



University of Nevada, Reno



Nevada Bureau of Mines and Geology Report 57

Opportunities for Precious Metals Toll Processing and Copper Concentrate Processing in Nevada



Thomas J. DeMull, David A. Davis, Lucia M. Patterson, and Joel Lenz

Cover photo (*courtesy of Barrick Gold Corporation*): Goldstrike roaster facility located in Eureka County, Nevada.

NEVADA BUREAU OF MINES AND GEOLOGY
REPORT 57

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2018

NEVADA BUREAU OF MINES AND GEOLOGY
NEVADA DIVISION OF MINERALS

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EXECUTIVE SUMMARY

Endeavoring to facilitate economic development in the minerals industry, the Nevada Commission on Mineral Resources initiated this study on opportunities for precious metal custom milling and copper concentrate processing in the state. The study compiled a listing of 51 existing processing facilities, including key data such as location, ownership, process type, and capacity, if available. Brief descriptions of the existing facilities are provided. A number of these facilities are either actively engaged in custom processing or will consider custom processing of materials. Precious metal resources that could become candidates for custom processing were identified, and descriptions of the resources are provided. Since ample opportunities for custom processing precious metal ores already exist, the viability of establishing a new plant for precious metals is questionable. Reactivating one of the idle plants would likely be more attractive than building a new one.

Undeveloped copper resources in Nevada are identified, including estimates of potential production that could feed a copper concentrate processing facility. The volume of existing copper concentrate production in Nevada is probably not adequate to support a concentrate processing facility. However, a case could be made for establishing a concentrate processing facility in Nevada, if production from other western states that is now exported and the potential production from undeveloped resources in Nevada and other states are considered along with the current Nevada production. Copper smelting and concentrate leaching are listed as alternative processing technologies. Autoclave leaching of concentrates is a lower capital cost alternative, which could increase the economic attractiveness of a copper concentrate processing facility. Potential developers could include the producers of concentrate and operators of concentrate processing facilities in other states. Nevada is a mining-friendly jurisdiction, and potential locations for a copper concentrate processing facility were identified with access to transportation, energy, and air basins with no current sources of emissions. Development of a concentrate processing facility may attract downstream copper facilities such as rod plants, wire manufacturers, brass mills, and copper-alloy manufacturers.

INTRODUCTION

The Nevada Commission on Mineral Resources, endeavoring to facilitate development in the mineral industry in the State, initiated a study in early 2018 intended to answer the following two questions. 1) Is there a need for a custom milling facility in Nevada for the processing of precious metals ores, or are there existing facilities that have capacity to process outside ores? 2) Would it be beneficial if there were a facility for processing copper concentrates in Nevada?

The scope of work for the study was divided into four tasks, as follows: 1) prepare a list of the precious metal and copper processing facilities in Nevada and their capacities, if applicable and available; 2) prepare a list of the known resources within the State that might benefit from precious metal ore custom processing or copper concentrate processing; 3) evaluate the potential for a toll ore or concentrate processing facility in Nevada based on compiled known resources; 4) analyze the findings to determine whether facilities for custom processing precious metal ores or processing copper concentrate should be pursued; 5) describe which entities might be interested in pursuing either of these, what infrastructure would be required, and, in the case of a copper concentrate processing plant, what types of downstream industries might locate near it.

PRECIOUS METAL AND COPPER ORE PROCESSING FACILITIES IN NEVADA

An inventory of precious metal and copper ore processing facilities in Nevada was conducted in early 2018. Every effort has been expended to include all such facilities. Any omissions are not intentional, and the authors regret omissions, if any.

The methodology used to prepare the inventory was to search publicly available information, such as company websites, company annual reports, company regulatory filings, NI 43-101 technical reports, publications from the Nevada Bureau of Mines and Geology, and other sources. After collecting information, telephone conversations were conducted, whenever possible, with representatives of the operating companies to verify the information.

A total of 51 facilities have been identified; most are actively operating but a few are idle. For purposes of classification, the facilities have been separated into four categories: 1) precious metal oxide heap or dump leach; 2) precious metal oxide mill; 3) precious metal refractory mill; and 4) flotation concentrator and copper processing facilities. Listings of the facilities by category are provided below along with a brief paragraph containing information about each. Several of the facilities are listed in more than one category, because the operation has circuitry to process more than one type of ore.

Figure 1 shows Nevada ore processing facilities and infrastructure. The table in appendix 1, List of Process Facilities in Nevada, presents a listing of the process facilities along with selected information and data pertinent to each.

Table 1. Precious Metal Heap and Dump Leach Facilities in Nevada.

Facility Name	Owner/Operator	Mine	Capacity, tpd*	Operating	County
Bald Mtn. No. Mooney	Kinross Gold Corp.	Bald Mtn.	Combined 55,000 to 60,000	Yes	White Pine
Bald Mtn. So. Mooney	Kinross Gold Corp.	Bald Mtn.		Yes	White Pine
Bald Mtn. Plant No. 2	Kinross Gold Corp.	Bald Mtn.	N/A	Partial – Residual Leach	White Pine
Borealis	Borealis Mining Co. LLC	Borealis	N/A	Partial – Residual Leach	Mineral
Carlin Heap Leach	Newmont Mining Corp.	Carlin	Varies	Yes	Eureka
Coeur Rochester	Coeur Rochester, Inc.	Rochester	48,000	Yes	Pershing
Comstock	Comstock Mining, Inc.	Lucerne Pit	1,780	No	Storey
Cortez Area 28, 30, 34	Barrick Cortez, Inc.	Cortez, Pipeline	46,000 to 64,000	Yes	Lander
Denton-Rawhide	Rawhide Mining, LLC	Denton-Rawhide	14,000	Partial – Residual Leach	Mineral
Emigrant	Newmont Mining Corp.	Emigrant	Varies	Yes	Eureka
Florida Canyon	Alio Gold	Florida Canyon	24,000	Yes	Pershing
Gold Bar	McEwen Mining Inc.	Gold Bar	8,050	No – In Construction	Eureka
Hycroft	Hycroft Mining Corp.	Hycroft Mine	N/A	Partial – Residual Leach	Humboldt
Lone Tree	Newmont Mining Corp.	Lone Tree	Varies	Yes	Humboldt
Long Canyon	Newmont Mining Corp.	Long Canyon	Varies	Yes	Elko
Marigold	SSR Mining Inc.	Marigold	64,700	Yes	Humboldt
Mineral Ridge	Mineral Ridge Gold LLC	Mineral Ridge	4,000	Partial – Residual Leach	Esmeralda
Pan	GRP Pan, LLC	Pan	13,000 to 14,400	Yes	White Pine
Phoenix	Newmont Mining Corp.	Phoenix	N/A	No	Lander
Relief Canyon	Pershing Gold Corp.	Relief Canyon	16,700	No – Proposed	Pershing
Round Mountain	Round Mtn. Gold Corp.	Round Mountain	55,000	Yes	Nye
Ruby Hill	Ruby Hill Mining Corp	Ruby Hill	7,000	Partial – Residual Leach	Eureka
Sterling	Northern Empire Res.	Sterling, Daisy	260	No	Nye
Twin Creeks	Newmont Mining Corp.	Twin Creeks	5,500	Yes	Humboldt
Vantage	KG Mining, Inc.	Vantage Basin	N/A	No – In Construction	White Pine

*tons per day

SUMMARY OF PRECIOUS METAL HEAP AND DUMP LEACH FACILITIES IN NEVADA

Below is a summary of the precious metal heap and dump leach facilities shown in table 1 and figure 1.

Bald Mountain and Vantage

KG Mining, Inc., an affiliate of Kinross Gold Corporation, operates three run-of-mine dump leach facilities at Bald Mountain in White Pine County located approximately 55 air miles (88.5 km) northwest of the county seat of Ely. The North and South Mooney as well as Plant No. 2 are located on the north end of the Bald Mountain property. Tonnage added to the heaps at North and South Mooney ranges from 55,000 to 60,000 tons per day. The heap at Plant No. 2 is no longer receiving fresh ore, but leaching continues to operate to recover residual values. Solution from the heaps is processed by carbon adsorption. The desorption and refining circuits are currently out of service, so loaded carbon is transported for processing off-site. Vantage is a new operation currently in construction on the south end of the property with production expected in first quarter 2019. Kinross acquired Bald Mountain from Barrick in January 2016.

Borealis

Borealis is a heap leach property in Mineral County currently part of the Elko Mining Group, LLC. Borealis is located approximately 12 air miles (19.3 km) southwest of the county seat of Hawthorne. Mining and heap stacking operations ceased several years ago, but leaching has continued intermittently to recover residual values from the heap. Borealis processes loaded carbon produced on site as well as loaded carbon from other Elko Mining Group operations.

Carlin and Emigrant

Newmont Mining Corp. operates three heap leach facilities in the Carlin Mine Complex. The Carlin Mine Complex is in Eureka County just north of the town of Carlin. The three facilities are called North Area, South Area, and Emigrant. The North Area and Emigrant leach pads receive run-of-mine ore. The South Area crushing plant has adequate capacity to crush leach ore when appropriate. Tonnage to the heaps varies from year to year as the mine plans vary. Leaching is actively managed to optimize production.

Coeur Rochester

Coeur Rochester, Inc. operates the Rochester mine and heap leach facility in Pershing County, approximately 13 miles (20.9 km) northeast of Lovelock. Rochester is the largest silver producer in Nevada. The operation has processed an average of approximately 48,000 tons per day through crushing, heap leaching, and Merrill Crowe recovery by zinc precipitation over the past three years.

Denton-Rawhide

Rawhide Mining LLC operates a heap leach facility in Mineral County approximately 50 air miles (80.5 km) southeast of Fallon. The plant has a two-stage crushing circuit with a capacity of 14,000 tons per day. As of March 2018, the crusher was idle, as the operation was awaiting approval of permits to commence mining in a new area. Residual leaching on the heaps continues with active management of solution distribution to enhance extraction of precious metals. Both Merrill-Crowe zinc precipitation and carbon-in-column plants process solution for recovery of gold and silver.

Florida Canyon

Rye Patch Mining US resumed mining and heap stacking at Florida Canyon in 2017. Since resuming operations at Florida Canyon, the operation was acquired by Alio Gold. Crushed ore is stacked on the leach pad at a rate of 24,000 tons per day. Solution processing is by carbon adsorption, desorption, and refining (ADR). Florida Canyon is in Pershing County directly adjacent to Interstate Highway 80, 128 miles (206 km) east of Reno.

Gold Bar

McEwen Mining is currently developing the Gold Bar Project on a portion of the Gold Bar property, formerly operated by Atlas Mining. Gold Bar is in Eureka County 30 miles (48.3 km) northwest of the town of Eureka. The process facilities are now in construction. The facilities include a crushing and agglomeration circuit with capacity of 8,000 tons per day, leach pad, conveyor stacking, and ADR plant. Mining will be from four different pits – Gold Ridge, Gold Pick, and two at Cabin Creek.

Hycroft

Hycroft Mining Corporation operates a large heap leach facility located 54 miles (86.9 km) west of Winnemucca with the property straddling the Pershing County and Humboldt County boundaries. Mining, crushing, and heap stacking ceased in 2015 as Allied Nevada, the parent company, sought protection under bankruptcy laws. The heap leach continues to operate, recovering gold and silver from heaps stacked in prior years. The mine emerged from Chapter 11 in October of 2015 and continues to produce gold and silver. The company has proposed a major expansion of operations, pending completion of pilot testing of the gold recovery process.

Lone Tree

Newmont Mining has operated the Lone Tree heap leach continuously since 1991. The amount of material stacked on the heap varies with the mine plan. Lone Tree is located approximately 20 miles (32.2 km) from Battle Mountain in Humboldt County. The operation is a run-of-mine heap leach with carbon adsorption for gold recovery.

Long Canyon

Newmont Mining commenced production from the Long Canyon run-of-mine dump leach in the fourth quarter of 2016. The Long Canyon Mine is in Elko County 75 miles (120.7 km) east of Elko. The tonnage of ore stacked on the heaps varies from year to year as dictated by the mine plan. The mine life is expected to be at least 8 years and possibly as much as 14 years.

Marigold

SSR Mining Inc. operates the Marigold Mine located in Humboldt County approximately 36 miles (57.9 km) southeast of Winnemucca. The mine is a large-scale run-of-mine heap leach. Recent production (2016) averaged nearly 65,000 tons per day to the leach pad. Solution is processed for gold recovery in an ADR plant. An expansion is underway to increase the capacity to 80,000 tons per day.

Mineral Ridge

Mineral Ridge Gold, LLC operates the Mineral Ridge heap leach facility located in Esmeralda County approximately four miles (6.4 km) northwest of the town of Silver Peak. The Mineral Ridge operation is a joint venture between Scorpio Gold and Elevon, LLC. In past years, the mine produced ore from both open pit and underground resources. Ore was crushed at an estimated rate of 4,000 tons per day and stacked on leach pads. Mining and crushing operations are currently suspended pending implementation of a proposal to convert operations to milling. Leaching on the heaps continues to recover gold. Solution processing is via carbon adsorption with loaded carbon being processed off site.

Pan

GRP Pan, LLC operates the Pan Mine located in White Pine County approximately 22 miles (35.4 km) southeast of the town of Eureka. The Pan Mine is an open pit and run-of-mine heap leach that commenced operations in March 2015 under the auspices of the previous owner. By June 2015 mining operations had been suspended as leach performance on the heap did not meet expectations. In May 2016 GRP and Fiore Gold acquired the property and modified operating practices to improve gold recovery. The mine returned to full operation in 2017. A major improvement project, involving the installation of a plant for crushing ore prior to stacking on the leach pad, is pending until completion of large scale testing at site.

