlaying these projected production levels during each phase with the projected personnel costs and annual expenditures on goods and services provided by RCM (as depicted in Figure II-1) and the mine's projected annual tax costs, we can estimate the proposed mine's annual variable cost per pound of copper produced across the anticipated 40 years of production. Overall, the proposed mine's variable costs are estimated to average about $1.18 per pound, but the variable costs per pound of production differ considerably among the three operational phases (as shown in Figure II-1). For purposes of comparison, Figure II-1 also depicts the average variable cost per pound of production for the existing mines in the 5-county region ($1.57 per pound), based on the 2016 economic profile of the region's copper industry provided in Figure II-2, updated to 2020 dollars.

As illustrated in Figure II-1, during the first ten-year ramp up to full production, the variable costs of the proposed Resolution Mine are estimated to average around $1.37 per pound, about 13 percent lower than the average variable costs per pound for the existing copper mines in the region. During the twenty-year period of full production, Resolution's variable costs are projected to drop to around $0.81 per pound. During the final decade of production, the variable costs of the proposed mine are projected to increase to around $1.79 per pound as production levels decline.

From a purely economic standpoint, the sustainability and consistency of operations at the proposed mine would depend on the level of copper prices in relation to these estimated variable costs.

Figure II-1. Projected Annual Variable Costs of the Proposed Resolution Mine per Pound of Copper Produced

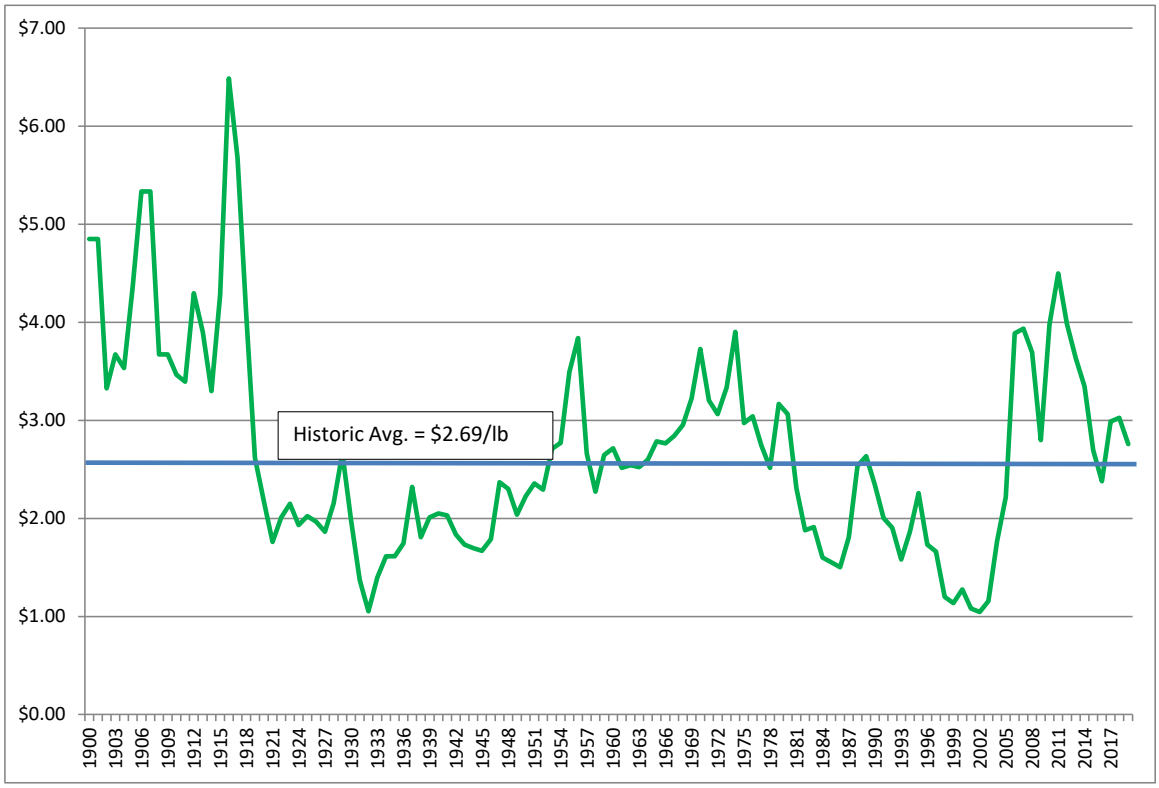


Source: BBC Research & Consulting based on data provided by Resolution Copper Corporation, 2020; BBC estimates of annual state and local tax costs; and EPC 2011 estimates of federal tax costs (updated for inflation).

Historical copper prices and price variability. Figure II-2 depicts historical copper prices from 1900 through 2019, expressed in terms of 2020 dollars (e.g. inflation adjusted). Over that 120 year period, the price of copper has averaged $2.69 per pound, but varied from as much as $6.49 per pound in 1916 to as little as $1.05 per pound in 1932 and 2002 (USGS 2017 and macrotrends.net 2020).

During the most recent 50 years shown in Figure II-2 (1966-2015), the average price of copper has been lower, at $2.53 per pound. The maximum price during this period was $4.50 (in 2011) and the minimum was $1.05 (in 2002).

Figure II-2. Historical Copper Price per Pound, 1900-2019



Source: BBC Research & Consulting based on data provided by Resolution Copper Corporation, 2017; BBC estimates of annual state and local tax costs; and EPC 2011 estimates of federal tax costs (updated for inflation).

Economic evaluation. From the standpoint of purely short-term economic considerations, the critical threshold where copper prices would fall below projected variable costs for the proposed mine during the first ten year ramp up to full production appears to be about $1.37 per pound (as shown in Figure II-1). Over the past 120 years, copper prices have fallen below this level about 7 percent of the time. During the potentially more relevant period of the past 50 years, prices have fallen below this level about 12 percent of the time.

However, as RCM is undoubtedly well aware, the relatively expensive production during the ramp up period is a necessary step to reach the much more profitable period of full production. Based on the projected variable costs over time illustrated in Figure II-1, it seems relatively unlikely that the proposed mine would shut down during the ramp up period based on short-term economic considerations as long as the production and cost path is consistent with these projections.

During the following twenty years of full production, it appears likely that the proposed mine would have very low variable costs per pound of production relative to the more conventional mines in the region. Again considering just short-term economic considerations, the critical threshold price during this period would appear to be below $1 per pound. Over either the full 120 year period of 1900-2019, or the more recent 50 year period from 1970-2019, the price of copper has not fallen below $1 per pound in terms of inflation-adjusted 2020 dollars. Consequently, again from a purely economic standpoint, it appears very unlikely that the

proposed mine would shut down or substantially cut back its operations during this period – as long as production and costs are following their projected paths.

The proposed mine would, however, appear to be more vulnerable to slow downs or operational suspensions for economic reasons during the final ten years of production. Based on the variable cost projections shown in Figure II-1, the critical copper price threshold during this period appears to be around $1.80 per pound. Over the past 120 years, copper prices have fallen below this level about 20 percent of the time. During the more recent last 50 years, prices have fallen below this level about 26 percent of the time.

Since 1970, there have been two extended periods of prices below $1.80 per pound, including the three year period from 1984-1986 and the nine year period from 1996-2004. Considering only short-term economic factors, there would appear to be a reasonable likelihood that the proposed mine could either scale back its operations or temporarily shut down at some point during the final ten years of production due to low copper prices.

The foregoing analysis assumes the accuracy of projected copper production from the proposed Resolution mine of about 40 billion pounds of copper over the 40-year production period. If the mine's production turns out to be less than expected, the variable costs per pound of copper are likely to be higher than anticipated. For example, if the mine yields 20 percent less copper than currently anticipated, but the projected personnel and non-personnel-related costs are consistent with current forecasts, the average variable cost would rise to about $1.48 per pound. That cost level would still be slightly lower than the $1.57 per pound average among Arizona copper mines.

Conclusions regarding potential for "boom-bust" cycles. The global price of copper has historically been highly variable. Periods of low and/or declining copper prices have contributed to fluctuations in copper mining employment and wages in Arizona, and those fluctuations have created economic and fiscal hardships in smaller communities that are heavily dependent on mining.

Presuming that RCM's projections of operational employment, labor costs, non-labor operating costs and output prove reasonably accurate, the proposed Resolution Mine will have lower operating costs than the typical conventional copper mines in the region. It appears unlikely that the proposed mine would have to suspend or substantially cut back its operations for purely economic reasons during either the ten year ramp up period or the following twenty years of full production. During the last ten years of the mine's anticipated production life, the operational economics of the mine appear less advantageous, and there appears to be a greater likelihood that operations could be reduced or suspended for economic reasons.

Whether or not there are any temporary shutdowns during the operation of the proposed mine, the mine would have a finite lifespan – currently projected to span about 54 years from 2020 through 2073. When the mine closes, and reclamation is complete, the Town of Superior and the Copper Triangle would likely experience a decline in local employment and – potentially – either a decrease in population or an increase in the local unemployment rate. These changes could also have adverse impacts on local fiscal and social conditions as has been previously experienced in Superior and other former mining communities in Arizona.

SECTION III.

Comparison to Previous Socioeconomic Studies

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Comparison to Previous Socioeconomic Studies

As noted at the outset of this TM, previous socioeconomic studies were conducted on behalf of Resolution Copper Corporation (EPC 2011) and on behalf of the San Carlos Apache Tribe in a critique of the proposed mine (Power 2013). Both of the two prior studies also used the IMPLAN modeling system. The following section compares and contrasts BBC's results with the two prior studies.

Elliott D. Pollack & Company, 2011 Study. The EPC study focused primarily on reporting cumulative projected economic and fiscal effects over the entire life of the proposed mine. BBC has not developed estimates of the potential cumulative effects over the next 50 or 60 years because annual economic effects provide much more useful information in the context of an EIS.