Phoenix

Newmont Mining operated a gold heap leach at the Phoenix Mine near Battle Mountain in Lander County. Phoenix is located approximately 14 miles (22.5 km) southwest of Battle Mountain. The heap leach pad was constructed in 1994 but is no longer operating as there is no gold oxide ore currently mined.

Relief Canyon

Pershing Gold Corp. is proposing to re-open the Relief Canyon mine and heap leach facility located 16 miles (25.7 km) east-northeast of Lovelock in Pershing County. Relief Canyon was operated in the past by Lacana Mining Inc., Pegasus Gold Corp., J. D. Welsh and Associates, and Firstgold Corp. Total production of gold by the various operators was on the order of 115,000 to 120,000 ounces. Pershing Gold intends to reactivate the operation with a modified crushing and agglomeration circuit. Capacity of the new facility will be 16,700 tons of ore per day.

Round Mountain

As part of the Smoky Valley Common Operation, Round Mountain Gold Corp. operates a heap leach in Nye County approximately 45 miles (72.4 km) north of the county seat of Tonopah. Round Mountain was a 50:50 joint venture between Barrick and Kinross prior to January 2016, when Kinross acquired Barrick's 50% share. Mining operations commenced at Round Mountain in 1976 and remain in full operation more than 40 years later. The operation is a large-scale heap leach with recent production (2017) averaging nearly 54,000 tons per day. Solution processing is via ADR. The operation also processes loaded carbon from off-site, specifically from Bald Mountain.

Ruby Hill

Ruby Hill Mining, LLC (an affiliate of Elko Mining Group, LLC) is operating a heap leach near the town of Eureka in Eureka County. As of March 2018, operations were limited to residual leaching on the leach pad. During previous years mill tailings were agglomerated with low grade leach ore at the rate of 7,000 tons per day. The agglomerated material was stacked on the leach pad. Solution processing was by ADR, but presently loaded carbon is transported to Borealis for processing.

Sterling

Northern Empire Resources Corp. holds the Sterling Mine and adjacent properties in Nye County near the town of Beatty and 115 miles (185.1 km) northwest of Las Vegas. Past production at Sterling by the Sterling Mine Joint Venture totaled 194,996 ounces gold between 1980 and 2000. In the late 1990s various operators produced 104,251 ounces gold from the adjacent Daisy Mine, now also part of the Northern Empire holdings. More recently, 2012 to 2014, Imperial Metals produced 12,698 ounces gold mining at an average rate of approximately 260 tons per day. Production was from both underground and open pit sources. Processing was by run-of-mine heap leaching and ADR. Permits are in place to resume operations and a leach pad extension has been proposed. On August 2, 2018, Coeur Mining announced a plan of arrangement to acquire Northern Empire.

Twin Creeks

Newmont Mining Corp. operates a heap leach as part of the Twin Creeks mining complex located in Humboldt County approximately 35 miles (56.3 km) northeast of Winnemucca. The tonnage added to the heap leach each year varies with the amount of material released by the mine plan. Daily average tonnage is expected to vary from as low as 550 tons per day to as high as 5,500 tons per day. Solution is processed in an ADR plant which is part of the Pinion mill facility.

Table 2. Precious Metal Oxide Mill Facilities in Nevada.

Facility Name	Owner/Operator	Mine	Capacity, tpd*	Operating	County
Aurora Mill	Klondex Mines, Ltd.	Aurora	350	Yes - Partial	Mineral
Carlin Mill 5	Newmont Mining Corp.	Carlin	13,000–17,000	Yes	Eureka
Cortez Pipeline Mill	Barrick Cortez, Inc.	Cortez Hills, Pipeline	14,000	Yes	Lander
Crown Point Mill	Crown Point Holdings	None	125	No	Storey
Gold Bar Mill	Fremont Gold Ltd	Gold Bar	3,500	No	Eureka
Goldwedge Mill	Mineral Ridge, LLC	Goldwedge	450	No	Nye
Midas Mill	Klondex Mines, Ltd.	Midas; Fire Creek; Hollister	1,200	Yes	Elko
Mineral Ridge Mill	Mineral Ridge, LLC	Mineral Ridge	4,000	No - Proposed	Esmeralda
Phoenix Mill	Newmont Mining Corp.	Phoenix	33,000–38,000	Yes	Lander
Round Mountain Mill	Round Mtn. Gold Corp.	Round Mountain	10,000	Yes	Nye
Ruby Hill Mill	Ruby Hill Mining Co. LLC	Ruby Hill	3,500	No	Eureka
Taylor Mill	Silver Predator Corp.	Taylor	1,320	No	White Pine
Twin Creeks Juniper	Newmont Mining Corp.	Twin Creeks	3,000	Yes	Humboldt
Twin Creeks Pinion	Newmont Mining Corp.	Twin Creeks	N/A	No	Humboldt

*tons per day

SUMMARY OF PRECIOUS METAL OXIDE MILL FACILITIES IN NEVADA

Below is a summary of the precious metal oxide mill facilities shown in table 2 and figure 1.

Aurora Mill

Klondex Mines, Ltd. owns the Aurora Mill located in Mineral County approximately 20 miles (32.2 km) west of Hawthorne. The mill is operational, but only a portion of the plant is presently operating. The actual tonnage capacity of the plant is unknown. The processing rate is currently limited to 350 tons per day by permit. The mill circuit consists of primary crushing, semi-autogenous grinding (SAG) and ball milling, carbon-in-leach (CIL), carbon desorption, and refining. Only the carbon desorption and refining areas are currently operating, processing loaded carbon from the Hollister Mine produced at the Midas Mill (see below). Klondex was actively seeking custom milling opportunities for the Aurora Mill. Hecla Mining Company completed an acquisition of Klondex July 20, 2018.

Carlin Mill 5

Newmont Mining Corp. operates Carlin Mill 5, which is located on the Carlin Mine Complex just north of the town of Carlin in Eureka County. The mill processes both oxide and refractory ore from the Carlin Mine on a campaign basis. The plant contains circuits for processing oxide ores by cyanidation and for concentrating refractory ores by flotation. Tonnage capacity varies with the character of the feed material from 13,000 to 17,000 tons per day. Oxide ore is processed by crushing, SAG and ball milling, cyanidation, and CIL.

Cortez Pipeline Mill

The Barrick Cortez Pipeline Mill located in Lander County is approximately 62 miles (99.8 km) southwest of Elko. The mill processes ore from the Cortez Hills open pit and the Pipeline open pit. Capacity of the plant is 14,000 tons per day. The facilities include two primary crushers, one located at Cortez Hills and the other at Pipeline, a SAG mill and ball mill grinding circuit, carbon-in-column (CIC) and CIL circuits for gold recovery, along with carbon

desorption and refining. Tailings from the CIL circuit are washed in a two-stage countercurrent decantation (CCD) circuit before pumped to the zero-discharge impoundment.

Crown Point Mill

The Crown Point Mill, located in the historic town of Gold Hill in Storey County, has a rated capacity of 125 tons per day. The circuit consists of single-stage crushing, ball milling, cyanide leaching, CCD, and Merrill Crowe precipitation. The mill was built in 1935 and operated until 1942, when it was closed by the War Act. In the late 1980s, the Art Wilson Company upgraded the mill. Although permitted and operational, the mill did not resume production at that time. The current owner, Crown Point Holdings Corporation, has attempted to return the mill to production but has encountered local resistance. The plant is mostly operational but would require additional investment to resume production. The business model for the company would be to operate the plant as a custom mill.

Gold Bar Mill

The Gold Bar Mill was operated by Atlas Gold Bar from 1986 to 1994. It processed primarily oxide ore, but also a small amount of refractory ore near the end of its operating life. The mill capacity for oxide was 3,500 tons per day and for refractory, 2,000 tons per day. The plant has been idle since 1994 but appears to be in good condition viewed in photographs of the exterior. The mill circuit comprises a primary grizzly, impact crusher, SAG mill, ball mill, and hybrid leach/CIL. The Gold Bar property is 30 miles (48.3 km) northwest of the town of Eureka in Eureka County.

Goldwedge Mill

Mineral Ridge, LLC owns the Goldwedge Mill located in Nye County approximately 32 miles (51.5 km) north-northeast of Tonopah. The mill has a capacity of 450 tons per day and consists of a grinding circuit followed by gravity concentration. The mill is operable but is currently idle on care and maintenance.

Midas Mill

The 1,200 ton per day Midas Mill processes ore from the Midas Mine, Fire Creek Mine, and Hollister Mine, all operated by Klondex Mines, Ltd. The Midas Mill located in Elko County is approximately 58 miles (93.3 km) east of Winnemucca. Ore from Midas and Fire Creek are processed by grinding, gravity concentration, cyanidation, CCD, and Merrill Crowe precipitation. Ore from Hollister is processed by grinding, cyanidation, and CIL. Merrill Crowe precipitate from Midas and Fire Creek is smelted at Midas to produce ore. Loaded carbon from the CIL circuit is processed at the Aurora Mill. Hecla Mining Company completed an acquisition of Klondex on July 20, 2018.

Mineral Ridge Mill

Mineral Ridge, LLC submitted an updated technical report in January 2018 describing the proposed implementation of a project to include a 4,000 ton per day mill. The mill would be constructed on the Mineral Ridge property located 35 miles (56.3 km) southwest of Tonopah in Esmeralda County. The mill would process material previously processed by heap leaching as well as material from open pit resources. The process would comprise grinding, thickening, and CIL. Loaded carbon from the CIL circuit would be processed off site.

Phoenix Mill

Newmont operates the Phoenix Mill at the property near Battle Mountain. The mill is both a copper concentrator and a gold cyanidation plant. Tonnage capacity of the mill varies from 33,000 to 38,000 tons per day depending on the character of the feed. Ore containing gold, copper, and silver values is processed by 1) crushing; 2) semi-autogenous grinding (SAG) and ball mill grinding; 3) gravity concentration for free gold; 4) flotation to produce concentrate containing copper, gold, and silver; 5) cyanidation; and 6) carbon-in-pulp (CIP) on the flotation tailings to recover gold and silver. Loaded carbon from CIP is processed by desorption and electrowinning, with the gold product from gravity concentration and electrowinning smelted off site.

The Phoenix plant is classified here as an oxide mill, because it is theoretically capable of processing oxide ore. The Phoenix ore is not considered an oxide ore. The deposit is a skarn that contains sulfides, gravity recoverable gold, and a small amount of cyanide leachable gold.

Round Mountain Mill

Round Mountain Gold Corp., an affiliate of Kinross Gold Corporation, operates a 10,000 ton per day capacity mill at the Smoky Valley Common Operation. The Smoky Valley Common Operation located in Nye County is 45 miles (72.4 km) north of Tonopah. The mill is a conventional design consisting of crushing, grinding, gravity concentration, cyanidation, and ADR.

Ruby Hill Mill

Ruby Hill Mining Co., LLC, an affiliate of the Elko Mining Group, owns the Ruby Hill Mill near the town of Eureka in Eureka County. The mill is presently idle. It has capacity of 3,500 tons per day and consists of 3-stage crushing, ball milling, ADR for gold recovery, thickeners, and belt filters for tailings.

Taylor

The Taylor Mill is in White Pine County approximately 17 miles (27.4 km) south of Ely. The Taylor Mill was constructed by Silver King with operations commencing in 1981. The mill with capacity of 1,320 tons per day comprised crushing, grinding, cyanidation, counter current decantation (CCD), and Merrill Crowe precipitation. The open pit mines and mill produced 3.77 million ounces of silver and 3,000 ounces of gold between 1981 to 1984. The Taylor Mine and Mill are currently owned by Silver Predator.

Twin Creeks Juniper and Pinion

There are two oxide mills at Newmont's Twin Creeks property: the 3,000 ton per day Juniper Mill and the idle Pinion Mill. Twin Creeks is in Humboldt County 35 miles (56.3 km) northeast of Winnemucca. The Juniper Mill consists of a crushing and grinding circuit. The ground slurry from Juniper is mixed with slurry discharge from the pressure oxidation (POX) at the adjacent Sage Mill, which is further described below under the refractory mills listing. The grinding mills have been removed from the Pinion Mill, but the carbon adsorption and desorption circuits remain. These circuits are used to process solution from the Twin Creeks heap leach. The tailings impoundment for the Pinion Mill has been reclaimed.

Table 3. Precious Metal Refractory Mill Facilities in Nevada.

Facility Name	Owner/Operator	Mine	Capacity, tpd*	Operating	County
Carlin Mill 6 Roaster	Newmont Mining Corp.	Carlin	9,000 – 10,500	Yes	Eureka
Goldstrike Autoclave	Barrick Goldstrike Mines, Inc.	Barrick Goldstrike	17,000	Yes	Eureka
Goldstrike Roaster	Barrick Goldstrike Mines, Inc.	Barrick Goldstrike	17,500	Yes	Eureka
Jerritt Canyon Roaster	Jerritt Canyon Gold, LLC	Jerritt Canyon	4,000 – 4,500	Yes	Elko
Lone Tree Autoclave	Newmont Mining Corp.	Lone Tree	2,500	No	Humboldt
Twin Creeks Sage	Newmont Mining Corp.	Twin Creeks	10,700	Yes	Humboldt

*tons per day

SUMMARY OF PRECIOUS METAL REFRACTORY MILL FACILITIES IN NEVADA

Below is a summary of the refractory mill facilities shown in table 3 and figure 1.