The EPC study does, however, summarize their estimates of the annual economic effects of the mine in Table 5 on page 7 of their report. Across the State of Arizona as a whole, EPC reports the following estimated, average annual effects:

- Direct employment 1,429 jobs
- Total employment 3,719 jobs
- Direct labor income $107.2 million
- Total labor income $220.5 million
- Direct output $645.1 million
- Total output $960.0 million

Comparison of the average annual statewide effects from the EPC report with the BBC's estimates of the average annual effects across the five county region (reported in Table 4 of this TM) indicates that BBC's regional economic effects estimates are almost identical in terms of direct employment, about six percent lower for total employment (including "multiplier effects"), about 27 percent higher in terms of labor income, and considerably higher in terms of economic output. We believe these differences stem from updated data used by BBC, inflation between the 2011 analysis by EPC and the 2020 analysis by BBC, and to a difference in modeling approach between the two studies.

Updated data in the BBC study. The BBC estimates for the Final EIS started from updated projections of employment, personnel costs and non-personnel expenditures provided by RCM in 2020. The EPC analysis was based on similar data that RCM provided to EPC in 2011.

Difference in modeling approach. The largest differences between the EPC estimates and the BBC estimates are in the considerably larger estimates of direct and total output in the BBC study than in the previous EPC study.

The EPC report does not provide much detail regarding their IMPLAN modeling, and there is no indication in the EPC report that they customized the default copper mining industry profile in the IMPLAN model to reflect the unique characteristics of the proposed Resolution mine. As described earlier in the TM, the information provided by RCM indicates that the proposed mine would be much less labor intensive (per unit of copper produced) than a typical copper mine. The differences are most apparent by comparing the default copper mining industry profile in the IMPLAN model shown in Figure I-2 with the customized profile for the proposed Resolution Mine that BBC developed based on the projected output, employment and purchases of goods and services provided by RCM (shown in Figure I-3).

For purposes of comparison to the EPC results, BBC examined the projected effects of the Resolution Mine using the default copper mining industry profile in the IMPLAN and the original inputs used by EPC in 2011, updated for inflation through 2017 (when the Draft EIS was prepared). Based on the projected direct employment of the mine (but using the default copper mining industry profile), we obtained output results that are more similar to the EPC results, as shown below:

- Direct output $729 million
- Total output $1.09 billion

The proposed mine, however, would use fundamentally different methods than a typical copper mining operation. One of the clearest indicators of the problems created by modeling the Resolution Mine based on its projected employment and the default profile of a typical copper mining operation is apparent in the EPC estimates of the direct output from the mine. As shown earlier, EPC estimated the direct output of the proposed mine at $645 million in 2011. The EPC report also indicates they assumed a copper price of $2.50 per pound, so this direct output estimate would correspond to production of approximately 258 million pounds of copper per year. While that level of production corresponds to the output of a conventional Arizona copper mine employing about 1,500 people, the proposed Resolution Mine is expected to produce an average of approximately 660 million pounds of copper per year over the full 54-year period from 2020 through projected mine closure in 2073 (an average of 1 billion pounds of copper per year during the 40-year production phase) with the same level of employment.

For purposes of further comparison, BBC also modeled the regional economic impacts of a conventional copper mine with the same level of production expected of the Resolution Mine (approximately 1 billion pounds of copper per year). A conventional mine with that level of production would directly employ about 4,200 workers and would produce total regional economic effects of over 10,000 jobs per year.

In sum, the proposed Resolution Copper Mine would be fundamentally different from traditional copper mines. Based on the data provided by RCM, the proposed mine would be much more productive and have low labor intensity and high capital intensity (relative to its level of production). To adequately assess the economic effects of the proposed mine, it is important to capture these distinctive aspects of the operation.

Fiscal revenue estimates. The EPC report also provides estimates of the benefits of the mine in terms of government revenues. Although EPC focused on quantifying government revenues over the entire life of the proposed mine, their estimates can be compared to BBC's estimates by dividing them by the assumed 54-year operational life of the facility.

EPC projected that state and local government entities would receive approximately $5.78 billion in direct and secondary revenues over the life of the proposed mine (EPC 2011, Table B, page iii). This corresponds to annual revenues of approximately $107 million (in 2011 dollars). As shown in Figure I-9, BBC's estimate of average annual state and local revenues is between $81 and $120 million. However, the EPC revenue estimates exclude property taxes to school districts (for the reasons noted earlier regarding the school equalization mechanism in Arizona). Excluding the school district property tax revenues shown in Figure I-9, BBC's estimate of annual state and local tax revenues would be between $64 and $89 million per year, which is lower than the EPC estimates. The difference may be attributable to the inclusion of more minor revenue sources in the EPC report (such as the vehicle license tax, unemployment tax and HURF tax) and EPC's estimates of the total property taxes that would be paid by all direct and secondary workers related to the mine. As noted earlier, BBC only sought to quantify employee property taxes for the portion of the workforce expected to reside in Superior.

EPC did not provide an estimate of the distribution of local government tax revenues among individual counties and municipalities, instead reporting only aggregate totals for all municipalities and counties in Arizona.

Power Consulting, Inc., 2013 Study. The Power study did not dispute the total statewide economic effects estimates from the EPC study, although Power did critique the EPC focus on cumulative effects over the life of the mine. One of the primary arguments in the Power study, however, was that the local economic effects in Superior and other communities within the "Copper Triangle" would be much smaller than the statewide effects.

Using an approach similar to BBC 's of estimating economic effects from the proposed mine within a local "copper triangle" region comprised of about 9 ZIP codes, Power concluded that "indirect and induced employment impacts within the local study area are only about a quarter of the statewide impacts estimated in the Pollack Report. The induced impacts on labor income are only about a fifth of what the Pollack Report estimated." (Power, 2013. Page 41).

While BBC disagrees with Power's approach of counting only a portion of the direct employment effects within the local region surrounding the mine (as discussed on page 1 of this TM), the results from our local area economic effects modeling are consistent with Power's observation regarding the distribution of indirect and induced economic effects (also termed "multiplier effects") from the mine. As shown in Figure I-4 of this TM, BBC estimates that approximately 32% of the indirect and induced employment from the proposed Resolution Mine are likely to occur within the "Copper Triangle."

In response to the fiscal estimates provided in the EPC report, Power raised concerns regarding the geographic distribution of the projected local governments (which was not provided in the EPC study). BBC's analysis indicates that Power was correct in their view that relatively little of the local government revenues would flow to the Town of Superior (or other nearby

municipalities in the "copper triangle"), though Pinal County would likely receive substantial property tax revenues from the proposed mine.

Power also raised concerns about the potential for the proposed mine (and the surrounding community) to be adversely affected by "boom-bust" cycles, primarily due to fluctuations in the global price of copper. While BBC agrees with Power that Arizona mines and mining communities have been substantially impacted by variability in the economics of mining, our analysis indicates that the proposed mine would be a low cost producer during much of its anticipated operational life. Prior to the final few years of anticipated production, it appears unlikely the proposed mine would have to suspend or substantially cut back its operations for purely economic reasons. During the final years of production, the proposed mine could be more vulnerable to low copper prices.

Power also raised concerns about the need to evaluate the additional costs that local governments could face to serve the mine and its workforce. Those potential costs and effects have been evaluated and described in this TM.

Power Consulting, Inc., Appendix for Comments Prepared for the San Carlos Apache Tribe. 2019. Power Consulting also prepared an appendix in support of comments on the Draft EIS on behalf of the Tribe. The appendix was structured in terms of five categories of "deficiencies" in the socioeconomic analysis provided in the DEIS as perceived by Power.

The first category in the Power appendix involved a comparison of the treatment of the "benefits" of the proposed mine with the "negative impacts" on recreation and "amenity-supported economic vitality." In this discussion, Power argues that the "benefits" and "negative impacts" were not treated equally in the DEIS. This argument cites some semantics from the Draft EIS, but mostly hinges on the points that natural amenities and the visitor-based economy are vital to Arizona, and to the area near the proposed mine in particular. These points are largely made by citing information provided in the DEIS, and BBC agrees with them. Power also notes that there is more quantification of the potential "benefits" associated with the proposed mine than of the "negative impacts" on the amenity and recreation-based economy. This is also true, though Power recognizes it is due to limitations in available data specific to the area near the proposed mine, but does not provide new data or analysis to support further quantification.

The second category in the Power appendix claims that the DEIS exaggerated the "positive impacts" of RCM. This assertion is based on the argument from the original Power report that most of the benefits of the proposed mine will occur outside the Town of Superior. BBC agrees that is likely to be the case, as indicated in the data and information provided in Section I of this report (and the comparable section of the previous version of this report published along with the DEIS). However, Power also bases this assertion, in part, on the DEIS' inclusion of economic and fiscal effects outside of the Copper Triangle, particularly in Maricopa and Pima counties. BBC does not agree that suppressing this information would lead to a more accurate disclosure of the potential effects of the proposed mine.

The third category in the Power appendix provides an argument that the EIS should quantify socioeconomic impacts associated with the mine's potential use of CAP water supplies. Potential

impacts of the proposed mine's water use are discussed in Section 3.7.1 "Groundwater Quantity and Groundwater-Dependent Ecosystems" and Chapter 4 "Cumulative Effects" of the EIS.

The fourth category in the Power appendix is a critique of the Draft EIS for "assuming nearly constant employment" over the life of the proposed mine, despite the history of copper booms and busts in Arizona. Employment in the EIS analysis is based on projections provided by RCM, and neither RCM or the EIS study team can forecast the timing of market changes in copper supply, demand and prices. However, Section II of BBC's report specifically addresses the boom-bust concern, acknowledges the fluctuating history of copper production in Arizona, and evaluates the likelihood of temporary or permanent shutdown due to market variability, as well as the sensitivity of the analysis to potential uncertainty in RCM's projections.

The fifth and final category in the Power appendix is that the DEIS did not adequately address potential social impacts from the proposed mine. A new section has been added to BBC's report (Section VII) to disclose potential social impacts in and near the Town of Superior.

SECTION IV.