Carlin Mill 6 Roaster

Carlin Mill 6 is part of Newmont Mining's Carlin Mine Complex located in Eureka County just north of the town of Carlin. Mill 6 has a capacity of 9,000 to 10,500 tons per day, depending on the feed. The process circuit includes crushing, dry grinding, roasting, and CIL. The plant processes refractory ore from the Carlin Mine and flotation concentrates from Carlin Mill 5 (see below). The mill will also accept materials from outside sources, particularly if the materials contain sulfides as well as gold. The sulfide minerals act as fuel in the roaster.

Goldstrike Autoclave

Barrick Goldstrike operates an autoclave plant at the Goldstrike property located 24 miles (38.6 km) north of Carlin in Eureka and Elko counties. The plant has capacity of 17,000 tons per day. The processing circuit comprises crushing, SAG mill and ball mill grinding, pressure oxidation in an autoclave, followed by thiosulfate leaching and resin-in-pulp for gold recovery. The plant accepts outside materials for processing. Materials that contain both gold and sulfur are particularly attractive.

Goldstrike Roaster

Barrick Goldstrike also operates a roaster on the Goldstrike property. The roaster plant has capacity of 17,500 tons per day. The plant features crushing, dry grinding in two double rotators, two stage fluid bed roasting, quench tank with lime neutralization, and CIL for gold recovery. The roaster will also accept outside materials on a selective basis. Materials containing both gold and sulfur are especially welcome.

Jerritt Canyon Roaster

Jerritt Canyon Gold, LLC operates a roaster plant for refractory ore in Elko County approximately 40 air miles (64.4 km) north of the city of Elko. The plant has capacity of 4,000 to 4,500 tons per day. Ore is processed by crushing, dry grinding, roasting, and CIL. Jerritt Canyon will consider custom processing outside materials if the economics are favorable.

Lone Tree Autoclave

Newmont Mining Corp. owns the Lone Tree Autoclave plant located in Humboldt County approximately 20 miles (32.2 km) from the town of Battle Mountain. The operation is currently idle but comprised a primary grizzly, SAG mill and ball mill grinding, an autoclave, and CIL for gold recovery. The capacity of the plant is 2,500 tons per day. The plant is not currently operable, as some equipment has been removed for use at the Twin Creeks Sage Mill, and the tailings impoundment is filled to capacity.

Twin Creeks Sage Autoclave

In addition to the various processing facilities described previously, Newmont's Twin Creeks operation also includes an autoclave plant for refractory ore. The Sage plant is located on the Twin Creeks mine site in Humboldt County 35 miles (56.3 km) northeast of Winnemucca. Capacity of the plant is 10,700 tons per day. The process circuit includes crushing, grinding, and an autoclave for POX. Autoclave discharge is combined with the oxide ore slurry from the Juniper Mill and the combined slurry is processed for gold recovery by CIL. The plant processes 2,000 tons per day of ore from the Turquoise Ridge Mine, a joint venture between Barrick and Newmont. The plant also processes concentrates from Carlin Mill 5 and accepts concentrates from other operations for processing.

Table 4. Concentrators and Copper Processing Facilities in Nevada.

Facility Name	Owner/Operator	Mine	Capacity, tpd*	Operating	County
Carlin Mill 5	Newmont Mining Corp.	Carlin	13,000 – 17,000	Yes	Eureka
Lone Tree	Newmont Mining Corp.	Lone Tree	6,000	No	Humboldt
Phoenix Copper Leach	Newmont Mining Corp.	Phoenix	Varies	Yes	Lander
Phoenix Concentrator	Newmont Mining Corp.	Phoenix	33,000 – 38,000	Yes	Lander
Robinson Concentrator	KGHM International, Ltd.	Robinson – Ruth Pit	46,000	Yes	White Pine
Taylor Mill	Silver Predator Corp.	Ward	1,320	No	White Pine

*tons per day

SUMMARY OF CONCENTRATORS AND COPPER PROCESSING FACILITIES IN NEVADA

Below is a summary of the concentrators and copper processing facilities shown in table 4 and figure 1.

Carlin Mill 5

Newmont Mining Corp. operates Carlin Mill 5, which is located on the Carlin Mine Complex just north of the town of Carlin in Eureka County. The mill processes both oxide and refractory ore from the Carlin Mine on a campaign basis. The mill contains circuits for processing oxide ores by cyanidation and for concentrating refractory ores by flotation. Tonnage capacity varies with the character of the feed material from 13,000 to 17,000 tons per day. Refractory ore is processed by flotation to produce a gold-bearing pyrite concentrate that is processed in either Carlin Mill 6 or the Twin Creeks Sage Mill.

Lone Tree

Newmont Mining Corp. operated a flotation concentrator at Lone Tree from 1997 to 2006. The circuit comprises SAG mill and ball mill grinding, inert gas flotation, thickeners for concentrate and tailings, and pressure filters for concentrate. The plant produced a gold-bearing sulfide concentrate that was further processed for gold recovery in the Lone Tree Autoclave or off site. Nameplate capacity of the plant was 6,000 tons per day. Lone Tree is in Humboldt County approximately 20 miles (32.2 km) from Battle Mountain.

Phoenix Copper Dump Leach

Newmont Mining Corp. operates a ROM copper dump leach at the Phoenix property near Battle Mountain. Run-of-mine ore is stacked on the leach pad where it is irrigated with a dilute acid solution. Solution discharge is processed by solvent extraction to produce a purified and concentrated electrolyte. The electrolyte is transferred to an electrowinning circuit, where the final copper cathode product is produced. Tonnage to the leach pad varies annually with the mine plan. Cathode production varies from 1 million to 2 million pounds per month.

Phoenix Concentrator

Newmont also operates the Phoenix Mill at the property near Battle Mountain. The mill is both a copper concentrator and a gold cyanidation plant. Tonnage capacity of the mill varies from 33,000 to 38,000 tons per day depending on the character of the feed. Ores containing gold, copper, and silver values are processed by crushing; SAG and ball mill grinding; gravity concentration for free gold; flotation to produce concentrate containing copper, gold, and silver; cyanidation and carbon-in-pulp (CIP) on the flotation tailings. Loaded carbon from CIP is processed by desorption and electrowinning, with the gold product from gravity concentration and electrowinning smelted off site.

Flotation concentrate production varies from 100 to 400 wet tons per day depending on ore grade and mineralogy. Annual concentrate production varies from 40,000 to 80,000 wet tons. The grade of the concentrate is between 15% and 20% copper and contains impurities that require specialty treatment at a plant such as Glencore's Horne smelter. Concentrate is trucked to a rail siding at Dunphy where it is transloaded into rail cars. A portion of the concentrate is railed to the Horne smelter in Quebec, Canada. The remainder is railed to either the Port of Vancouver, WA, or the Port of Oakland, CA. At the ports, the concentrate is transloaded into ships for transport to smelters in Asia.

Robinson Concentrator

KGHM International, Ltd. owns and operates the Robinson Concentrator located near the town of Ruth in White Pine County. The capacity of the plant is 46,000 tons per day. The plant flowsheet is a conventional copper concentrator comprising crushing, SAG mill and ball mill grinding, followed by flotation to recover copper. The concentrator produces some 300,000 wet tons of concentrate per year grading from 17% to 22% copper on dry basis.

Concentrate from Robinson is trucked from the plant to Wendover where it is transloaded into rail cars. A small portion of the concentrate is railed to Kennecott's Garfield smelter in Magna, UT. The major portion of the concentrate travels by rail to the Port of Vancouver, WA, where it is transloaded onto ships for transport to Asian smelters.

Taylor

The Taylor Mill is in White Pine County approximately 17 miles (27.4 km) south of Ely. Alta Gold modified the mill in 1989 to include flotation to recover copper, lead, and zinc from ore from the Ward Mine located approximately 10 miles west of the Taylor property. The plant operated until 1991 when the Ward Mine was closed.

CUSTOM PROCESSING

Custom processing is the practice of a mine operator shipping ore to a facility where the processing operator charges a fee to extract the valuable metals or minerals from the ore. The fee is also known as a toll, so custom processing may also be referred to as toll processing. The mine operator and processing operator reach agreement on financial terms, which may be as simple as the processing facility purchases the ore, or more complex as the processing operator takes a portion of the final product as payment of the toll and returns the balance of the product to the mine operator, or even more complex. The variations in custom processing agreements are many, depending on the creativity and financial needs of the operators. But for the arrangements to be beneficial, both the mine operator and process operator must make a profit. Assuring success means that both the mine operator and process operator must understand their cost structures and mutually agree on the metallurgical characteristics of the ore.

Custom processing is normally associated with small mining operations, where the mining company does not have a processing facility. The reasons the mine operator does not have their own processing facility could be numerous, but it usually boils down to economics. Any of the following may preclude building a mill: 1) the deposit is small, 2) the location is remote from water or power supply, 3) there is inadequate space for facilities because of insufficient property holding, 4) inability to build because of rugged topography, 5) inability to raise capital for the investment, and 6) inability to obtain permits for a process operation on the site, and many other reasons.

Custom processing of precious metal ores could involve milling oxide ore, milling refractory ore, or heap leaching oxide ore. However, in general, low grade oxide resources that would typically be processed by heap leaching are not considered good candidates for custom processing. Heap leach operators are reluctant to accept outside materials for several reasons. First, leach pads are typically designed and constructed to contain the reserves at the mine. Outside materials would consume valuable space needed to process the mine's reserves. Second, outside materials should ideally be segregated from the bulk of the material on the heap so that metallurgical performance can be tracked. Even if possible, this is usually not practical and would drive up costs. Third, leach cycles on the heap can be lengthy affecting cash flow to the mine operator. Fourth, prediction of metallurgical performance on the heap can be uncertain. These factors combine to make custom processing by heap leaching too complicated for most process operators. In addition, low grade materials have low gross metal value which may not support the cost of transport over even moderate distances.

Examples of mining and processing costs can be found in many NI 43-101 Technical Reports. Open pit mining costs range from \$1.50 to \$4.00 per ton of material depending on whether the mine is operated by the owner or by a contract miner. Costs per ton of ore will depend on the waste to ore ratio. Oxide ore processing ranges from \$5.00 to \$10.00 per ton. Refractory ore processing could be as much as \$30.00 per ton. Transport costs are \$0.20 to \$0.40 per ton mile. These cost estimates would apply to mature, large-scale operations. A small operation would likely experience higher costs, particularly in the early stages of production. Careful evaluation of the resource and realistic estimation of costs are essential prior to engaging in a venture that involves mining and custom processing.

AVAILABILITY OF CUSTOM PROCESSING IN NEVADA

Custom processing for precious metal and copper ores is currently practiced at several facilities in Nevada. In addition, many others are willing to consider custom processing at their facilities, as listed below.

- Newmont's Carlin Mill 5 and Mill 6 will consider custom processing of oxide or refractory ores on a selective basis.
- Jerritt Canyon will consider custom processing of refractory ore if the economics are favorable.
- Pan will custom process loaded carbon from other operations through their desorption and refining circuits.
- The Midas Mill is essentially a custom mill, as it processes ore from three Klondex mining operations: Midas, Fire Creek, and Hollister. Klondex is also willing to custom process ores from other mine operators at both the Midas Mill and the Aurora Mill. Hecla Mining Company completed an acquisition of Klondex July 20, 2018.
- Mineral Ridge is actively seeking ore for custom processing at both its Mineral Ridge and Goldwedge sites.
- Barrick Goldstrike will consider custom processing of gold-bearing sulfide ores or concentrates in either the roaster or autoclave plant. Although not meeting the strict definition of custom processing, Goldstrike currently processes refractory ores from its Cortez mine and plans to do more in the future.
- Newmont Twin Creeks will consider custom processing of oxide ores in the Juniper Mill. Newmont Twin Creeks currently custom processes ore from the Turquoise Ridge joint venture as well as gold-bearing concentrates sourced from other internal and external mine operations.
- Newmont's Phoenix Mill will consider custom processing of ores. This mill could process either copper or gold ores.
- Borealis will custom process loaded carbon through their desorption and refining circuits.
- Coeur Rochester will consider custom processing of ores if the circumstances and economics are favorable.
- Bald Mountain would not currently consider custom processing but may do so in the future.
- KGHM has evaluated custom processing copper ores at the Robinson concentrator and will continue to consider custom processing in the future.
- The Crown Point Mill has actively sought ores for custom processing.
- Relief Canyon will consider custom processing of ores from other sources and custom processing of loaded carbon.

With a wide variety of custom milling options for precious metals already available in Nevada, it appears that establishing a new custom mill would not be beneficial. However, if an entity were interested in establishing a custom milling business, it might consider re-opening one of the idle mills rather than building a new plant. Four such opportunities exist: the Lone Tree autoclave and flotation concentrator, the Twin Creeks Pinion oxide mill, the Gold Bar mill, and the Taylor oxide mill and concentrator. Additional considerations include required renovations, permitting, and tailings capacity.