Effects on Tourism and Recreation

SECTION IV.
Effects on Tourism and Recreation Economies

Introduction

The proposed Resolution Copper Mine would affect the tourism and recreation economies of Pinal and Gila counties, as well as the Town of Superior. The study area's economy benefits from spending by tourists visiting the region and purchasing goods and services from local businesses. The study area's relative abundance of natural amenities, including hiking and off-road vehicle (OHV) trails, campgrounds, rock climbing, and other features, also attracts recreationists – also referred to as nature-based tourists – who support the economy with their spending.

Previous studies of mining's effect on tourism have found that operational mines can have both negative and positive effects on a region's tourism economy. In some cases, growing demand for mine workers can 'crowd out' employment in other industries, making it harder for other industries, including tourism, to hire workers (Dwyer et al. 2016). Evidence from the coal-mining regions of the Appalachian Mountains also suggests tourists may avoid areas where mining is prevalent (Betz at al. 2014), but evidence from a copper producing area in Utah has shown that industrial sites may increase tourism as part of a phenomena described as 'industrial tourism' (Andreadakis-Rudd and Davis 1998).

In this particular context, evidence from survey data referenced below suggests that tourists are primarily attracted to the area surrounding the proposed mine operations for the natural amenities and recreational opportunities rather than the area's historical mining landscape. The proposed mine would degrade or destroy some natural amenities and recreational opportunities due to surface subsidence, surface disturbance, introducing additional traffic, visual changes, and other characteristics of industrialized landscapes. Most of the effects would occur in or near the Town of Superior and in Pinal and Gila Counties. Nature-based tourists – the primary type of visitors to the area – may respond by choosing to recreate elsewhere or not at all.

Data on tourism and recreation, including visitation numbers, visitor spending, and visitor activities, are often collected and reported at the county level. However, the 'Copper Triangle' area, which contains portions of both Pinal and Gila counties and the Town of Superior, has been the focus of recent efforts to study and promote the area's tourism and recreation amenities as a way to expand and diversify its economic base beyond its historical reliance on mining. Information on recreation visitation, participation in activities, and recreation-related expenditures is collected by the USFS's National Visitor Use Monitoring Program (NVUMS) and reported for the Tonto National Forest as a whole.

This section uses these data to discuss the importance of the tourism and recreation economy to the study area – defined as the Town of Superior and Pinal and Gila Counties – in terms of employment, labor income, economic output, and the welfare of visitors. The data are also used

to qualitatively discuss the anticipated impacts of the proposed action and action alternatives on the tourism and recreation economy of the study area.

Current Travel and Tourism Economy

The travel and tourism economy is a critical component of the economy of the state of Arizona. Businesses in the leisure, hospitality, transportation, and retail sectors are the primary conduits between tourists and the state's economy. Tourists spend money for goods and services provided by businesses in these sectors and that spending generates employment, income, and tax revenue for the state, county, and local governments. Businesses also use part of the money received from tourists to purchase goods and services from other businesses, creating additional employment, income, and tax revenue.

In 2017, travel and tourism directly employed more than 187,000 people in Arizona. During that time, the industry's gross domestic output – roughly defined as industry's gross sales net of the cost of goods sold in retail and wholesale trade – amounted to approximately $9.8 billion, making the travel and tourism industry the top export-oriented industry in the state (Dean Runyan Associates 2017). The export-oriented nature of the industry brings new income into the state that flows to local businesses. In 2017, the state's 38.3 million overnight visitors spent a total of $18.7 billion on goods and services, generating $6.9 billion in income and approximately $1.9 billion in tax revenues for state, county, and local governments (Figure IV-1).

The vast majority of overnight visitors (84% in 2017) come to the state for leisure, which includes shopping, visiting national or state parks, fine dining, visiting historic sites, and hiking or backpacking (Arizona Office of Tourism 2018). The high percentage of leisure travelers visiting the state underscores the importance of the state's natural amenities. It also highlights the importance of the state's public lands, since 5.6 million visitors spent time at National Parks within Arizona and 1.7 million visitors to spent time at Arizona State Parks on their trip.

The travel and tourism economy in North and Central Arizona. The majority of the travel and tourism economy of Arizona is concentrated in the Phoenix and Central Arizona region, which includes Maricopa and Pinal Counties (Figure IV-1 and Figure IV-2). Gila County is located in the North Central portion of the state. In 2017, the Central Region hosted a total of 22.7 million of the state's 38.3 million overnight visitors and there were 5.9 million visitors in the North Central Region. During this time, overnight visitors spent a total of $11.6 billion in the Central Region and $1.4 billion in the North Central Region. This spending generated approximately $4.7 billion in income in the Central Region, supporting about 109,000 jobs and producing more than $1.3 billion of tax revenue for state, county, and local governments. Figure IV-1 displays 2017 visitation data and visitor profiles by region across the state of Arizona.

Figure IV-1.
2017 Arizona Overnight Visitors by Region

	Total Arizona Overnight Visitors	North Central Overnight Visitors	Northern Overnight Visitors	Phoenix & Central Overnight Visitors	Tucson & Southern Overnight Visitors	West Coast Overnight Visitors
Visitors	38.3 million	5.9 million	7.8 million	22.7 million	6.5 million	6.1 million
Leisure/Business Visitors	84%/16%	92%/8%	95%/5%	84%/16%	88%/12%	90%/10%
Non-resident/Resident Visitors	72%/28%	66%/34%	63%/37%	79%/21%	65%/35%	82%/18%
Average Length of Stay	3.6 nights	3.7 nights	3.1 nights	4.5 nights	4.2 nights	3.2 nights
Average Travel Party Size	2.8 persons	3.0 persons	3.1 persons	2.7 persons	2.5 persons	3.1 persons
Average Age	45 years	44.1 years	42.8 years	47.3 years	50 years	39 years
Trip Expenditures per Party	$645	$719	$664	$561	$698	$582
Top Activities	Shopping; National/State Park; Fine Dining; Landmark/Historic Site	Shopping; National/State Park; Hiking/Backpacking; Landmark/Historic Site	National/State Park; Shopping; Hiking/Backpacking; Landmark/Historic Site	Shopping; Fine Dining; Swimming; Landmark/Historic Site	Shopping; National/State Park; Fine Dining; Landmark/Historic Site	Shopping; Casino; Swimming; Museum

Note: Trip expenditures do not include travel to or from Arizona.

The sum of visitors across all regions is greater than the total visitation for the state because of some overlap in visitors to each region.

The West Coast region includes La Paz, Mohave, and Yuma Counties.

Source: Arizona Office of Tourism 2018.

Maricopa County is the hub of the state's travel and tourism industry due to its proximity to the state's largest airport and to a number of leisure amenities, including restaurants, golf courses, and resorts (Figure IV-2). However, in percentage terms, the travel and tourism industry makes larger contributions to the economies of Pinal and Gila counties. In Pinal County, travel-generated employment accounted for approximately 7.6% (7,090) of the County's 93,780 jobs in 2016 compared to approximately 3.9% (101,660) of jobs in Maricopa County (BEA 2016). In Gila County travel-generated employment accounted for 13.5% (2,940) of the County's jobs during the same time period.

Figure IV-2.
Economic Impact of Visitor Spending in Arizona Counties (2017)

County	Travel Spending		Related Travel-Generated Impacts				
	Total ($Million)	Visitor ($Million)	Earnings ($Million)	Employment (jobs)	Local Taxes ($Million)	State Taxes ($Million)	Total Taxes ($Million)
Apache	118	106	37	1,650	3.9	5.9	9.8
Cochise	326	304	84	3,630	13.5	14.9	28.4
Coconino	1,447	1,397	403	13,200	72.5	62.3	134.8
Gila	294	285	78	2,940	9.5	13.4	22.9
Graham	63	56	14	880	2.7	3.0	5.7
Greenlee	13	12	2	110	0.3	0.7	0.9
La Paz	146	142	36	1,350	5.3	6.4	11.7
Maricopa	14,036	10,963	4,542	101,660	698.6	546.3	1,245.0
Mohave	584	541	183	7,040	23.3	27.8	51.1
Navajo	331	312	107	4,110	14.0	16.0	30.0
Pima	2,911	2,353	756	25,500	74.1	126.7	200.8
Pinal	691	617	185	7,090	25.3	33.3	58.5
Santa Cruz	239	231	55	2,100	7.9	9.7	17.6
Yavapai	843	800	244	9,400	40.9	38.0	78.9
Yuma	635	588	164	6,400	22.6	28.2	50.8
Arizona Total	22,677	18,708	6,889	187,060	1,014.0	932.0	1,947.0

Note: The sum of county visitor spending is less than statewide visitor spending because a portion of county ground transportation is allocated to "other travel" at the county level.

Source: Dean Runyan Associates (2017) and Arizona Office of Tourism (2018).

The travel and tourism industry also constitutes a larger share of Pinal and Gila counties' total earnings. In 2017, earnings in Pinal County totaled $4.0 billion, of which the travel and tourism industry contributed just over $184.6 million (4.6%) compared to 3.1% of total earnings in Maricopa County. In Gila County travel and tourism generated approximately 8.6% of the County's total earnings. The earnings from travel and tourism in Pinal and Gila counties, were generated by $617 million and $285 million of resident and non-resident spending, respectively (Dean Runyan and Associates 2017). This spending generated approximately $25 million in tax revenue for local governments in Pinal County and $10 million in Gila County, in 2017 (Figure IV-2; Dean Runyan and Associates 2017).

Economic importance of nature-based tourism in Superior and Pinal and Gila Counties. The travel and tourism economy of the Copper Triangle, which includes portions of Pinal and Gila counties as well as the Town of Superior, is primarily dependent on nature-based tourism to draw visitors to the area. Nature-based tourism is based on visitor experiences that directly or indirectly involve the natural environment. Surveys of visitors to the area found that they come to take advantage of the region's natural amenities and recreational opportunities on Federal and State lands.