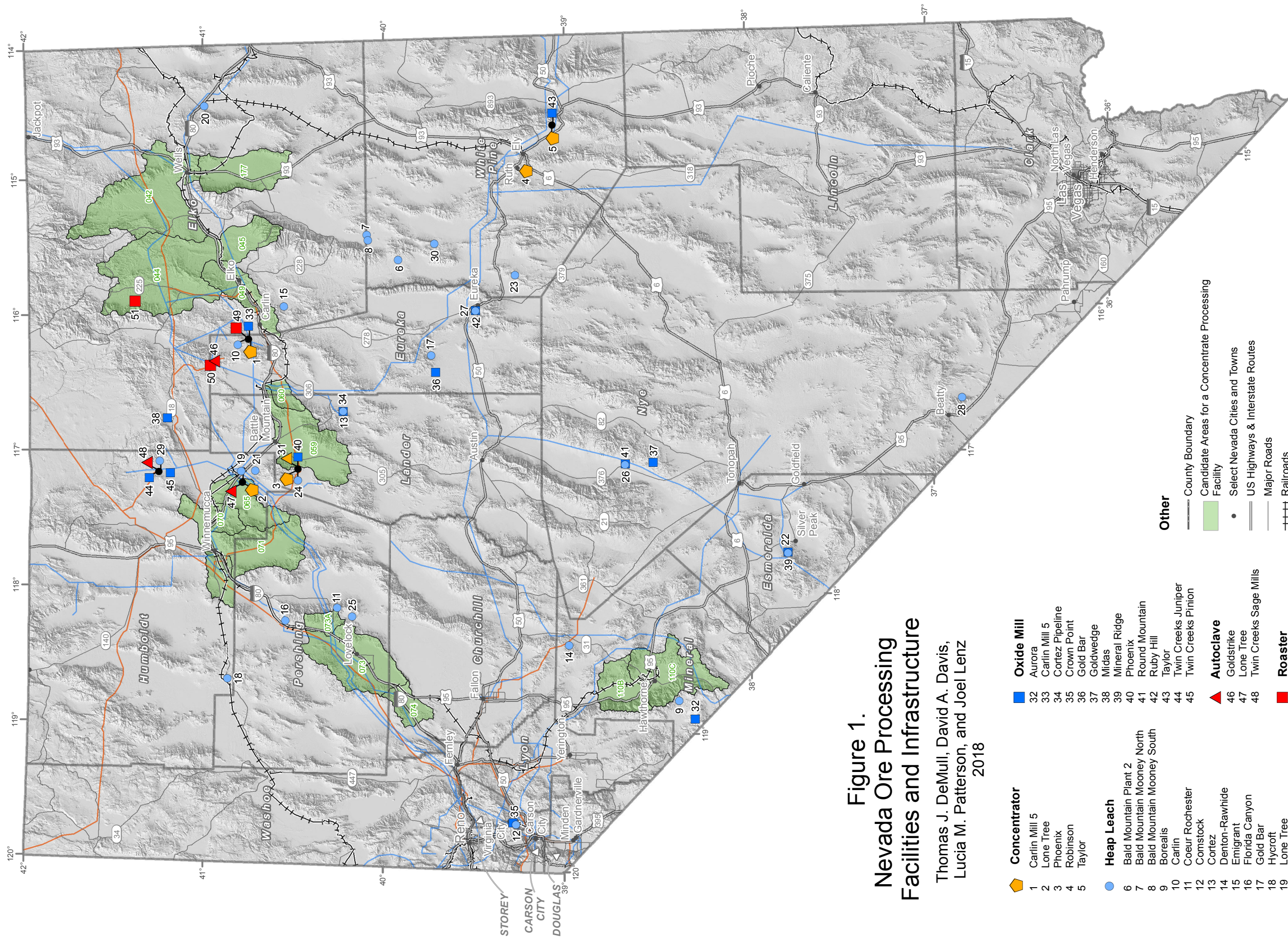
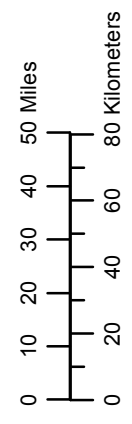


Figure 1.
Nevada Ore Processing
Facilities and Infrastructure

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 Lucia M. Patterson, and Joel Lenz
 2018

- | | | |
|------------------------------|---------------------------|---|
| Concentrator | Oxide Mill | Other |
| 1 Carlin Mill 5 | 32 Aurora | County Boundary |
| 2 Lone Tree | 33 Carlin Mill 5 | Candidate Areas for a Concentrate Processing Facility |
| 3 Phoenix | 34 Cortez Pipeline | Select Nevada Cities and Towns |
| 4 Robison | 35 Crown Point | US Highways & Interstate Routes |
| 5 Taylor | 36 Gold Bar | Major Roads |
| | 37 Goldwedge | Railroads |
| Heap Leach | 38 Midas | Transmission Lines |
| 6 Bald Mountain Plant 2 | 39 Mineral Ridge | Natural Gas Lines |
| 7 Bald Mountain Mooney North | 40 Phoenix | |
| 8 Bald Mountain Mooney South | 41 Round Mountain | |
| 9 Borealis | 42 Ruby Hill | |
| 10 Carlin | 43 Taylor | |
| 11 Coeur Rochester | 44 Twin Creeks Juniper | |
| 12 Comstock | 45 Twin Creeks Pinion | |
| 13 Cortez | | |
| 14 Denton-Rawhide | Autoclave | |
| 15 Emigrant | 46 Goldstrike | |
| 16 Florida Canyon | 47 Lone Tree | |
| 17 Gold Bar | 48 Twin Creeks Sage Mills | |
| 18 Hycroft | | |
| 19 Lone Tree | Roaster | |
| 20 Long Canyon | 49 Carlin Mill 6 | |
| 21 Marigold | 50 Goldstrike | |
| 22 Mineral Ridge | 51 Jerritt Canyon | |
| 23 Pan | | |
| 24 Phoenix Gold | | |
| 25 Relief Canyon | | |
| 26 Round Mountain | | |
| 27 Ruby Hill | | |
| 28 Sterling | | |
| 29 Twin Creeks | | |
| 30 Vantage | | |
| Copper Dump Leach | | |
| 31 Phoenix | | |



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PRECIOUS METAL AND COPPER RESOURCES IN NEVADA

As a second step in the evaluation of the desirability of installing a custom mill for precious metal ores or a processing plant for copper concentrates, a summary of available precious metal and copper resources has been compiled as of May 2018. Every effort has been made by the authors to identify all resources in the state. Any omissions are not intentional and the authors apologize if any resources have been overlooked.

Information available in the public domain was used to identify precious metal and copper resources. Precious metal resources were screened using the guidelines established in the paragraphs above. Only precious metal resources with an expected grade equivalent to 0.100 ounces per ton (opt) Au, or higher, have been included. There were no similar screening guidelines for copper resources. Resources are tabulated below along with brief descriptions. As might be expected, the largest resources containing 0.100 opt Au, or more, are held by the major mine operators. For example, the underground resources for Barrick are shown in table 5.

Table 5. Contained Gold in Barrick Underground Resources in Nevada.

Deposit Name	Year	Tons (000)	Au, opt*	Classification	Contained Au oz** (000)
Barrick Cortez, Inc.					
Buckhorn Property	1996	1,100	0.11	Geologic	121
Goldrush	2017	34,744	0.27	Measured & Indicated	9,938
Goldrush	2017	9,719	0.24	Inferred	2,335
Barrick GoldStrike Mines					
Banshee	2017	548	0.311	Measured & Indicated	170
Barrel	2017	152	0.259	Measured & Indicated	39
Dee	1999	1,400	0.157	Proven & Probable	220
Extension	2017	156	0.404	Measured & Indicated	63
Griffin	2017	147	0.336	Measured & Indicated	49
Main/East	2017	324	0.361	Measured & Indicated	117
North Post	2017	294	0.257	Measured & Indicated	76
North Post JV	2017	32	0.234	Measured & Indicated	8
REN	2007	2,991	0.37	Measured & Indicated	1,107
REN	2007	835	0.47	Inferred	392
Rodeo - Lower	2017	559	0.344	Measured & Indicated	193
Rodeo - Upper	2017	932	0.251	Measured & Indicated	234
South Meikle	2017	96	0.396	Measured & Indicated	38
West Griffin	2017	74	0.293	Measured & Indicated	22
Other					
Turquoise Ridge	2017	5,628	0.268	Measured & Indicated	1,506
Turquoise Ridge	2017	1,871	0.380	Inferred	711
Total Contained Au		61,602	0.281		17,339

*ounces per ton, **ounces

As a further example, effective as of December 31, 2017, Newmont reports the underground reserves and resources shown in table 6.

Table 6. Contained Gold in Newmont Underground Resources in Nevada.

Deposit Name	Year	Tons (000)	Au, opt*	Classification	Contained Au oz** (000)
Reserves					
Carlin	2017	18,600	0.278	Proven & Probable	5,310
Turquoise Ridge (25%)	2017	2,900	0.455	Proven & Probable	1,980
Twin Creeks	2017	880	0.204	Proven & Probable	250
Resources					
Carlin	2017	2,600	0.214	Measured & Indicated	580
Carlin	2017	2,700	0.276	Inferred	710
Turquoise Ridge (25%)	2017	1,900	0.268	Measured & Indicated	490
Turquoise Ridge (25%)	2017	600	0.380	Inferred	240
Twin Creeks	2017	330	0.160	Inferred	53
Total Contained Au		30,510	0.32		9,613

*ounces per ton, **ounces

The reserves and resources for the major operators such as Barrick and Newmont will, most likely, be processed in their own facilities, so would not be available as feed for a custom mill.

Gold resources that could potentially become available for custom milling are shown in table 7 below.

Table 7. Contained Gold in Selected Precious Metal Resources in Nevada.

Deposit Name	Year	Tons	Au, opt*	Classification	Contained Au oz**
Fondaway Canyon	2017	2,260,000	0.18	Measured & Indicated	406,800
Fondaway Canyon	2017	3,530,000	0.19	Inferred	670,700
Pyramid	2003	4,000	0.516	Inferred	2,064
Buckskin	1978	561,500	0.18	Unclassified	101,070
Big Springs - North Sammy	2014	1,607,000	0.13	Unclassified	208,910
Kinsley Mtn. - Secret Canyon	2015	1,619,000	0.17	Measured & Indicated	275,230
Tip Top	2009	388,920	0.096	Measured & Indicated	37,336
Gold Wedge	2005	330,000	0.31	Measured & Indicated	102,300
Tonopah (Midway)	2011	114,000	0.3017	Inferred	34,394
Subtotal		10,414,420	0.177		1,838,804
Winnemucca Mountain	1998	N/A	N/A	Indicated	300,000
Victorine	2000	N/A	0.36	Proven & Probable	120,000
Victorine	2000	N/A	0.36	Possible	200,000
Grand Total Contained Au					2,458,804

*ounces per ton, **ounces

Identifying precious metal resources in Nevada that may be candidates for custom processing requires establishing criteria. The resource must contain adequate metal value to cover the costs of mining, transport to the custom process facility, processing, processing fees, recovery of capital, and profit for the mine operator. As a guideline for the

present study, a gold equivalent grade of 0.1 opt Au was selected to screen resources. This provides gross metal value of approximately \$120 to \$130 per ton, judged to be adequate to cover costs.

Fondaway Canyon

The Fondaway Canyon deposit is located on the western flank of the Stillwater Range approximately 43 miles (69.2 km) northeast of Fallon. Several companies have conducted exploration on the property with the latest being Canarc Resource Corp., which acquired Fondaway in 2017. According to the NI 43-101 Technical Report dated April 3, 2017, “gold mineralization is localized along over 2 miles (3.2 km) of an echelon, east-northeast trending [*sic* (striking)] and steeply south dipping structures developed within fine grained Triassic carbonaceous siliciclastic sedimentary rocks and Jurassic limestone, cut by Tertiary dikes.” The report does not estimate resources for near surface oxide material, but only for deeper, sulfide mineralization, which would be exploited by underground mining methods. Testing has indicated that oxidation pre-treatment followed by CIL achieved high gold extraction. Multi-stage flotation also produced high gold recovery. Historical production from the Fondaway property includes 10,000 tons of tungsten ore and 7,902 ounces of gold.

Pyramid

The Pyramid project is located within the Walker River Indian Reservation. Past exploration operators include Western Goldfields and New Gold. Historical production is estimated at approximately 80,000 ounces of gold between the years of 1910 and 1956. The small resource at Pyramid contains an estimated 2,064 ounces of gold and 299,960 ounces of silver. The resource contains 0.516 opt Au, 74.99 opt Ag, 5.95% Pb and 7.08% Zn.

Buckskin

The Buckskin Project, located in Douglas County, has reported production of 3,000 tons grading 0.2 opt Au, 0.4 opt Ag, and 0.9% Cu in the early 1980s. In addition to the estimated 101,070 ounces of gold, the Buckskin resource also contains 280,750 ounces of silver.

Big Springs – North Sammy

The North Sammy deposit in Elko County is part of the former Big Springs property mined by Independence Mining Co. from 1986 to 1993. Production during this period was 386,000 ounces of gold. North Sammy exhibits many of the characteristics of a refractory, Carlin-style deposit. Adjacent, but lower grade deposits, include North Sammy – Contact, South Sammy, Beadles Creek, Mac Ridge, Dorsey Creek, and Briens Fault. There is currently a resource of 208,910 with an estimated grade of 0.13 opt Au. The property is approximately 54 miles north of the city of Elko and near the Jerritt Canyon Mine, which would seem the obvious location for custom processing ores from North Sammy.

Kinsley Mountain Project – Secret Canyon

Secret Canyon is one of the deposits comprising the Kinsley Mountain Project being explored by Kinsley Gold LLC. The project is in the Kinsley Mountains in Elko and White Pine counties, approximately 90 miles (144.8 km) northeast of Ely. USMX discovered the sediment-hosted, Carlin-type gold mineralization in 1984 and Alta Gold produced approximately 135,000 ounces of gold from an oxide heap leach between 1995 and 1999. The Secret Canyon Shale resource is refractory, and proposed processing includes flotation to produce a gold-bearing sulfide concentrate followed by cyanidation of the flotation tailings. Oxide and mixed mineralization also exists on the project but are lower grade.