A survey of visitors to Boyce Thompson State Park near Superior, which hosted more than 64,000 tourists in 2017 found that the state park's visitors participated in multiple activities in the area, including hiking (58 percent); wildlife viewing (54 percent); camping (15 percent) and picnicking (15 percent) (ASU 2017). Trails, like the Arizona Trail and the Legends of Superior Trail (LOST), are also popular attractions for tourists visiting Pinal County and the Town of Superior (Arizona Commerce Authority 2017). Many visitors also come to the area to take advantage of the abundant climbing, bouldering, and camping opportunities near Oak Flat.

Visitors to the Tonto National Forest (TNF) also engage in a wide variety of recreational activities as shown in Figure IV-3.

Figure IV-3.
Percent of Visitors to Tonto National Forest Participating in Various Activities

Activity	Percent Participation	Percent Main Activity
Hiking/Walking	29.3	15.3
Viewing Wildlife	25.1	1.2
Relaxing	22.6	5.3
Viewing Natural Features	22.2	5.7
Fishing	17.9	11.8
Non-motorized Water	14.9	13.6
Some Other Activity	14.5	10.9
Motorized Water Activities	12.5	8.5
Other Non-motorized	11.1	6.7
Driving for Pleasure	10.5	3.3
Developed Camping	7.9	2.9
Picnicking	7.7	2.5
OHV Use	7.5	5.8
Nature Study	5.9	0
Primitive Camping	4.1	1.1

Source: U.S. Forest Service, 2016

Nature-based tourists support the study area's economy through spending at local businesses. Visitors to the TNF spent an average of $115 per party per day on an average trip lasting approximately four days, but the economic impact depends on the activity that visitors participate in, whether they are local or non-local and whether the trip is a day trip or an overnight trip (USFS 2016; USFS 2017).

On average, visitors participating in motorized activities like off-roading have the highest expenditures of nature-based tourists to National Forests. Their average expenditures per-party per trip in forests like Tonto NF, range from a low of $63 for local day trips to more than $208 for non-local overnight trips. Expenditures from visitors participating in other activities like hunting, fishing, and hiking range from lows of $26 for local day trips for hiking to more than $313 for non-local overnight trips to view wildlife. In the Tonto NF, approximately 74% of visitors traveled 50 miles or less and 68% of visits were local day trips. Of the 26% of visits made to Tonto NF by non-locals (defined as traveling more than 50 miles), few (21%) of the non-local trips – or about 5% of all trips – are overnight visits (USFS 2017).

In total, recreation visitors to Tonto NF spend approximately $63.4 million per year in surrounding communities, generating $24.7 million in direct and indirect labor income, which sustains an annual average of approximately 760 jobs (USFS 2019). Most of the economic impacts by visitors to Tonto NF occur in the accommodation and food services sectors, but significant impacts also occur in the arts, entertainment and recreation sector and the transportation sector (USFS 2017). Only a small portion of the Tonto NF – which is approximately 2.9 million acres in size – would be directly impacted by the proposed action and action alternatives. In total, the action alternatives would impact between 7,270 and 13,028 acres of the Tonto NF.

In addition to the travel, tourism and recreation that occur in the TNF, there is significant recreational activity – particularly OHV use – on land managed by the state of Arizona and the Bureau of Land Management (BLM). Several popular OHV trails are located in or near the Town of Superior and throughout Pinal and Gila counties. According to a report prepared by the Arizona Department of Game and Fish:

"…there is a significant amount of OHV activity within and adjacent to the proposed Resolution Mine project area. National Forest lands north and south of US Highway 60 just west of Superior, the Mineral Mountains on BLM, and the Desert Wells OHV area just west of Superior on state trust lands receive high levels of activity and are considered hotspots for OHV recreation just outside the metro Phoenix area." (AGFD 2018).

OHV recreation and tourism generate significant economic effects in the counties surrounding the proposed mine (Figure IV-4). In Pinal County, OHV recreationists and tourist spend approximately $192 million dollars per year within the county. Fuel, lodging, and food from restaurants and grocery stores account for the majority of expenditures. Based on the only available data (from 2003), updated for inflation, the total spending within Pinal County supports an estimated 1,561 jobs, paying total annual wages of $34 million. In Gila County, OHV recreation and tourism directly contributes about $171 million to the county's economy each year, employing approximately 1,877 people in full and part-time positions. The economic effect of OHV recreation and tourism is largest in Maricopa County, where annual expenditures total $1.9 billion. An estimated 18,620 jobs are created as a result (Silberman 2003, BLS CPI Calculator 2020). These estimates likely understate the total economic contribution from OHV activity, given substantial population growth since 2003.

Figure IV-4.
Annual Economic Effect of OHV Recreation and Tourism in Three Arizona Counties ($ millions), 2018

Economic Impact	Pinal County	Gila County	Maricopa County
Total OHV expenditures	$192.13	$171.11	$1,928.50
Full and part-time jobs*	1,099	1,322	13,113
Total multiplier effect	$216.83	$195.39	$2,537.68
Salaries and wages	$34.36	$31.67	$609.04
State tax revenue	$8.38	$5.96	$111.47

Note: Financial values were updated from Silberman (2003) using the Bureau of Labor Statistics Consumer Price Index.

*Job projections are based on original estimates reported in Silberman (2003). .

Estimates have not been revised to reflect increased activity levels associated with population growth.

Source: Silberman, 2003; Bureau of Labor Statistics (2018).

In total, visitors from outside Pinal County accounted for about 402,100 OHV activity days in 2002, the most recent year for which data are available at the county-level. In Gila County, visitors from other areas accounted for a total of 230,332 OHV activity days in 2002, while visitors from outside of Maricopa County accounted for 1,034,536 of the County's OHV activity days (Silberman 2003).

Potential Effects of Proposed Resolution Copper Mine on the Tourism and Recreation Economy of the Town of Superior and Pinal and Gila Counties

The proposed mine would have operations located east and west of the Town of Superior. The tailings produced by the proposed mine would be stored at one of four sites currently being considered as alternatives. The activities at each of the proposed sites would affect the region's travel and tourism economy.

Tourist's response to the proposed mine would depend on their individual preferences, the proximity of alternative natural amenities and recreational opportunities, and the mine's permitted operating plan. As a result, it is difficult to predict the exact magnitude and duration of the effects the proposed action and alternatives would have on the travel and tourism economy. If the proposed mine's permitted operating plan mitigates the proposed mine's most negative effects on the region's natural amenities and recreational opportunities, the effect on nature-based tourism could be small and at least partly offset by an increase in industrial tourism. However, the effects that cannot be fully mitigated would have lasting and detrimental impacts on the region's nature-based tourism economy.

The magnitude of economic impacts in and around the Town of Superior would be limited by the Town's relatively minimal tourist infrastructure, including only a small number of businesses able to capture the spending of nature-based tourists, though that infrastructure could develop further over the roughly 50-year period encompassed in this socioeconomic evaluation. Still, the impact on individual businesses could be substantial if their current customer base is composed of nature-based tourists that no longer choose to visit the area as a result of the proposed action or action alternatives. Additionally, the loss of nature-based tourists could temporarily or permanently delay the Town's efforts to expand and diversify its economy based on tourism and amenity-based attraction of new residents.

Economic effects would also be experienced elsewhere in Pinal and Gila counties. If nature-based tourists substitute their visits to sites impacted by the mine to sites in other counties that offer similar amenities it would be negatively impact the economies Pinal and Gila counties. Based on survey data, it is likely that a portion of nature-based tourists visiting the study area portion of Tonto NF would visit sites outside of the two-county area, stay home, or choose a different activity to participate in under the proposed action and action alternatives unless measures were taken to mitigate potential negative impacts on recreational and natural amenities from the proposed mine. The proposed action and action alternatives would directly impact less than 0.5% of the Tonto NF's total land area.

According to USFS survey data of visitors to Tonto NF, approximately 48% of visitors would visit a location outside of Tonto NF if they were not able to participate in their planned activity inside the Forest for some reason. Approximately 30% of visitors who took the survey said they would choose to stay home, and about 5% said they would go somewhere else to participate in a different activity if they were not able to participate in their planned activity inside the Forest for some reason.

The remainder of this section discusses the effects that the activities proposed at each site would have on the region's nature-based tourism economy assuming the economic activity related to

the parcel is removed from the economy. As noted above, this may overstate potential impacts since site substitution is possible and likely. In some cases, quantitative estimates of impacts are available for specific activities, such as hunting. When such estimates are available, they are presented below. However, most economic impacts cannot be quantified without making a number of speculative assumptions about individual behavior and hypothesizing about current visitation levels and expenditures in specific portions of the Tonto National Forest where no data are available. In these cases, impacts are discussed qualitatively. A summary of impacts that would affect the resource that underpin the region's nature-based tourism is displayed in Figure IV-5.

Figure IV-5.
Impacts of Action Alternatives on Recreation and Tourism Economy Resources

Alternative	Impacts
East Plant Site	Loss of access to 1,560 acres of public land Loss of access to 14 miles of OHV trails Loss of access to 433 acres of dispersed camping Loss of access to rock climbing 188 fewer hunting days
West Plant Site	Increased industrial activity
Near West Tailings Site	Loss of access to 7,270 acres of public land Loss of access to 32 miles of OHV trails Loss of access to 1,175 acres of dispersed camping 1,200 fewer hunting days Aesthetic and noise impacts to recreational and tourism resources Arizona Trail segment impacted
Silver King Tailings Site	Loss of access to 8,023 acres of public land Loss of access to 24 miles of OHV trails Loss of access to 619 acres of dispersed camping Aesthetic impacts to recreational and tourism resources 1,078 fewer hunting days Arizona Trail segment impacted
Peg Leg Tailings Site	Loss of access to 13,027 acres of public land Aesthetic impacts to recreational and tourism resources 219 fewer hunting days Arizona Trail segment impacted
Skunk Camp Tailings Site	Loss of access to dispersed camping areas Loss of access to 32 miles of OHV trails Loss of access to rock climbing areas Hiking trail impacts 500 fewer hunting days

East Plant Site. The operations at the East Plant Site (EPS) would affect some of the natural amenities that attract tourists to the area. The EPS is located on approximately 1,544 acres of land belonging to the USFS, including 1,500 acres of land that would subside, ending the use of the area by the general public. The EPS and subsidence zones would eliminate the Oak Flat campground and its surroundings, an area that is popular with campers, picnickers, hikers, and

rock climbers. OHV activities would also be affected by the proposed mine's operations. Portions of Forest Road 315, a popular off-road loop between US Highway 60 and SR177, would be eliminated by the activities at the EPS and the eventual subsidence of the area. In total, the Arizona Game and Fish Department (AGFD) estimates that about 14 miles of motorized off-road trail would be lost in addition to 433 acres of dispersed camping. The site is also used for hunting, although according to AGFD the area does not contain a disproportionate amount of habitat favoring any particular species of interest to hunters.