Tip Top

Parker Mining Corp. owns the Tip Top prospect in southwest Esmeralda County near the border with Mineral County. Gold/silver mineralization at Tip Top is volcanic hosted, low sulfidation, epithermal and stockwork system. Parker recently estimated that an open pit resource of 804,816 tons grading 0.126 opt Au and 0.45 opt Ag exists at Tip Top. This estimate was compiled internally using proprietary software and is not NI 43-101 compliant. Results of metallurgical testing completed by past owners shows that the material is amenable to heap leaching.

Goldwedge

The Goldwedge property, located in the Manhattan mining district approximately 32 miles (51.5 km) north-northeast of the town of Tonopah, is managed by Scorpio Gold Corp. The reported resource estimate is from a previous project operator.

Tonopah (Midway)

The Tonopah project is in Nye County approximately 20 miles (32.2 km) northeast of the town of Tonopah. The project is owned by Viva Gold Corp. The property contains a low sulfidation epithermal gold system mostly masked by quaternary sediments. A large volume of drilling was completed by Midway Gold Corp. from 2005 to 2011. The project was known as Midway during this period. The 2011 resource estimate has recently been updated to a larger tonnage, lower grade resource possibly more suited to on site heap leaching.

Winnemucca Mountain

The Winnemucca Mountain property was initially explored by Santa Fe Pacific Mineral in the 1980s and is currently held by Northern Minerals and Exploration. The contained gold resource estimate is dated with no tonnage or grade information available.

Victorine

This property in Lander County produced 64,378 ounces of gold and 88,207 ounces of silver during the period 1987 to 1989. A proposal to resume operations was submitted by Western Mine Development in 1999 mined to mine material by underground methods and ship the ore to Manhattan for processing and gold recovery.

Table 8. Sulfide Copper Resources in Nevada.

Deposit Name	Year	Tons (000)	% Cu	Classification	Contained Cu Pounds (000)
Yerington District					
Ann Mason	2017	1,400,000	0.32	Measured & Indicated	9,809,000
Ann Mason	2017	623,000	0.29	Inferred	3,987,200
Blue Hill - Sulfide	2017	49,860	0.17	Inferred	169,524
MacArthur - Sulfide	2014	1,098	0.292	Measured & Indicated	6,408
MacArthur - Sulfide	2014	134,900	0.283	Inferred	764,074
Pumpkin Hollow - Open Pit	2015	566,400	0.43	Measured & Indicated	4,840,000
Pumpkin Hollow - Open Pit	2015	8,000	0.52	Inferred	83,000
Pumpkin Hollow - U'ground	2015	54,100	1.39	Measured & Indicated	1,503,000
Pumpkin Hollow - U'ground	2015	29,200	1.09	Inferred	636,000
Yerington - Sulfide	2013	105,000	0.3	Measured & Indicated	633,000
Yerington - Sulfide	2013	128,000	0.23	Inferred	600,000
Subtotal Yerington District		3,099,558	0.37		23,031,206
Other Districts					
B and C Springs - Open Pit	2007	105,902	0.068	Measured & Indicated	144,027
B and C Springs - U'ground	2007	2,846	0.334	Measured & Indicated	19,011
Desert Scheelite	2012	9,270	0.14	Measured & Indicated	26,000
Desert Scheelite	2012	1,642	0.17	Inferred	5,510
Liberty	2014	566,159	0.084	Measured & Indicated	956,400
Liberty	2014	148,598	0.115	Inferred	341,800
Majuba Hill	1965	30	3.0	Unclassified	1,800
New York Canyon - Copper Queen	1979	142,360	0.35	Unclassified	996,520
Pine Tree	2011	240,840	0.09	Measured & Indicated	433,512
Pine Tree	2011	196,760	0.09	Inferred	354,168
Victoria	1981	1,375	2.15	Proven and Probable	59,125
Subtotal Other Districts		1,415,782	0.12		3,337,873
Grand Total		4,515,340	0.292		26,369,079

SUMMARIES OF COPPER SULFIDE RESOURCES

Yerington District

Ann Mason

Ann Mason, located in Lyon County approximately 4 miles (6.4 km) west of the town of Yerington, is owned by Mason Resources. The deposit is a copper porphyry system which also contains values in molybdenum, gold, and silver. Mason Resources has published a Preliminary Economic Assessment that proposes to develop the property as an open pit mine and conventional concentrator with capacity of 120,000 tons per day. The production from the concentrator is projected to average 241 million pounds of copper per year over a mine life of 21 years. Concentrate grade is expected to be 30% Cu and life-of-mine concentrate production on the order of 1,200 wet tons per day. Total production from the proposed development would be 5.1 billion pounds of copper, 46 million pounds of molybdenum, 400,000 ounces of gold, and 8.8 million ounces of silver. It is anticipated that the concentrate would be processed in smelters in Asia. Shipping costs are estimated as \$66 per wet ton for trucking from the mine site to the Port of Stockton, \$5.48 per wet ton for port handling, and \$25 per wet ton for ocean freight.

Blue Hill – Sulfide

The Blue Hill deposit is approximately a mile (1.6 km) northwest of the Ann Mason deposit and is also controlled by Mason Resources. Blue Hill is not an advanced project and was not part of the Preliminary Economic Assessment of Ann Mason. It is considered primarily an oxide resource (see table 9 below), but also contains a sulfide resource. Conceptually, it seems that Blue Hill would be developed as an oxide leach, solvent extraction, and electrowinning project followed by processing the sulfide resource in the Ann Mason mill. Since Blue Hill is lower grade than Ann Mason, processing Blue Hill would likely occur after the Ann Mason resources were exhausted. Although there is insufficient information to estimate concentrate production, there is a possibility that Blue Hill may contribute feed to a copper concentrate processing plant at some time in the future.

MacArthur – Sulfide

MacArthur is another large copper prospect near Yerington in Lyon County. The MacArthur deposit is part of a large, complex, and only partially defined porphyry system. The owner of the property, Quaterra Resources, Inc., views MacArthur primarily as a leach project and the development plan contemplates installation of a leach pad and solvent extraction/electrowinning system for processing the oxide and mixed zones of the deposit (see table 9 below). From 1994 to 1997 Arimetco produced 6.1 million tons of oxide ore grading approximately 0.30% copper from an open pit at MacArthur.

However, the deposit also contains a sizable sulfide resource which could be developed as an open pit mine with a concentrator. Although there have been no test results reported, it is not unreasonable to consider that the metallurgical characteristics of the MacArthur sulfide might be similar the Ann Mason deposit. At some time in the future MacArthur could produce concentrate that would provide feed to a copper concentrate processing facility.

Pumpkin Hollow

Nevada Copper Corp. is developing the Pumpkin Hollow deposits in Lyon County approximately 7 miles (11.3 km) southeast of Yerington. The property contains five mineable skarn deposits which are part of two development areas. The Western Area deposits are shallower so would be exploited by open pit mining. The Eastern Area deposits are deeper and would be mined by underground methods. Two development scenarios have been proposed: Case A is a 5,000 ton per day underground mine; Case B is a 63,500 ton per day open pit combined with a 6,500 ton per day underground mine. Development already undertaken includes a production shaft that is 1,900 feet (579 m) deep, head frame, and hoist house with supporting equipment and facilities. Ore processing for either case would be a conventional copper concentrator.

Concentrate production in Case A would average approximately 313 tons per day grading 26% Cu. For Case B concentrate production would average approximately 1,145 tons per day at a grade of 25.5% Cu. Nevada Copper has

considered the possibility of shipping concentrates to domestic smelters, such as Kennecott's in Magna, Utah and Asarco's in Hayden, Arizona, as well as smelters in Asia. Shipping costs to domestic smelters are estimated to range from \$41.61 to \$66.81 per wet short ton depending on destination. For shipment to Asia costs are estimated to be \$103.76 to \$108.50 per wet short ton depending on the port of export.

Yerington

Singatse Peak Services LLC, a subsidiary of Quaterra Resources Inc., now holds the Yerington copper property that was mined by Anaconda from 1952 to 1979. Arimetco operated a copper recovery operation from existing ore heaps within the site from 1989 to November 1999. Copper production totaled more than 1.8 billion pounds by a combination of acid leaching oxide ore and milling sulfide ore. The Yerington deposit is a partially mined copper porphyry containing both oxide and sulfide mineralization. The deposit is adjacent to the town of Yerington. No specific details are available for any proposed redevelopment of the deposit. The likely redevelopment would comprise an open pit mine with both leaching of oxide ore and a concentrator for the sulfide ore. There is insufficient information to estimate production at this time.

Other Districts

B and C Springs

In 2007 Adanac Molybdenum Corp. published open pit and underground resources for the B and C Springs deposit in Nye County. The deposits contain an estimated 163 million pounds of copper and 115 million pounds of molybdenum.

Liberty

The Liberty molybdenum project in Nye County is approximately 25 miles (40.2 km) northwest of the town of Tonopah. Liberty (previously called the Hall deposit) was mined by Anaconda from 1980 to 1985, by Cyprus from 1988 to 1991, and by Equatorial from 2000 to 2002. While primarily considered a molybdenum project, the property also contains a copper resource. General Moly, the current owner, proposes to re-develop Liberty as an open pit mine with a 26,500 ton per day concentrator producing both molybdenum and copper concentrates. Copper production is projected to average 10 million pounds per year. With a projected concentrate grade of 20% copper and moisture content of 8%, average copper concentrate production would be on the order of 75 tons per day. General Moly anticipates shipping the copper concentrate to China for smelting. Shipping costs are estimated to be \$182.59 per wet ton of concentrate.

New York Canyon – Copper Queen

The New York Canyon deposits, owned by Canyon Copper Corp., are located 30 miles (48.3 km) east of Hawthorne in Mineral County. The Longshot Ridge oxide deposit (table 9 below) has received the bulk of the work including an NI 43-101 compliant resource published in 2010. The Copper Queen porphyry prospect contains a historical sulfide resource.

Pine Tree

The Pine Tree copper-molybdenum prospect is owned by IEMR Resources Inc. The deposit is in the Pilot Mountains near Mina. Proposed development would be an open pit mine and concentrator. The deposit is low grade and, if developed, might provide a small volume of concentrate feed to a smelter.

Minor Deposits

Desert Scheelite, Majuba Hill, and Victoria are small copper deposits in Mineral, Pershing, and Elko counties, respectively. Desert Scheelite is held by Thor Mining PLC and is primarily a tungsten project with a small copper resource. Majuba Hill, held by Galileo Exploration Ltd, is a porphyry deposit with historical copper production of 2.8 million pounds. The resource data for Victoria resource is dated (1981) and it does not appear to be a large deposit. None of these would result in significant copper concentrate production.

COPPER OXIDE RESOURCES IN NEVADA

Table 9 shows a listing of oxide copper resources in Nevada. These would typically be processed by acid leaching, solvent extraction, and electrowinning. The final product is cathode copper, not concentrate, so development of these properties would not produce feed for a copper concentrate processing plant. These deposits are included herein for completeness, even though they are not directly relevant to the discussion of a concentrate processing plant for Nevada. If such a plant becomes a reality, copper cathode could be processed in the downstream copper production plants that may be established in conjunction with the concentrate processing facility.

Table 9. Oxide Copper Resources in Nevada.

Deposit Name	Year	Tons (000)	% Cu	Classification	Contained Cu pounds (000)
Contact	2016	213,113	0.2	Measured & Indicated	831,494
Contact	2016	12,982	0.2	Inferred	52,188
Blue Hill - Oxide	2017	47,440	0.17	Inferred	179,370
Blue Hill - Mixed	2017	24,960	0.18	Inferred	98,210
MacArthur - Oxide	2014	159,094	0.212	Measured & Indicated	675,513
MacArthur - Oxide	2014	243,417	0.201	Inferred	979,510
Yerington - Oxide	2013	23,500	0.25	Measured & Indicated	118,000
Yerington - Oxide	2013	26,000	0.23	Inferred	118,000
New York Canyon - Longshot	2010	16,250	0.43	Measured & Indicated	139,750
New York Canyon - Longshot	2010	2,900	0.31	Inferred	17,980
Total Oxide Copper		769,656	0.21		3,210,015

COPPER PRODUCTION

Since 1900, global copper mine production has increased 3.2% per year reaching 20.2 million metric tonnes of refined copper in 2016. Production is forecast to continue growing in the coming years reaching nearly 22 million metric tonnes in 2019. Usage of refined copper in 2019 is forecast at nearly 25 million metric tonnes, the difference between mine supply and usage taken up by recycling scrap copper and/or drawing down stocks.

The largest producing country, by far, is Chile with an estimated 5.55 million metric tonnes in 2016. In order, the next largest producing countries in 2016 were Peru, China, and the United States. Global copper mine production is forecast to grow by 2.5% per year with the growth rate in copper concentrate production exceeding that of cathode copper from SX-EW (The world copper factbook 2017). Copper mine production in the U.S. was 1.43 million metric tonnes in 2016 and an estimated 1.27 million metric tonnes in 2017, including both copper concentrates and copper cathode.

COPPER CONCENTRATE PROCESSING

Global smelting production reached 19 million metric tonnes in 2016 including both primary sources, i.e., concentrates, and secondary sources, i.e., scrap. Smelter production was highest in China at 7.2 million metric tonnes. For comparison, smelter production in the U.S. was 0.55 million metric tonnes.

There are three copper smelters in the U.S.: Miami, Arizona operated by Freeport McMoran; Hayden, Arizona operated by Asarco; and Magna, Utah operated by Kennecott Rio Tinto. In addition, Freeport operates a concentrate leach plant at Morenci, Arizona, where copper concentrates are pressure leached in autoclaves to produce cathode copper. The three smelter operators also operate electrolytic refineries: Kennecott also at Magna, Utah; Asarco at Amarillo, Texas; and Freeport at El Paso, Texas. Combined capacity of these smelters is estimated to be approximately 7,000 tons per day of concentrate. Domestic mine production exceeded smelter and concentrate leach capacity as an estimated 235,000 metric tonnes of copper in concentrate were exported in 2017, equivalent to an estimated 2,500 to 3,000 wet tons of concentrate per day.

Figure 2 provides a simplified flowsheet for a copper smelter. Modern smelters employ flash smelting technology as illustrated in the figure. The final product of a copper smelter is called blister copper and must be processed by fire-refining and electrolytic refining to produce market grade metal containing approximately 99.99% copper.

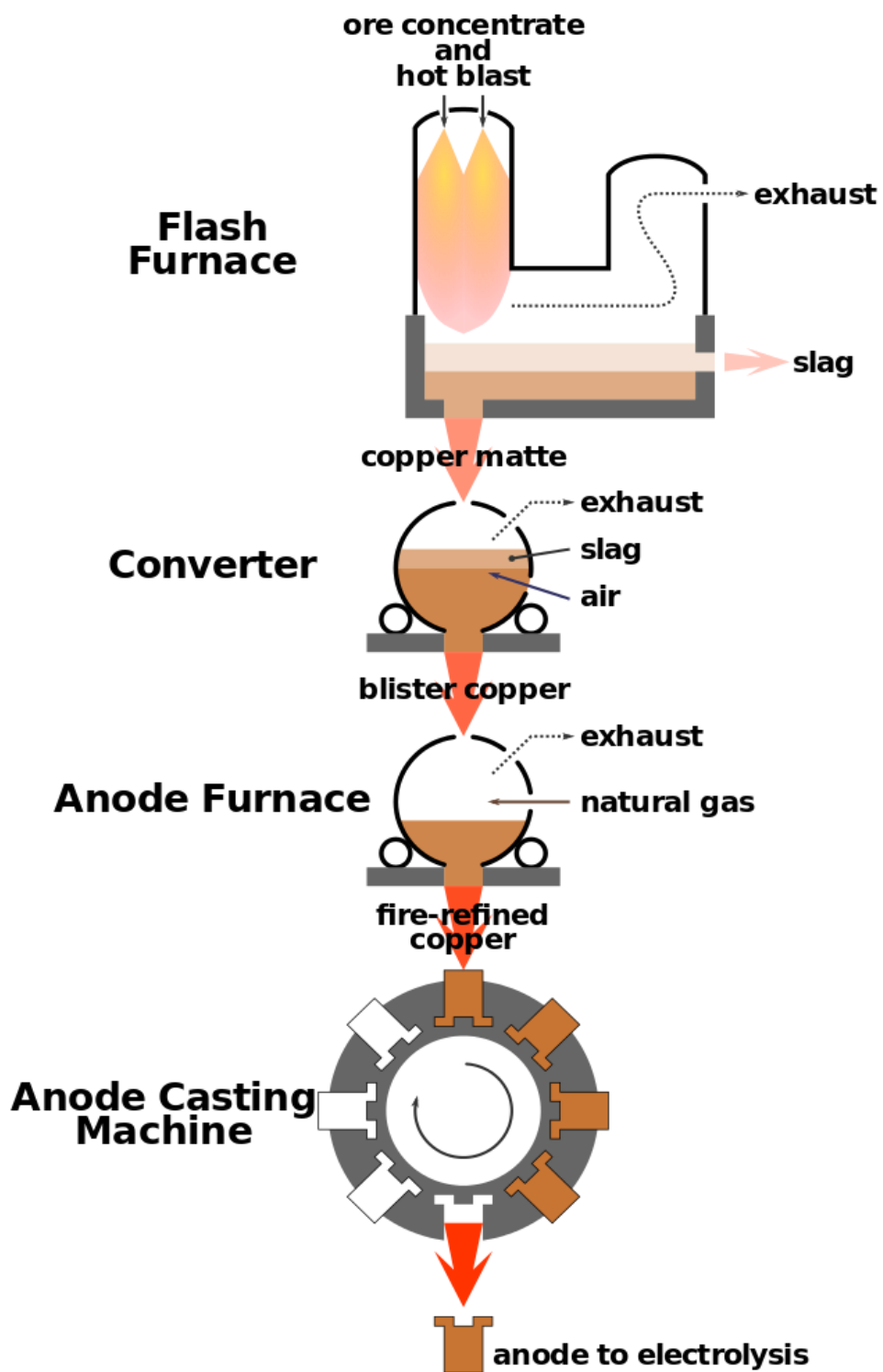


Figure 2. Simplified Flowsheet of a Copper Smelter.

Concentrate exporters in Nevada are Newmont Phoenix and KGHM Robinson. Phoenix exports concentrate to Glencore's Horne smelter in Quebec, Canada as well as to Asia. A portion of Robinson's concentrate is processed at Kennecott in Utah, but the majority is exported to Asia. Other exporters in the western states include Freeport and Montana Resources. Deposits in Nevada that may export concentrates in the future include Pumpkin Hollow (Nevada Copper), Liberty (General Moly), and Ann Mason (Mason Resources). Future exporters in other western states include Rosemont in Arizona (Hudbay Minerals) and Mineral Park in Arizona (last known owner Mercator Minerals).

Concentrate exporters face charges for transportation and smelting of the concentrate as well as refining of the blister copper produced. Estimates for transportation of concentrates to Asia found in recent NI 43-101 reports range from approximately \$90 per wet ton to approximately \$200 per wet ton. The price paid for smelting is called Treatment Charge (TC) and, for refining, the Refining Charge (RC). TCs are stated in US\$ per dry ton of concentrate, and RCs are given in U.S. cents per pound of copper. TCRCs are typically quoted together, for example \$90 per ton and 9 cents per pound. TCRCs tend to converge to common values globally driven by supply and demand for concentrate. Concentrate producers and smelter operators usually enter into annual contracts for processing concentrate. Concentrate producers may also place concentrate on the spot market or engage metal traders and intermediaries to complete the transaction.

Smelter operators endeavor to operate their smelters as close as possible to capacity to maximize efficiency. For this reason, smelter operators compete for the available supply of concentrate and TCRCs fluctuate with the demand for concentrate. TCRCs typically rise when smelters are operating at, or even above, capacity and fall when capacity utilization is low. Currently, TCs are in the range of \$80 to \$90 per ton and RCs are in the range of 8 to 9 cents per pound and both are forecast to decline, suggesting that there may be excess smelter capacity available globally. It has been reported that smelters in China were operating at only 75% of capacity in 2016. Anecdotally, China and India are continuing to build smelters without first securing a source of concentrate feed. If true, TCRCs should remain low in the coming years.

CONCENTRATE LEACHING

The search for a hydrometallurgical substitute for smelting copper dates back at least to the 1970s. Several processes have been developed using various lixivants including ammonia, chlorides, sulfates, ferric ion, and combinations of chlorides and sulfates. Until recently, commercialization of the processes has been hampered by factors such as process complexity, materials of construction, and problems recovering precious metals. Advances in smelter technology have also served to inhibit the application of concentrate leaching.

Cominco Engineering Services, Ltd. (CESL) and Phelps Dodge have developed and commercialized proprietary copper concentrate leach processes. The processes both involve pressure leaching in autoclaves followed by solid-liquid separation and electrowinning to produce LME Grade A cathode copper equivalent to electrolytic refined copper.

The CESL process has been proven in pilot, demonstration, and commercial scale plants. The pilot and demonstration plants have operated successfully for thousands of hours on copper concentrates of varying quality from various sources. Vale operated a commercial scale plant in Brazil from 2008 to 2010, processing concentrates from their Sossego and Salobo mines. The CESL process utilizes a medium temperature pressure leach, which converts only a portion of the sulfide minerals to acid with most of the sulfide being converted to elemental sulfur.

Phelps Dodge, a subsidiary of Freeport-McMoran, constructed a large-scale demonstration plant for its concentrate leach process at Bagdad, Arizona in 2003 and now operates a full-scale commercial plant at Morenci, Arizona. The Bagdad plant has been used to demonstrate both high temperature and medium temperature leach processes. The high temperature leach converts all the sulfide minerals to sulfuric acid, whereas the medium temperature process converts the major portion of the sulfides to elemental sulfur.

Concentrate leaching was adopted at Morenci when the concentrator was idle from 2001 to 2007. Concentrate leaching has been integrated into the overall copper production scheme at Morenci. The plant was sized to match the volume of concentrate produced. The acid produced in the autoclave is used on the leach heaps, and the copper is recovered from autoclave solution using capacity available in the existing SXEW plants. The benefits of concentrate leaching at Morenci included both lower capital cost and lower operating cost compared to smelting. Figure 3 shows a simplified flowsheet for the concentrate leach plant at Morenci, courtesy of Freeport McMoran. The final product

of a concentrate leach plant is cathode copper from electrowinning which is typically market grade and does not require further refining.

Precious metals may be extracted from the autoclave leach residues of either the CESL or Phelps Dodge processes by adding appropriate circuitry. CESL has also developed a proprietary method for recovering gold from the autoclave residue.

A concentrate leach plant appears to be an excellent alternative to a smelter for installation in Nevada. The plant would be less costly than a smelter and would probably be simpler to permit as the only air emissions are from vents for the autoclave flash cooler. A medium temperature alternative seems most appropriate, as there is no obvious outlet currently for the dilute sulfuric acid produced in the high temperature process. It appears that either the CESL or Phelps Dodge process could be utilized successfully, the ultimate selection made based on estimated capital and operating costs and benefits.

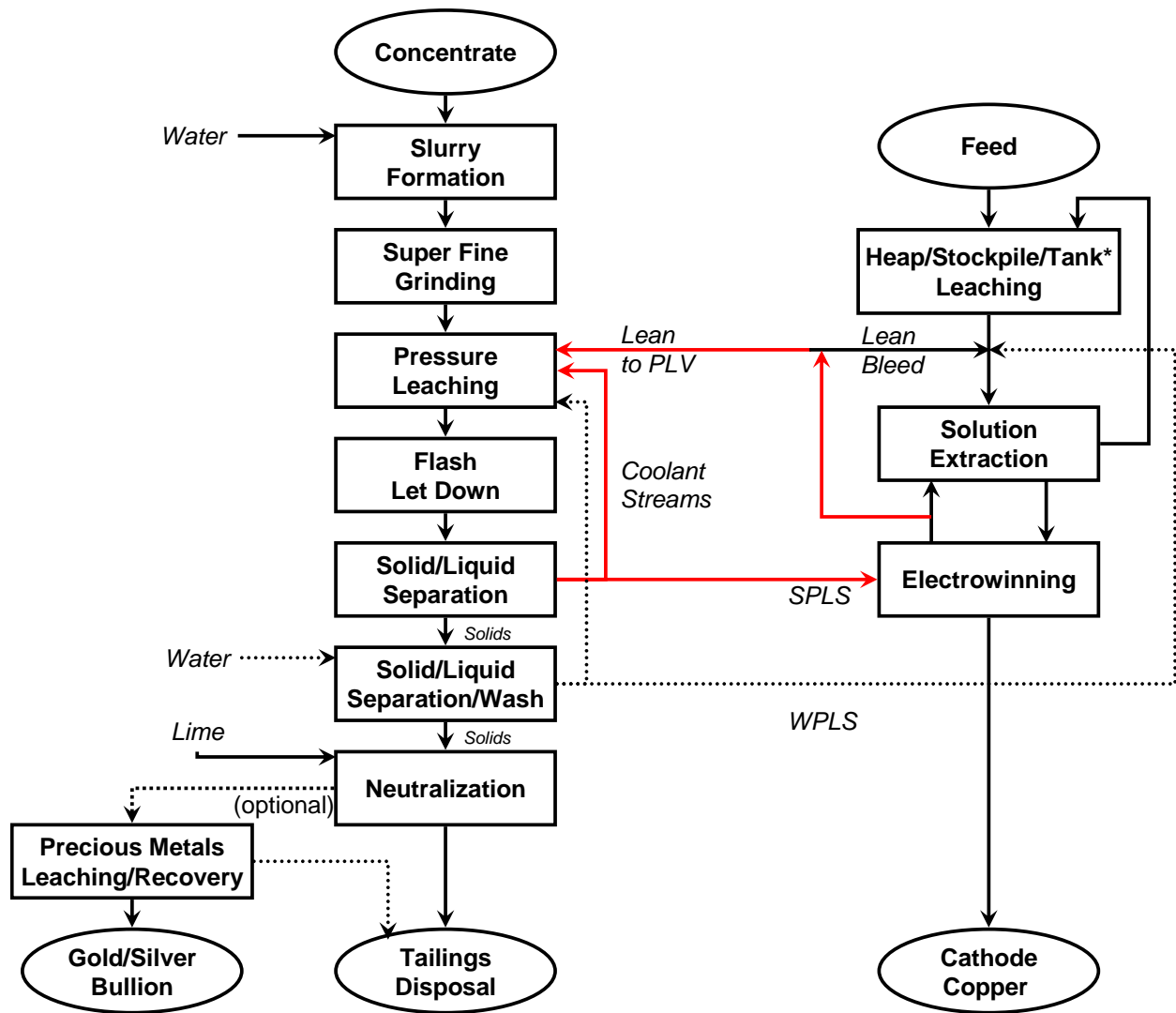


Figure 3. Simplified Flowsheet of the Morenci Concentrate Leach Plant.

COPPER CONCENTRATE PROCESSING IN NEVADA

HISTORY

Copper smelting has a history in Nevada. In 1912, Boyce Thompson established a smelter in Mason Valley near Yerington and named the accompanying townsite, Thompson, after himself. The smelter had a capacity of 700 to 1,000 tons of copper per day. It was located at the northern terminus of the Nevada Copper Belt Railroad, transporting ore and other operating supplies. The smelter operated intermittently until final closure in 1928. More than 200 small mines shipped material to the facility during its operating life.