The loss of this area would likely have large effects on existing nature-based tourism patterns and expenditures around the Town of Superior. The loss of camping and climbing amenities at Oak Flat would reduce recreational use of the area, which would lead to a reduction in tourism spending amongst recreational users that have been observed to spend between $82 to $185 per visit (USFS 2017). AGFD estimates that the effects of the proposed mine at the East Plant Site would result in 188 fewer hunter days per year. This would lead to a direct reduction of $10,510 worth of wildlife-related recreation spending in the local economy, which would equal a nominal value of $630,480 over the 60-year life of the proposed mine (AGFD 2018).

West Plant Site. The West Plant Site (WPS) is located on private land near the town of Superior's northwest edge. The WPS was formerly used by the Magma Mine as the site of its copper concentrator. The proposed mine would increase the scale of industrial activity at the site, but the proposed activities would be consistent with the site's historical use. The increased industrial activity could create beneficial effects on the Town's tourism economy for tourists interested in mining activity.

Near West Tailings Site. This alternative would have the largest negative effect on tourism and recreation of any of the proposed tailings disposal alternatives. The area on and around the Near West Tailings alternative is used for a variety of activities, including OHV use, camping, and hunting, by visitors from outside Pinal County. AGFD estimates that the Near West Tailings alternative would affect about 32 miles of motorized off-road trails and eliminate 1,175 acres of dispersed camping. The area is also popular with hunters due to its populations of mule deer, javelina, quail, and predators. According to a survey and mapping exercise conducted by AGFD, the site has some of the highest rates of use amongst hunters. The aesthetic effects would likely change people's desire to visit and recreate in the area thereby shifting visitation and spending patterns and reducing nature-based tourism expenditures in the region.

In total, this alternative would result in the loss of access to approximately 7,270 acres of Federal Land, not including the acreage that would be lost as part of the Land Exchange. The loss of access would likely lead to more crowding and congested conditions in other parts of the Tonto National Forest and potentially increase competition and conflict between different visitor activities.

These effects would negatively impact the number of nature-based tourist visits and tourism spending in the tailings site area - particularly amongst OHV users - resulting in lower tourism spending, earnings, and employment. The Near West Tailings alternative would also reduce the number of hunting days on the site by approximately 1,200 hunter-days per year, amounting to a reduction in direct wildlife-related recreation expenditures of $66,920 per year or $4.0 million over the 60-year operational time horizon of the proposed mine (AGFD 2018).

Silver King Tailings Site. The alternative would result in a loss of access to approximately 8,023 acres of Federal Land. AGFD estimates that this alternative would also result in the loss of about 24 miles of motorized OHV routes and 619 acres of dispersed camping. The large tailings pile would also have a negative impact on the aesthetics of the area, particularly for users of OHV routes and other tourists who value the views and vistas of the Superstition Mountains. The loss of access to Federal Lands and the negative aesthetic effects would likely change people's desire to visit and recreate in the area thereby shifting visitation and spending patterns and reducing nature-based tourism expenditures in the area.

The site at the proposed Silver King alternative also receives a moderate to high number of hunters who use the area to hunt mule deer and predatory animals. The higher-elevation areas of the site are the most valued by hunters because the quality of mule deer habitat increase with altitude at the site. According to the AGFD, the proposed alternative would have a negative effect on mule deer populations, which would reduce the number of hunting days by about 1,078 per year. This would reduce the amount of direct wildlife-related recreation expenditures by about $60,368 per year or $3.6 million over the 60-year operational time horizon of the proposed mine (AGFD 2018).

Peg Leg Tailings Site. The alternative would result in a loss of access to approximately 13,027 acres of Federal Land. Despite the large reduction in accessible acreage, tourism and recreational use of the site is relatively low according to AGFD. Still, development of this alternative would have a negative effect on the aesthetics of the area, particularly for visitors driving from the Florence Kelvin Highway and for outdoor enthusiasts who value pristine views of the Mineral Mountains and the Gila River. The Peg Leg alternative site also contains a variety of species that are popular with hunters, including predators and small game. This also makes the site popular with wildlife-watchers. The AGFD estimated that the site supports about 219 hunting-days each year. Under this alternative, the hunting activity would be lost, resulting in a loss of direct wildlife-related recreation spending of $12,254 per year or $735,269 over the 60-year life of the proposed mine (AGFD 2018).

Skunk Camp Tailings Site. The alternative would create impacts on access to dispersed recreation opportunities, including camping, hiking, and OHV trail use. According to an analysis by AGFD, approximately 32 miles of OHV trails would be impacted under the alternative (AGFD 2018). The alternative would also result in impacts to rock climbing areas. Hunting is permitted for several species and the site is popular with people who enjoy watching wildlife. AGFD estimated that the site hosts approximately 500 small game hunter days per year. The loss in hunting days at the site would lead to a reduction in hunting expenditures in the study area of approximately $70,554 per year or $4,233,240 over the 60-year life of the proposed mine (AGFD 2018).

SECTION V.

Effects on Amenity-Based Migration

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Effects on Amenity-Based Migration

Residents of Pinal and Gila counties – including residents of the Town of Superior – are attracted to the area in part because of its proximity to undeveloped public lands, like the Tonto National Forest, that contribute to the area's high quality of life. While quality of life is very difficult to measure, there is a substantial body of literature that has linked proximity to public lands like national forests and wilderness areas to residential and business location decisions and the associated economic outcomes. This section of the report discusses this concept – known as amenity-based migration – and applies the results of recent research to evaluate potential socioeconomic effects associated with the proposed mine.

Amenity-based Migration in the West

Amenity-based migration describes the movement of people based on the draw of natural and/or cultural amenities (Gosnell and Abrams 2009). This type of migration is primarily focused on areas with an abundance of public lands, wild places, scenic character and a high quality of life. As a result, scenic landscapes contribute to this type of migration primarily due to their aesthetics and recreational amenities rather than their stocks of minerals, timber, and forage (Rasker and Hansen 2000).

Amenity-based migration has occurred in many former mining towns throughout the American West. Places like Telluride and Aspen in Colorado and Moab in Utah – all former mining towns – became symbols of amenity-based migration as the towns' mining industries were replaced by the tourism and amenity industries. New jobs that ranged from ski-lift operators, waitresses, and bike technicians to attorneys and real estate agents replaced mining jobs, broadening each towns' economic base. Resident educational attainment levels also increased. At the same time, the towns' primary sources of income changed as new residents relied more on investment income and less on labor income.

The share of personal income that comes from investments is a good indicator of the amenity-based migration phenomenon (Rasker and Hansen 2000). In Teton County, Wyoming (home of Jackson) more than 50 percent of personal income is derived from investments. The ratio is similar for other popular amenity-based counties like Pitkin and Summit counties in Colorado and Grand County in southeast Utah. In contrast, only about 12 percent of personal income in San Juan County, New Mexico – which is heavily dependent on extractive industries – comes from investment sources (Headwater Economics 2018).

Amenity-based Migration in Pinal and Gila Counties

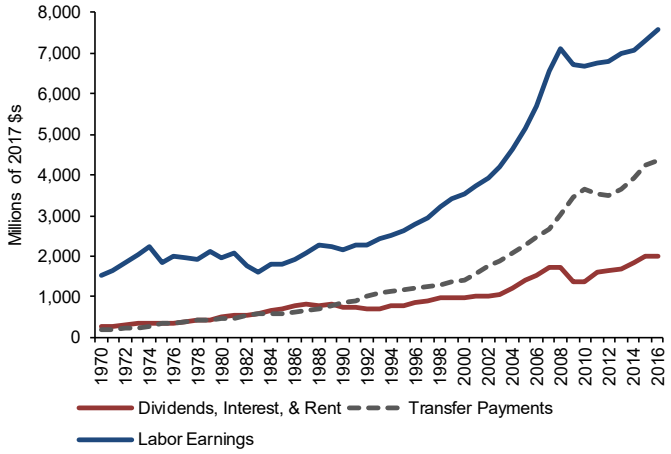
Pinal and Gila counties some amenity-based migrants, but the scale of such migration has been much smaller than in other amenity destinations in the West (High Country News 2012). The economies of both counties have not shown a decline in the importance of mineral extraction and manufacturing while other sectors gained more prominence; investment income does not

make up a large share of personal income; and the average educational attainment of residents has not risen substantially over time.

Instead, the mining, quarrying, oil and gas extraction, and manufacturing sectors remain a significant source of employment in Pinal and Gila counties. In Pinal County, these sectors combined to employ about 6.4 percent of the County's population. Between 2001 and 2015, employment in these sectors grew by between 24 and 33 percent. In Gila County, the combined sectors employed about 12.5 percent of the County's workforce in 2015. Between 2001 and 2015, Gila County's manufacturing sector employment grew by 47.1 percent (U.S. Bureau of Economic Analysis 2017).[1]

In an amenity-based economy the share of personal income derived from investments is generally larger than income derived from labor earnings and transfer payments (Rasker and Hansen 2000). In Pinal and Gila counties, labor earnings – rather than investment income – were the fastest growing component of personal income between 1970 and 2016 (Figure V-1). Transfer payments, which include Social Security, Medicare, Food Stamps, veterans' benefits, unemployment, and other entitlements, were the second fastest growing component while personal income derived from investments including dividends, interest, and rent grew at the slowest rate.