Copper mining began in White Pine County in the early 1900s. Open pit mining was conducted at Ruth, west of the town of Ely. Ore was transported on a newly constructed railroad to McGill where it was processed by concentrating and smelting. The Northern Nevada Railroad extended north from McGill to connect to the Southern Pacific line, transporting both supplies to the mine, mill, and smelter and finished copper product to market. Market conditions caused the mill and smelter to close in 1983. Mining restarted in the 1990s when a new concentrator was built near the mine in Ruth. The ownership has changed twice since re-opening, and today KGHM operates the Robinson Mine and Concentrator.

FATAL FLAW ANALYSIS

The following would be among the important considerations for establishing a new smelter or concentrate leach plant in Nevada today: 1) copper concentrate supply, 2) environmental permitting, 3) land use policy, 4) accessibility and infrastructure, and 5) return on investment. While beyond the scope of the current report to deal quantitatively with each of these considerations, comments are provided attempting to identify if there are any obvious fatal flaws to the development of a copper concentrate processing plant in the state.

Concentrate Supply

Supply of concentrate to feed a smelter is fundamental to developing a new facility in Nevada. KGHM Robinson and Newmont Phoenix are the only two producers of copper concentrate in the state at this time. As of first quarter 2018, these two operators produce an average of approximately 900 to 1,000 tons per day of concentrate containing an estimated 300,000 to 400,000 pounds of copper. This output is probably insufficient to sustain operations at a new smelter of reasonable commercial size (i.e., annual capacity of approximately one million tons of concentrate).

Since the economics of concentrate leaching are different from smelting, the current supply could be sufficient to support a concentrate leach plant. Internal studies of concentrate leaching have been completed by one of the Nevada copper concentrate producers. Since the studies were for internal use, results are not available to report here.

In 2017, U.S. producers exported 235,000 metric tons of copper in concentrate, equivalent to an estimated 2,500 to 3,000 wet tons of concentrate per day. This volume of concentrate would be sufficient to feed a new concentrate processing facility with capacity approximately equivalent to one of the three domestic smelters currently in operation. In addition, there are new projects on the horizon such as Pumpkin Hollow and Ann Mason near Yerington in Nevada, Liberty near Tonopah in Nevada, Rosemont and Resolution in Arizona, and Black Butte and Montanore in Montana. For example, Pumpkin Hollow is projecting initial production in 2019 at a rate of approximately 300 wet tons of concentrate per day. It appears that there is now, and likely will continue to be, adequate domestic supply of concentrate to justify installation of a new smelter or concentrate leach plant. Everything else being equal, U.S. concentrate producers would tend to favor a domestic facility over shipping to a foreign smelter as transport costs would be lower, reducing overall production costs.

Environmental Permitting

As for any new mining venture, obtaining the necessary environmental permits for a new smelter or concentrate leach plant would likely be the most complicated and potentially the most time-consuming endeavor of the project. A full description of the permits required is not possible without a full understanding of the size, technology, location,

and environment surrounding the proposed project, but, in general, the primary environmental concern would be air pollution with secondary concerns for water pollution and solid waste management.

To obtain permits for a new smelter or concentrate leach plant, the developer would be required to prepare a detailed environmental assessment, most likely in the form of an Environmental Impact Statement. The assessment process requires interaction with the public including conducting meetings, receiving comments, and responding to the comments.

There are four federal regulations that copper smelters may be subject to:

1. 40 CFR 60 Subpart P – Standards of Performance for Primary Copper Smelters
2. 40 CFR 63 Subpart QQQ – National Emission Standards for Hazardous Air Pollutants for Primary Copper Smelting
3. 40 CFR 63 Subpart EEEEEEE – National Emission Standards for Hazardous Air Pollutants for Primary Copper Smelting Area Sources
4. 40 CFR 63 Subpart EEEEEEE – National Emissions Standards for Hazardous Air Pollutants: Gold Mine Ore Processing and Production Area Source Category

Subpart P applies to concentrate dryers, roasters, smelters, and converters and establishes standards for emissions of particulate matter, sulfur dioxide, and visible emissions. Monthly monitoring is required for specified metals in the smelter charge, continuous visible emission monitoring for concentrate dryers, and continuous sulfur dioxide monitoring for roasters, smelters, and converters.

Subpart QQQ applies to primary copper smelters that are a major source of hazardous air pollutants and establishes standards for particulate emissions for concentrate dryers, smelters, and slag cleaning vessels. This subpart prohibits the use of batch copper converters in new facilities. Continuous monitoring is required for emissions capture systems for converters.

Subpart EEEEEEE applies to copper smelting facilities that include concentrate dryers, flash furnaces, bath furnaces, converters, combination smelting and converting reactors, anode shaft furnaces, and anode refining furnaces. This subpart establishes standards for emissions of particulate matter and requires continuous monitoring.

Subpart EEEEEEE applies to gold ore processing facilities and establishes standards for mercury vapor emissions. Facilities, where 95% or more of the metal(s) produced are other than gold, are not considered part of a gold processing plant.

The Multilateral Investment Guarantee Agency (MIGA) is a member of the World Bank Group, which promotes direct investment in developing countries. MIGA proposes guidelines for air and water quality for smelters. For air emissions, guidelines are provided for sulfur dioxide, particulates, and heavy metals including arsenic, cadmium, copper, lead, and mercury. Air emission control systems include a double contact acid plant for producing sulfuric acid as a byproduct for sale. Particulates are captured by fabric filters and volatilized arsenic and mercury are condensed by cooling the off-gas. Continuous monitoring for sulfur dioxide and particulates is recommended, with monthly monitoring for the other parameters.

MIGA guidelines for water quality parameters are pH, total suspended solids, and the same heavy metals as for air emissions with the addition of zinc. Control of pollutants in liquid emissions would be by precipitation and filtration. Daily monitoring of liquid effluents is recommended for pH and suspended solids along with monthly monitoring for the other parameters. While MIGA guidelines are not directly relevant to standards that might be applied to a smelter in Nevada, where they are more stringent than federal requirements, the MIGA guidelines may be viewed by regulators and financiers as representative of best practices, becoming *de facto* targets for air and water emissions for a new domestic facility.

Smelters also produce solid waste in the form of slag. MIGA recommends managing this solid waste by landfilling or granulating. Granulated slag may be sold as a byproduct.

MIGA summarizes key issues of production and control as follows:

- Give preference to processes that are energy efficient and produce high sulfur dioxide concentrations (e.g., flash smelting).

- Use oxygen for enrichment of sulfur dioxide.
- Use the double contact double absorption process for sulfuric acid production.
- Reduce effluent discharge by maximizing wastewater recycling.
- Maximize the recovery of dust and sludges.
- Minimize fugitive emissions by encapsulation of process equipment and use of covered or enclosed conveyors.
- Give preference to dry dust collectors over wet scrubbers.

The MIGA guidelines highlight a key advantage for a smelter. A smelter would produce a readily marketable, concentrated sulfuric acid byproduct, whereas a leach plant produces dilute acid, which must be neutralized for disposal if there is no facility nearby with a use for the dilute acid.

The technology exists to design, build, and operate an environmentally compliant smelter. Nevada remains one of the most mining-friendly jurisdictions in the world. These factors improve the chances for success in obtaining the necessary permits for a new smelter. While undeniably complex and potentially controversial, environmental permitting should not be considered a fatal flaw.

A concentrate leach plant would be similar in many ways to the autoclave pressure oxidation facilities that have been built in Nevada to process refractory precious metal ores. The primary environmental concerns for a smelter are sulfur dioxide and particulate emissions, which are reduced for a concentrate leach plant. The federal regulations cited above, 40 CFR 60 Subpart P, 40 CFR 63 Subpart QQQ, and 40 CFR Subpart EEEEEEE, address air emissions from copper smelters and associated facilities, but probably would not apply to concentrate leach plants. The primary source of air emissions from a concentrate leach plant is the vent on the autoclave flash cooler, which is not listed as a regulated source in the federal regulations. Subpart EEEEEEE, 40 CFR 63, would likely not apply to the pressure oxidation, solvent extraction, or electrowinning portion of a concentrate leach plant, but could apply to a precious metal recovery circuit processing concentrate leach residue.

Leach residue from the concentrate leach plant must be disposed and stored in an engineered facility. The MIGA water quality guidelines for liquid emissions from a smelter would seem to also be appropriate for a concentrate leach plant.

Land Use

Installation of a smelter or concentrate leach plant and supporting facilities will require a sizable piece of real estate. Authorities maintain regulations on land use that will certainly impact the location of the facility. Although theoretically possible to locate the facility on public land, first preference would be private ground that is, or could be, zoned for heavy industrial activity.

Accessibility and Infrastructure

Transportation of concentrate to a new processing facility requires accessibility to highway and rail systems. Proximity to the electrical grid and natural gas pipelines is important to supply the energy to operate the concentrate processing facility and refinery. A source of water nearby is also required.

Tentatively, a swath of potential locations along the I-80 corridor west from Wells west to about Fernley then south between highways US-95 and US-95A toward Yerington is initially proposed. At first look, this swath of land appears to provide access to transport and utilities required to support a processing facility. Potential areas for siting a concentrate processing facility are highlighted on the map on figure 1. These areas have access to highway and rail systems, the electrical grid, and natural gas pipelines as well as having no current sources of air emissions within the boundaries of the basin. Specific locations would be subject to land use regulations, other restrictions, and public input.

Return on Investment

Calculating return on investment, in simplest terms, requires estimation of capital costs, estimation of operating costs, and projection of revenues from processing concentrate. Although reluctant to call return on investment a fatal

flaw without benefit of the calculations, economics will certainly be challenged for a smelter or concentrate leach plant at the level of TCRCs existing today. Preliminary studies with rough cost estimates are required.

Domestic concentrate producers will favor shipping concentrate to a domestic concentrate processing facility rather than a foreign smelter to save on freight costs, specifically port charges and ocean freight. Transport cost estimates from Nevada mine to Asian smelters published in recent NI 43-101 reports fall in the range of \$90 to \$200 per wet ton. The wide variation in cost estimates results from differences in truck transport distance, transloading charges, rail transport distance, port charges, and ocean freight cost. The port charges and ocean freight components of the estimates also range widely from \$28 to \$60 per wet ton, which would be equivalent to \$0.05 to \$0.13 per pound of contained copper.

ANALYSIS

The purpose of this high-level study is to answer two questions:

1. Is there a need for a custom milling facility in Nevada for the processing of precious metals ores, or are there existing facilities that have capacity to process external ores?
2. Would it be beneficial if there were a processing facility for copper concentrates in Nevada?

Attempting to provide answers for these questions, an inventory of existing processing facilities in Nevada has been compiled along with a listing of known resources that may benefit from a custom mill or a copper concentrate facility. An evaluation of the information gathered indicates that there is probably no need for the construction of a new custom mill for precious metals in Nevada, but that a smelter or alternative copper concentrate processing plant may be attractive.

CUSTOM MILL FOR PRECIOUS METALS

There are several mills in Nevada that are engaged in custom processing of precious metals ore and concentrates, see listing on page appendix 1. In all, there are six mills that will consider processing precious metal oxide ore, six mills that process (or will consider processing) precious metal refractory materials, three that will process loaded carbon, two concentrators that will consider custom processing copper ores, two heap leach plants that will consider custom processing, and one heap leach plant that may consider custom processing in the future.

With a broad variety of options in terms of locations and processing technologies currently available, it is difficult to imagine that a new custom processing facility could be competitive. If an entity was interested in establishing a new custom processing business, it should consider reactivating one of the plants now idle rather than building a new one from scratch.

COPPER SMELTER OR CONCENTRATE LEACH PLANT

The output of the copper concentrators now operating in Nevada is in the range of 340,000 to 380,000 tons of concentrate per year, probably not an adequate volume of concentrate to support a new smelter but perhaps enough to support a concentrate leach plant. To be competitive with existing facilities, a new smelter should be sized at 500,000 to 1 million tons per year of concentrate feed. Since concentrate leach plants are less expensive to build and operate, it may require a smaller volume of concentrate to justify building a leach plant.

In addition to the copper concentrators in Nevada, there are other producers in the western U.S. that would consider shipping concentrates to a new domestic concentrate processing facility, as their cost of production would be reduced by saving in shipping costs. In addition, there are copper projects in Nevada and other western states that may be developed in the future that could provide concentrate feed to a concentrate processing plant. There appears to be sufficient supply of concentrate now and in the future to support a smelter or concentrate leach plant. Environmental permitting for a new concentrate processing facility could be difficult, but the technology exists, at a cost, to design, build, and operate a fully compliant facility.

A new smelter would only be built if it made sense economically. The project must support a viable business case for the new facility. But a viable business case is questionable, as capital costs for a new smelter would be high, certainly running into the billions of dollars. Justifying this amount of capital at a time when TCRCs are low and declining would be challenging.

Autoclave leaching is a lower cost alternative to smelting for processing copper concentrates. Capital costs are estimated to be approximately one-third that of a smelter of equivalent capacity. Three important considerations for a concentrate leach plant would be: 1) recovery of precious metals, 2) dealing with the acid generated in the autoclave, and 3) handling impurities in the concentrate. Although there are concerns, based on economics, a concentrate leach plant probably makes more sense to pursue than a smelter.

Companies with potential interest in developing a copper concentrate processing facility, either a smelter or leach plant, include current exporters of concentrate, Asian smelter operators, and developers of commercial scale concentrate leach plants. These entities should have information readily available that could quickly evaluate the business case for a new facility.