Figure V-1.
Components of Non-Labor Income Compared to Labor Earnings for Pinal and Gila Counties, 1970 to 2016



Source: U.S. Department of Commerce Bureau of Economic Analysis 2017.

Educational attainment statistics from Pinal and Gila counties also suggest that amenity-based migration has not had a large effect on the two counties. In some of the best-known areas for amenity-based migration more than 60 percent of the population has at least a four-year college degree (U.S. Census ACS 5-year averages 2012 to 2016). In Maricopa County, home of the Phoenix Metro Area, about 31 percent of the population has at least a four-year college degree.

[1] No data were available from 2001 to calculate the growth of the mining, quarrying, and oil and gas extraction sector.

In contrast, about 19 percent of the population of Pinal County and about 18 percent of residents in Gila County gave at least a four-year college degree (U.S. Census ACS 5-year averages 2012 to 2016).

The data also indicate that amenity-based migration has not been a prominent migration trend in the Town of Superior. The Town has an older, but less educated population compared to Pinal County. Between 2012 and 2016, only about 8 percent of residents in Superior had at least a four-year college degree. The Town's economy also shows a relatively high degree of dependence on mining and manufacturing and a lack of the diversification that be expected to develop as part of an amenity-based migration trend. Between 2012 and 2016, mining and manufacturing employed an average of 20 percent of the Town's workforce. Employment in arts, entertainment, and recreation accounted for an average of less than 5 percent of total employment and professional services employed about 9 percent of the workforce during this time (U.S. Census ACS 5-year averages 2012 to 2016). In contrast, in Sedona, Arizona – a small city in central Arizona known for amenity-based migration – about 32 percent of the workforce worked in the arts, entertainment, and recreation and professional services sectors between 2012 and 2016. During that same time, less than 6 percent of Sedona's workforce was engaged in mining and manufacturing (U.S. Census ACS 5-year averages 2012 to 2016).

Demographic Effects from Changes in Natural Amenities

While Pinal and Gila counties, and the Town of Superior, may not currently be popular destinations for amenity migrants like some former mining communities, the situation could change. The region boasts many natural amenities that may attract amenity migrants in the future, including close access to outdoor attractions and a relatively low-cost of living. The study team used available research to estimate the potential effect of the mine on future amenity-based migration.

In 2011, the U.S. Forest Service estimated the effects of specific natural amenities on rural population migration through a statistical analysis of over 2,000 rural counties in the U.S. The results were used to forecast changes in migration based on changes to natural amenities due to climate change (Cordell et al. 2011). The analysis isolated the effect that the amount of federally-owned land within 100 miles of a county has on rates of rural migration and found that an increase of one acre of federally-owned land per resident increases annual net migration to a county by an average of 360 residents. The analysis controlled for the effect of other factors, including the presence of mountains, coastline, annual snowfall, warmer winter temperatures, rangeland, forestland, and pasture.

The proposed Resolution Copper Mine would have a footprint ranging from about 7,840 acres to more than 15,360 acres. Federally owned lands would make up between 16 and 84 percent of the proposed mine's footprint under the various alternatives in this EIS. The loss of federally owned land available for public use and recreation could adversely affect amenity-based migration to the area. Whether or not there could be further negative effects to amenity-based migration because these lands are not only being lost to public use and recreation, but also converted into mining and tailings facilities cannot be determined from the 2011 Forest Service analysis.

Figure V-2 below, applies the model from the 2011 U.S. Forest Service study to the changes in land amenities that would occur under each alternative in the Resolution DEIS. The model is applied to Pinal County, which contains the majority of private, public, and state lands that would be affected by the proposed mine. Potential effects to Gila County and the Town of Superior are discussed qualitatively.

Figure V-2.
Potential Effects to Net Migration in Pinal County by Alternative

		Tailings Alternatives				
Acreage of proposed Resolution Copper Mine	Plant Sites and Subsidence Rings	Near West	Near West Modified	Silver King	Peg Leg	Skunk Camp
Total (acres)	2,856	4,987	4,987	5,691	12,503	12,015
Federally owned land (acres)	1,593	4,933	4,933	5,634	8,065	887
Private (acres)	649	53	53	57	172	2,534
State (acres)	1,166	0	0	0	4,267	8,595
Change in net migration due to loss in federally owned lands	-1	-4	-4	-5	-7	-1
Change in net migration as a percent of county population	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Note: Total population of Pinal County was 417,540 in 2016. Plant Sites and Subsidence Rings include area estimates for the West and East Plant Sites, the zone of continuous subsidence, the MARRCO Corridor, and the Filter Plant/Loadout Facility. The area of each tailings alternative represents the total area enclosed by the alternative's fence line and the tailings corridor.

Source: BBC Research and Consulting; Resolution Copper Company (acreage estimates).

Based on the Forest Service Model, domestic migration to Pinal County could decline by 5 people per year under the Proposed Action or by up to 7 people per year under the Peg Leg Alternative. The Skunk Camp Alternative would have the smallest effect on future migration to the County (1 less person per year). These effects represent less than one tenth of one percent of the County's 2016 population. A proportional effect in Gila County and the Town of Superior would indicate almost no reduction in future rates of migration.

Overall, both recent trends and the analytical model developed by the Forest Service indicate the proposed mine would have little effect on amenity-based migration. Pinal and Gila counties, as well as the Town of Superior, have no pronounced pattern of amenity-based migration to date. The analytical model indicates that changes in natural amenities due to the proposed mine (including effects from construction, operation and reclamation) could reduce net domestic migration to Pinal County by about 120 to 480 people over the 60-year life of the proposed mine. Based on population projections for Pinal County from Arizona Office of Economic Opportunity, that reduction would amount to less than one tenth of one percent of the County's projected future growth (OEO 2018). A similar effect in Gila County would reduce domestic migration by 16 to 64 people over the 60-year life of the proposed mine.

SECTION VI.

Other Potential Economic Effects

SECTION VI.
Other Potential Economic Effects

In addition to the potential economic costs of the proposed Resolution Mine in terms of effects on economic activity (e.g., tourism and amenity-based migration), the mine and tailings facilities could also impose economic costs on nearby residents and landowners in the form of reduced property values. Effects on local water supplies could also have economic effects and reductions in available grazing lands could also have an adverse economic impact on local livestock production and supporting industries.

Hedonic Property Value Approach

Numerous studies since the early 1970s have investigated the effect on property values of proximity to special, distinguishable features and activities. These special features, near but not necessarily part of the real estate to be valued, are referred to as *externalities*. These externalities include both positive and negative attributes, from parks and beaches to power lines and hog farms. There are numerous methodological approaches to examining the effect of externalities on property values—such as contingent valuation methods like the survey-based willingness-to-pay or willingness-to-accept techniques—but most studies of externalities affecting property values have used a technique known as hedonic valuation.

Hedonic valuation is an analytical method for explaining prices for a good based on multiple characteristics and is an analysis particularly used in real estate economics and consumer price index (CPI) calculations. Using multiple regression equation analysis, hedonic valuation can identify the magnitude of an effect that a single housing attribute (e.g., proximity to a nearby copper mine) has on the sale price of that property while controlling for any other identifiable characteristics of that property (e.g., square footage, building age, or quality of construction).

Houses are varied and it is difficult to estimate demand generically. Instead, hedonic valuation defines a house as the sum of its component characteristics. Hedonic regression treats these attributes separately and estimates values (in the case of an additive model) or price elasticity (in the case of a log model) for each attribute or bundle of attributes.

The literature of hedonic valuation of residential real estate falls into two general categories. The first, which is the theoretical literature, focuses on identification of housing supply and demand equations and comparisons among equations of differing forms. The second category consists of the empirical literature that describes specific hedonic valuation investigations where the measurements of value are the implicit prices of a property's physical attributes as well as at least one additional attribute from the surroundings, such as an external amenity or disamenity.

In order to evaluate the price impact of an external attribute, effects of other attributes must be controlled. For example, *Palmquist, Roka, and Vukina* (1997) controlled for all characteristics that contributed to a home's sale price in order to estimate the effect of the proximity of a hog farm.

There is a consensus among economists as to the general factors that explain the market price of a property. For example, one well-known study—*Pompe and Rinehart* (1995)—investigated the effect of beach quality on the purchase price of single-family homes with and without water frontage in South Carolina. The authors used a standard hedonic valuation model—

$$P = f(s, n, x)$$

—where P is the selling price of a property. The expression includes structural characteristics (s), neighborhood characteristics (n), and external effects (x). The structural characteristics were age of house, size of living area, number of bathrooms, and having a fireplace. The neighborhood characteristics were distance to Myrtle Beach and whether the property sold after Hurricane Hugo in 1989. To measure the externality of interest—beach quality from the perspective of the property—the model included both width of the nearest beach at high tide and distance to the nearest beach multiplied by the width of the nearest beach at high tide. The model also controlled for a property's ocean views, being on the water, and having a dock; all of these are attributes expected to affect property values.

The hedonic valuation model developed by *Pompe and Rinehart* is similar to that used across the economics and planning literature. For other representative examples, see *Bayer et al.* (2009); *Morancho* (2003); *Palmquist, Roka, and Vukina* (1997); *Palmquist* (1992); *Graves et al.* (1988); *Ridker and Henning* (1967); and *Levesque* (1994).

Hedonic studies are complex and have limitations. Many factors may contribute to the perceived value of any individual property. Not all of these factors can be measured. No model can explain 100 percent of the variation in the sale price of a home. The portion of the variation explained by hedonic valuation models of housing values is typically in the range of 70 to 90 percent.

In addition, housing markets vary substantially from place to place. For example, the square footage of a house is statistically significant in explaining valuation difference in almost every hedonic model of residential property values. While specific quantitative measurements of the effect of square footage on the total sales price cannot be generalized from one geographic area to another, it is reasonable to expect that square footage will be significant in future studies and should be included in the analysis.

Despite limitations, hedonic analysis provides an established and practicable basis for estimating the potential effect of externalities on real estate values. In this case, however, we are interested in the potential effects on future property values from the proposed Resolution mine. Because the mine does not yet exist, it is not possible to estimate its effects on the values of surrounding property values based on prior market transactions. Instead, the study team reviewed the hedonic valuation literature to identify the most comparable studies in other locations for the purpose of developing general estimates of the potential magnitude of effects of the mine on nearby property values.

Most relevant previous studies. Although the empirical literature includes many hedonic valuation studies spanning the past several decades, very few studies have focused specifically on the effect of mining on surrounding property values. The most recent study potentially relevant to the proposed Resolution mine was a national study focused on the impact of surface

coal mines on property values in the U.S. The Impact of Surface Coal Mining on Residential Property Values: A Hedonic Price Analysis was completed in 2011 (Williams 2011). The study employed the somewhat unusual approach of examining the impact of surface coal mining activity on median home values at the county level, using data from 13 states where there was a substantial amount of surface coal mining activity. Numerous county-level variables were included to control for variations between counties in structural housing characteristics, socioeconomic characteristics, and various environmental characteristics (including number of mines, mine production, and other variables such as climate, topography, and the presence of water features). Based on various model specifications, the impact of a surface coal mine on aggregate county residential property values was estimated at between $8 million and $40 million. These effects were relatively small on a percentage basis—reflecting a decrease in overall residential property values ranging from approximately 0.3 to 1.5 percent—but were statistically significant.

While the national study of effects of surface coal mines on county-wide property values provides evidence that large surface mines have an overall negative effect on property values, the study's results are not directly applicable to the proposed Resolution mine. The focus of the study was on coal mines, not copper mines, and on average the coal mining counties had smaller populations than Pinal County. Neither the aggregate estimates of the dollar reduction in property values nor the percent decreases in property values can reliably be transferred.

The previous hedonic property value study most relevant to the proposed Resolution mine is an earlier analysis based on the more traditional approach of evaluating the sales values of individual properties. Air Quality and View Degradations due to Copper Mining and Milling: Preliminary Analysis and Cost Estimates for Green Valley, Arizona ("Green Valley study") was published in Nonrenewable Resources in 1996. For the purpose of evaluating the potential effects of the Resolution mine on nearby property values, there are several advantages in using the information from the Green Valley study. The study focuses specifically on property value effects associated with copper mining and is based on another Arizona community south of the Pinal County border with Pima County.

One important limitation of the Green Valley study is that the analysis was based on real estate transactions over a relatively short four-month period. Only 20 properties in Green Valley were sold during that period, resulting in an unusually small sample for a hedonic property value study. However, the hedonic models based on those transaction had relatively strong statistical properties, and the estimated effects of proximity to the copper mines were consistently significant from a statistical standpoint.

The Green Valley study is now two decades old and the typical values of residential property in Green Valley may be quite different from typical property values in proximity to the proposed Resolution mine. Consequently, the most useful information from the Green Valley study for our purpose is the estimated percentage change in residential property values at varying distances from the copper mines rather than the absolute dollar impacts described in the study. The Green Valley study found that, relative to a home situated 10 miles or more from the copper mine tailings piles, homes in closer proximity experienced a decrease in value as shown in Figure VI-1.

Figure VI-1.
Proximity Effect on Property Values

Source:

Air Quality and View Degradations due to Copper Mining and Milling: Preliminary Analysis and Cost Estimates for Green Valley, Arizona (1996)

Distance to tailings piles	Decrease in home value
Within 1 mile	11%
Between 1 and 2 miles	9%
Between 2 and 5 miles	4%

Potential Property Value Effects from Resolution Mine

Applying the Green Valley study relationships between distance from the tailings piles and property values may somewhat understate the potential effects of the Resolution mine on property values. In addition to the distance variable, the Green Valley study also incorporated a variable to examine the additional effects on property values for homes that faced the tailings bank. This variable, also statistically significant, indicated an additional reduction in property values for properties that did face the tailings compared with those that faced away. The magnitude of this effect was relatively small compared to the distance variable—approximately one-third of the distance effect in scale. However, given the limited information in the Green Valley study publication and absent access to the original data, we cannot reliably transfer this effect to potentially impacted properties in proximity to the proposed Resolution mine.

The study team retrieved 2017 parcel information from the Assessor's offices and GIS departments for both Pinal and Gila Counties. Pinal County would house the tailings piles for four of the five proposed alternative scenarios, while the tailings pile for the remaining alternative would be located on the Pinal-Gila county line.

For both counties, the study team focused on information from and effects on active, real, and taxable parcels for which the assessor's offices maintain data. There are limitations to these data. For example, currently Gila County does not have digital parcel shapefiles available for all parcels in the county, and parcel data around the relevant portion of the Pinal-Gila County line is particularly sparse. For both counties, the study team requested all applicable and available information for any parcels located within seven miles of the perimeter of each tailings alternative, including the full cash value of the property.

This assessment of the projected aggregate property value effects due to proximity focuses on residential properties. Residential property sales are the most common in most real estate markets. Additionally, the Green Valley study focused on residential property sales, and it is appropriate to apply the resulting impact percentages to similar property types.

Figure VI-2 shows the total number of residential parcels within five miles of the perimeter of each tailings alternative along with the total projected property value reduction for each alternative and the corresponding percent change in property value for each alternative.

Figure VI-2.
Total Projected Property Value Reduction

Property within 5 Miles of Tailings Perimeter	Tailings Alternatives				
	Near West	Near West Modified	Silver King	Peg Leg	Skunk Camp
Number of Residential Parcels	1,370	1,370	1,181	8	31
Total Projected Property Value Reduction	-$3,059,395	-$3,059,395	-$5,472,374	-$69,178	-$57,575
Percent Change in Value	-4.1%	-4.1%	-10.6%	-6.3%	-4.0%

Source: Pinal County Assessor's Office (2018); Pinal County GIS Department (2018); Gila County Assessor's Office (2018); Gila County GIS Department (2018); BBC Research & Consulting.

As shown in Figure VI-2, the Silver King alternative is projected to have the largest impact on nearby property values, followed by the Near West and Near West Modified alternatives. The Peg Leg and Skunk Camp alternatives are more remote and would affect far fewer residential properties.

These estimates of potential effects on property values should be considered order-of-magnitude estimates based on relatively limited information. Unlike the results of an original hedonic property value study of an area, which would occur after mining has commenced and the local real estate market has had time to reflect corresponding changes, these estimates are based on applying the estimated percentage impacts from the Green Valley study to the properties surrounding each of the alternatives for the Resolution mine tailings. While the actual effects on property values could be considerably larger or smaller than these estimates, there is sufficient information from both the Green Valley study and other previous hedonic property value studies to conclude that a measurable effect on the value of nearby residential properties would be likely to occur.

The Green Valley study does not provide any information regarding effects on the values of more distant properties. This does not rule out the possibility that values of properties further from the mine or tailings could also be affected.

Apart from effects on property values from proximity to the proposed tailings storage facilities, increased traffic and industrial development could also adversely impact the quality of life for residents in proximity to the proposed mine and tailings storage facilities.

Potential Economic Effects from Water Supply Disruption

Effects of the proposed mine, and the mine tailings storage facility, on water quality and water quantity could also have financial and economic impacts on water users dependent on local groundwater or surface water supplies.

Any of the proposed tailings storage facilities would lose seepage with poor water quality, and all are dependent on a suite of engineered seepage controls to reduce this lost seepage. Modeling indicates that seepage from tailings storage facilities under alternatives 2 and 4 would result in

water quality problems in Queen Creek. Alternative 3 would not, but requires highly efficient seepage control to achieve this (99.5 percent capture). Seepage from Alternatives 5 and 6 does not result in any anticipated water quality problems; these alternatives also have substantial opportunity for additional seepage controls if needed (DEIS, p. ES-24).

Resolution Copper would have the responsibility to demonstrate to the State of Arizona that the regulated discharge would not violate water quality standards and would be required to obtain a permit under the Arizona Pollutant Discharge Elimination System (AZPDES) program for any discharges to surface waters, including stormwater runoff, as well as an Aquifer Protection Permit (APP) for any discharges to groundwater, or discharges to the ground that could seep into groundwater. However, TDS and sulfate, which do not have numeric thresholds, are anticipated to increase in the downgradient aquifer. Increased levels of these contaminants could impact the desirability of groundwater, or its usability.

Groundwater drawdown in the vicinity of the mine site could impact water supply availability for some existing users, including the Town of Superior, Boyce Thompson Arboretum and Top-of-the-World. However, Resolution Copper has committed to mitigating impacts on these users if necessary (DEIS, page 343).

Groundwater quantity near the Desert Wellfield could also be impacted. Groundwater users in this area could experience increased pumping costs or potentially need to drill deeper wells to obtain their water supplies (DEIS, p. 335-337). Higher pumping costs and deeper well requirements could also affect the desirability of properties in this area and, potentially, the value of those properties.

Potential Economic Effects from Reduced Grazing Land

More cattle are raised in Pinal County than in any other county in Arizona. The 430 cattle ranches in the county currently account for about 1/3 of the state's total inventory of cattle and calves and the state's annual cattle sales. The majority of the county's cattle production comes from about 30 large ranches with more than 500 cattle on each ranch and an average herd of about 9,000 animals per ranch (Census of Agriculture 2017).

The proposed mine, and particularly the proposed tailings storage facility alternatives, would result in the loss of several thousand acres of public and private land currently available for livestock grazing. The Livestock and Grazing section of the EIS (Section 3.16) has quantified the potential reductions in the number of acres available for grazing on private land and on lands managed by NFS, ASLD and BLM.

The potential economic implications of the reduction in available grazing land depend on several factors, including the extent to which the existing grazing allotments are being fully utilized by local ranchers and the availability of substitute pasture. At a minimum, the reduction in available grazing land would likely increase the costs of grazing for local ranchers if they substitute private pasture or more distant public grazing land for the decreased allotments available due to mine development.

The maximum economic effects from reduced availability of public grazing land would occur if ranchers had to reduce the size of their cattle herds in proportion to the decrease in the number of available grazing AUMs. Based on the projected reductions in grazing land under each tailings storage facility alternative, annual direct gross revenues from cattle production could be reduced by between $123,000 under Alternatives 2 and 3 and $517,000 under Alternative 6. Figure VI-3 illustrates the potential economic consequences of these reductions in annual cattle production, including indirect and induced effects on businesses supplying goods and services to cattle operations and their owners and employees.

Figure VI-3.
Maximum Potential Annual Economic Effects from Reduced Cattle Production*

TSF Alternative	Employment	Labor Income	Total Value Added	Output
Alt 2/3	-0.3	-$26,699	-$26,730	-$123,238
Alt 4	-0.3	-$28,196	-$28,229	-$130,149
Alt 5	-0.6	-$60,385	-$60,455	-$278,726
Alt 6	-1.1	-$112,037	-$112,166	-$517,140

Note: *Includes indirect effects on businesses supplying ranching operations and induced effects on businesses supply affected households.

Source: BBC Research & Consulting, 2020 based on Census of Agriculture 2017 and projected reductions in grazing AUMs from EIS Section 3.16..

SECTION VII.

Social Impacts of Hard Rock Mining

SECTION VII.
Social Impacts of Hard Rock Mining

The social impacts of hard rock mining extend beyond the economic activity generated by a mine. While a range of diverse issues related to mining activity can be quantitatively assessed—such as impacts to employment, income, tax revenues, and property values—there are aspects of mining activity that can have very real social impacts on local residents and communities but have no standard or straightforward methodology for evaluation.

A mining operation may temporarily or permanently alter the demographic, social, or cultural makeup of a community, in addition to altering the physical landscape in proximity to cities or towns. Examples of the social impacts of mining can include residents' perception of and reaction to the visible evidence of mine-disturbed land (Moran and Brereton, 2013) or to the presence of a non-resident workforce (Petkova et al., 2009). Still other impacts may include increased demand on community and emergency services (Lockie et al., 2009) or a rise in crime (Carrington et al., 2011).

The study team thoroughly reviewed the public comments received on the Draft EIS for the Resolution Copper Project. Four key issues stood out regarding community concerns about the project's social impacts on Superior and other Copper Corridor towns. Commenters raised concerns about:

- Increased demand for emergency services (i.e., police, ambulance, and fire departments);
- Increased crime, illicit activity, or public safety issues (e.g., domestic violence, drug abuse);
- Increased pressure on community services (e.g., child care, counseling, and alcohol and drug rehabilitation services); and
- Social or cultural disconnects between community residents and the RCM workforce (with anticipated workforce characteristics of being more transient, predominantly male, with high discretionary income and work hours out of sync with standard community business hours, and potentially less invested in a community in which they do not reside).

Organized by these four categories of concern, this literature review presents peer-reviewed research addressing the social impacts of mining, drawing insights from comparable examples to identify potential impacts of the proposed mine on Superior and other Copper Corridor towns.

Methodology and comparisons to the proposed mine. Social impact assessment (SIA) is a broad methodology commonly seen in the literature to evaluate the social impacts of a large infrastructure, development, or industry project, such as a mine. However, SIA is not rigidly prescriptive. Depending on the context of the project, SIA can involve a number of complementary methods to evaluate social effects, including analyzing municipal and regional data, conducting interviews and surveys, consulting with stakeholder groups, evaluating current and proposed policy, and determining the relative significance of potential impacts (Mancini and Sala, 2018; Moran and Brereton, 2013).

Worldwide, social impact assessments of mining operations are becoming more common in peer-reviewed literature in recent years, although the field is still developing and authors and researchers have identified a need for more studies (Hajkowicz et al., 2010). To identify the most relevant findings from the literature to assess the proposed Resolution Copper Mine, we have focused on impact studies of hard rock mining where possible. However, some papers on coal mining impacts—as well as more generalized research on the mining industry as a whole—have been included in this review.

It is important to note that the increasing application of SIA globally is not reflected in the United States, where use of such assessments has generally declined over the past 50 years (Jacquet, 2014). The relative scarcity of SIA studies in the United States necessitates examining research from other countries. Many of the publications discussed in this review come from the mining regions of Australia, which have a long history of mining and are comparable to mining regions of the southwestern US in terms of topography, climate, population density, demography, and industrial composition. Several towns and communities in the state of Queensland have their origins in mining, and residents are often familiar with both the benefits and costs of mining activity (Rolfe at al., 2007). Similarly, residents of the Copper Corridor understand the role that mining has had in shaping the social, cultural, and economic history of the area.

Impacts on emergency services. Several stakeholders provided comments on the Draft EIS expressing their concern about increased pressure on emergency services such as police, ambulance, and fire department services. The proposed mine would bring new residents and new non-resident labor forces to the area, and emergency services will serve a larger population.

One longitudinal study of the Coppabella Mine in central Queensland found that demand for emergency services increased during mine development, expansion, and operation between 2003 and 2006 (Lockie et al., 2009). The two closest towns to the Coppabella Mine have populations roughly comparable to Superior (in a predominantly rural region, one with fewer than 1,000 residents and one with fewer than 9,000), and the research team found that emergency services staffed by volunteers responding to traffic incidents were especially stressed, as those services served a larger overall population but did not attract additional volunteers from that same pool of new workers and residents. The study did not quantify the increase in demand for emergency services but described it as an “acute social impact” (Lockie et al., 2009).

It is reasonable to anticipate that Superior's emergency services would be noticeably impacted by an influx of new residents and new non-resident workers. The town is not large enough to readily absorb the larger population, and greater traffic volumes, without some level of strain placed on existing services. Even if a majority of the RCM workforce does not live in Superior, those workers will commute to and from the mine each workday, adding to traffic volumes and the rate of traffic incidents. Ongoing discussion between the town of Superior, Resolution Copper, and relevant resident stakeholder groups regarding mitigation measures is essential to mitigate or manage impacts, based on evidence from comparable examples.

Impacts to crime and public safety. Another issue of concern that arose from the public comments was impact to criminal activity and implications for public safety. Concerns about crime primarily related to alcohol and substance abuse, domestic violence, and traffic incidents (discussed previously).

A 2011 study in Australia reported that breaches of domestic violence protection orders in a large mining region of Queensland were more than 1.5 times the rate for the state capital; in a South Australian mining town, bodily injury offenses were 1.4 times the regional average; and violence in a mining town in Western Australia was 2.3 times the state average (Carrington et al., 2011). The authors' field research identified an increase in unreported male-on-male assaults in which alcohol consumption exacerbated the conflict – although it is important to note that this particular finding was in the context of residential work camps in which mine workers lived and may not be applicable to the proposed Resolution Copper Mine

Without intentional mitigation efforts, crime rates could increase in Superior due to the sharp increase of residents and workers present in the town and the surrounding area. A cooperative and responsive effort between Superior, RCM, and other regional stakeholders could establish measures to mitigate a rise in crime.

Impacts on community services. Closely related to the impacts on emergency services and crime is potential for other impacts on community services. Public comments on the DEIS revealed a concern about various community services that may experience increased demand, including childcare, counseling, and rehabilitation services.

While the characteristics of the workforce can vary depending on specific mine characteristics and locations, there is evidence that the workforce within the hard rock mining industry is more likely to be transient (Petrova and Marinova, 2014) and be predominantly male (Petkova et al., 2009). It is not likely that demand for childcare in Superior would increase drastically, particularly as most of the RCM workforce will live in larger urban areas outside of Superior. Counseling and rehabilitation services could also be obtained in nearby urban centers if or when needed, although an increased awareness (from both Superior and RCM) about the potential increase in local demand for these services would be needed.

Impacts to community cohesion or cultural identity. A sense of community cohesion is the most difficult of these four issues to define and measure, although it is important to consider, nonetheless. Public comments on the DEIS reflected a concern about the ability of existing

residents and the incoming RCM workforce to successfully interact and maintain a sense of community and identity. This could be especially difficult considering the large proportion of non-resident commuting workforce at RCM and the work hours of RCM workers (which may be very different than standard daytime business hours). Both of these factors may prevent RCM employees from engaging with the community meaningfully at events or in local establishments.

A discussion of conflicts of identity, belonging, and community is common in research on the social impacts of mining (Rolfe et al., 2007; Petrova and Marinova, 2014; Hajkowicz et al., 2010; Suopajarvi et al., 2017; and Lockie et al., 2009). These sociocultural conflicts are multifaceted, are perceived uniquely by different stakeholders, and do not have a designated solution. Functional strategies to address this problem must rely on cooperative communication between relevant stakeholder groups. For example, the operator of the Coppabella Mine invested time and energy engaging with some relevant stakeholders, particularly Aboriginal groups, but this engagement could not fully mitigate demographic and social shifts that negatively impacted the local community (Lockie et al., 2009).

The increase in population and different demographics of the potential RCM workforce, combined with the nonstandard work hours and high proportion of commuting employees, would likely have an impact on the existing resident community of Superior. It could be difficult to form a sense of community cohesion encompassing both existing residents and RCM workers, but frequent and constructive conversation between the town and RCM could help alleviate some of those conflicts. Based on the experiences in other mining communities, it is unlikely that these potential social conflicts can be entirely mitigated.

Conclusion regarding potential social impacts. In the public comments received on the Resolution Copper Project Draft EIS, local residents and stakeholders indicated they have concerns about social impacts of the mine, such as increased demand for emergency services, impacts on crime and safety, demand for community services, and sense of community cohesion. The available literature on the social impacts of hard rock mining, primarily based on academic studies in other countries, suggests that some negative social impacts are unavoidable. Much closer to the proposed Resolution Copper Mine, the experience of the Town of Hayden with an aging and dwindling population and increasing crime rates and drug use since the closure of the former ASARCO mine illustrate that these types of social impacts can and have occurred in Arizona (AZ Central, 2017). However, ongoing communication and coordination between the town of Superior and RCM could help anticipate and identify conflicts and craft cooperative mitigation strategies where feasible.

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