Potential locations for a new copper concentrate processing facility, be it a smelter or a leach plant, exist in a corridor along Highway I-80 from east to west between about Wells and Fernley, then south between US-95 and US-95A toward Yerington. Access to power, water, transport via truck or train, and natural gas exists in this corridor. Candidate locations are highlighted in green on figure 1.

The anticipated final product of a new smelter or leach plant would be refined copper. First users of refined copper include ingot makers, rod plants, alloy makers, wire mills, brass mills, and foundries. Any of these may elect to locate a plant near a new source of refined copper. The most likely would be an ingot maker or rod plant, as these are intermediaries between the refined copper cathodes and final products such as copper wire, copper tube, or alloy products. Manufacturers producing these products might also evaluate locating a new plant near a new source of refined copper.

Copper is ranked third in total volume of metal used in the U.S. after steel and aluminum. Final copper and copper alloy products are used in electrical generation and distribution, building construction, transportation, industrial products, consumer products, chemicals, and electronics. Global mine production has grown by 3.2% annually since 1900. Growth is forecast to continue growing by 2.5% per year through 2020, and expectations are that this trend will continue into the future as demand for transportation vehicles, housing, appliances, and electronics continues to grow.

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APPENDIX 1 — LIST OF PROCESS FACILITIES IN NEVADA

OPERATING	PLANT NAME	OPERATOR	MINE	PROCESS TYPE	CAPACITY OR RECENT PRODUCTION SHORT TONS	SUMMARY DESCRIPTION	AVAILABLE FOR CUSTOM MILLING	LOCATION	MERIDIAN	COUNTY	COM-MODITY	EMPLOYEES	ADDRESS	SOURCE	REMARKS	START DATE	MINING ENDED	UTMn	UTMe	ZONE	NAD	TOPOGRAPHIC MAP	DISTRICT	CONTACT
YES	Carlin Mill 5	Newmont Mining Corp.	Carlin Trend Operations	Oxide Mill Concentrator	13,700 tons per day 13,000 to 17,000 tons per day	Processes both oxide and refractory ores. Oxide ore: SAG mill/ball mill grinding, cyanide leaching. Refractory ore: flotation to produce gold pyrite concentrate for feed to Mill 6 and Twin Creeks Autoclave	Yes in certain cases	S36, T34N, R51E	Mt. Diablo	Eureka	gold silver	Not noted in MSHA 2017	1655 Mountain City Highway Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4751 Web: http://www.newmont.com	NDM16	MSHA 2017 mill/prep plant employment: Genesis 30; South Area 363	1988		4514858	568484	11	27	Schroeder Mtn. 7.5' (1968)	Maggie Creek	Jerry Pfarr Megan Tibbals
YES	Carlin Mill 6	Newmont Mining Corp.	Carlin Trend Operations Future: Concentrates from Cripple Creek	Roaster	9,300 tons per day 9,000 to 10,500 tons per day	Refractory ore and concentrate. Dry grinding, roasting, and CIL Acid from Phoenix	Yes in certain cases	S36, T34N, R51E	Mt. Diablo	Eureka	gold silver	136 - MSHA 2017	1655 Mountain City Highway Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4751 Web: http://www.newmont.com	NDM16	MSHA 2017 mill/prep plant employment: Genesis 30; South Area 363	1994		4515041	568891	11	27	Schroeder Mtn. 7.5' (1968)	Maggie Creek	Jerry Pfarr Megan Tibbals
YES	Carlin Heap Leach	Newmont Mining Corp.	Carlin Trend Operations	Heap Leach	Varies with the mine plan	Oxide. ROM Heap Leach South Area has crusher capacity, gyratory and cone crusher; North Area ROM	No	S36, T34N, R51E	Mt. Diablo	Eureka	gold silver	136 - MSHA 2017	1655 Mountain City Highway Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4751 Web: http://www.newmont.com				4515041	568891	11	27	Schroeder Mtn. 7.5' (1968)	Maggie Creek	Jerry Pfarr Megan Tibbals	
YES	Emigrant Heap Leach	Newmont Mining Corp.	Emigrant Mine	Heap Leach	Varies with the mine plan	Oxide. ROM Heap Leach	No	S12, T31N, R53E	Mt. Diablo	Eureka	gold silver	13 - MSHA 2017	1655 Mountain City Highway Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4751 Web: http://www.newmont.com	MSHA16; Google Map; Newmont form 10-K for 2016		2012		4493220	588619	11	27	Bullion 7.5' (1985)	Carlin	Jerry Pfarr Megan Tibbals
YES	Jerritt Canyon Mill	Jerritt Canyon Gold, LLC	Jerritt Canyon Mine	Roaster	4,000–4,500 tons per day	Refractory. Dry grinding, two stage, roasting, and CIL	Yes, if the economics are right	S33, T41N, R54E	Mt. Diablo	Elko	gold silver	146 - MSHA 2017	HC31 Box 78 Elko, NV 89801 Phone: 775-738-5600 FAX: 775-758-9233 Web: http://www.jerrittcanyon.com	NDM16		1981		4584563	591670	11	27	California Mtn. 7.5' (1982)	Independence Mountains	Mark Melanson
YES	Long Canyon Heap Leach	Newmont Mining Corp.	Long Canyon Mine	Heap Leach	Varies with the mine plan	Oxide. ROM Heap Leach	No	S20, 21, 28, 29, 32, T36N, R66E	Mt. Diablo	Elko	gold	31 - MSHA 2017	1655 Mountain City Highway Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4751 Web: http://www.newmont.com	Newmont Form 10-K for 2016 Long Canyon FEIS		2016		4542199	711481	11	27	Independence Valley NE 7.5' (1968)	Pequop	Jerry Pfarr Megan Tibbals
YES	Midas Mill	Klondex Mines, Ltd.	Midas Mine; Fire Creek Mine; Hollister	Oxide Mill	1,200 tons per day	Oxide. For Midas and Fire Creek: Crushing, ball mill and vertimill grinding, gravity, pre-leach thickener, cyanidation, CCD, Merrill-Crowe. For Hollister: Crushing, grinding, gravity, cyanidation, and CIL	YES	S22; T39N, R46E	Mt. Diablo	Elko	gold silver	30 - MSHA 2017	360 Western Rd., Suite 1 Reno, NV 89563 Phone: 775-284-5757 FAX: 775-284-5756 Web: http://www.klondexmines.com	NDM16; Klondex Form 10-K for 2016; Klondex Form 10-K for 2017; www.klondexmines.com		1998		4564755	519820	11	27	Midas 7.5' (1965)	Gold Circle	Matt Dusenbury
YES	Pan Heap Leach	GRP Pan, LLC	Pan Mine	Heap Leach	13,000 to 14,400 tons per day	Oxide. ROM Heap Leach, CIC and ADR for gold recovery	Yes, carbon strip or refining	S26 and S36; T17N; R55E S1; T16N; R55E	Mt. Diablo	White Pine	gold silver		Web: www.fioregold.com Suite 1410, 120 Adelaide St. West Toronto, ON M5H 1T1 Canada Phone: 1-416-639-1426	NI-43-101 Technical Report Dated July 2017 www.fioregold.com	Mine production commenced in 2014 and leaching in early 2015 under management of Midway Gold; mining was suspended in June 2015 as a result of poor percolation on the leach pad; GRP acquired the mine in May 2016; improvements in operations were undertaken in January 2017 to rectify percolation problems on the heap; NI 43-101 Technical Report proposes installation of crushing and agglomeration following completion of test heaps now underway	2015		4351063	607889				Pancake	Andy Britton

OPERATING	PLANT NAME	OPERATOR	MINE	PROCESS TYPE	CAPACITY OR RECENT PRODUCTION SHORT TONS	SUMMARY DESCRIPTION	AVAILABLE FOR CUSTOM MILLING	LOCATION	MERIDIAN	COUNTY	COMMODITY	EMPLOYEES	ADDRESS	SOURCE	REMARKS	START DATE	MINING ENDED	UTMn	UTMe	ZONE	NAD	TOPOGRAPHIC MAP	DISTRICT	CONTACT
YES	Mineral Ridge Heap Leach	Mineral Ridge Gold, LLC	Mineral Ridge Mine Residual Leaching on Heap Only	Heap Leach	4,000 tons per day	Oxide. Four Stage Crushing, Heap leach with ADR for gold and silver recovery, loaded carbon processed off-site		S1, T2S, R38E	Mt. Diablo	Esmeralda	gold silver	56 (plant and crusher) - MSHA 2017	1515 7th St. Elko, NV 89801 Phone: 775-753-4778 Site Phone: 702-799-9273 FAX: 775-753-4780 Web: http://www.scorpiongold.com	NDM16 NI 43-101 Technical Report Jan. 2018	1991- Mine production started, but not certain when plant was built	1991		4183020	437063	11	27	Silver Peak 7.5' (1987)	Silver Peak	Chris Zerga
NO Proposed	Mineral Ridge Mill	Mineral Ridge Gold, LLC	Mineral Ridge Mine	Oxide Mill	4,000 tons per day	Oxide. Two Stage Crushing, Ball Milling, CIL, Off-site carbon processing	Yes	S1, T2S, R38E	Mt. Diablo	Esmeralda	gold silver	56 (plant and crusher) - MSHA 2017	1515 7th St. Elko, NV 89801 Phone: 775-753-4778 Site Phone: 702-799-9273 FAX: 775-753-4780 Web: http://www.scorpiongold.com	NDM16 NI 43-101 Technical Report Jan. 2018	1991- Mine production started, but not certain when crusher was built	1991		4183014	437286	11	27	Silver Peak 7.5' (1987)	Silver Peak	Chris Zerga
NO	Gold-wedge Mill	Mineral Ridge Gold, LLC	Goldwedge Mine	Oxide Mill	450 tons per day	Oxide. Care and maintenance Grinding and gravity concentration	Yes			Nye	Gold		1515 7th St. Elko, NV 89801 Phone: 775-753-4778 FAX: 775-753-4780 Web: http://www.scorpiongold.com	www.scorpiongold.com	Potential customer for custom milling has requested that Scorpio add a flotation circuit			4265989	492555					Chris Zerga
YES	Gold-strike Autoclave	Barrick Goldstrike Mines, Inc.	Barrick Goldstrike Mines, Betze Post	Autoclave	17,000 tons per day	Refractory. SAG mill/ball mill grinding, acid or alkaline pressure oxidation, thiosulfate leaching for extraction and resin-in-leach for recovery	Yes, sulfide ores on a selective basis	S29; T36N, R50E	Mt. Diablo	Eureka	gold silver	227 - MSHA 2017	P. O. Box 29 Elko, NV 89803 Phone: 775-748-1001 FAX: 775-748-1240 Web: http://www.barrick.com	NDM16 Annual Report 2016 NI 43-101 Technical Report April 2017		1980s		4535897	554777	11	27	Rodeo Creek NE 7.5' (1968)	Lynn	Nigel Bain
YES	Gold-strike Roaster	Barrick Goldstrike Mines, Inc.	Barrick Goldstrike Mines	Roaster	17,500 tons per day	Refractory. Dry grinding in 2 double rotators, two stage fluid bed roasting, quench tank and lime neutralization, CIL for recovery	Yes, sulfide ores on a selective basis	S13; T36N, R49E	Mt. Diablo	Eureka	gold silver	137 - MSHA 2017	P. O. Box 29 Elko, NV 89803 Phone: 775-748-1001 FAX: 775-748-1240 Web: http://www.barrick.com	NDM16 Annual Report 2016 NI 43-101 Technical Report April 2017		2000		4538274	552269	11	27	Rodeo Creek NW 7.5' (1968)	Lynn	Nigel Bain
YES PARTIAL (LEACH ONLY)	Ruby Hill Mill	Ruby Hill Mining Co., LLC Elko Mining Group, LLC	Ruby Hill Mine	Oxide Mill Heap Leach	Mill 3,500 tons per day. Heap leach 7,000 short tons per day	Oxide. 3 stage crushing, ball mill, thickener, belt filters, ADR Heap leach with agglomeration of mill tailing Current: Residual Leaching with carbon processed at Borealis	N/A	S10, T19N, R53E	Mt. Diablo	Eureka	gold silver	10 - MSHA 2017	230 South Rock Blvd., Suite 30 Reno, NV 89502 Phone: 775-826-7567	NEV0096103 Renewal 2017, Fact Sheet Revision	1997 - Mine production started, but not certain when crusher was built	1997		4376443	586832	11	27	Eureka 7.5' (1990)	Eureka	Lisanna Lewis
YES PARTIAL (LEACH ONLY)	Hycroft Heap Leach	Hycroft Mining Corporation	Hycroft Mine	Oxide Heap Leach	N/A Mining and Stacking Ceased in 2015	Oxide. Residual Leaching on Heaps, Merrill-Crowe for Gold & Silver Recovery	NO	S19, T35N, R30E	Mt. Diablo	Humboldt	gold silver	31 - MSHA 2017	P. O. Box 3030 Winnemucca, NV 89446 Phone: 775-623-5260 FAX: 775-623-0215 Web: http://www.alliednevada.com/	NDM16		2011		4527813	359885	11	27	Sulphur 7.5' (1981)	Sulphur	Jim Gubler
NO	Lone Tree Auto-clave	Newmont Mining Corp.	Lone Tree Mine (Lone Tree Complex) Brooks Project	Autoclave	N/A	Refractory. Grinding, flotation, POX ROM Heap Leach	No: Equipment Has Been Scavenged for Twin Creeks Sage Mill	S15, T34N, R42E	Mt. Diablo	Humboldt	gold silver	30 - MSHA 2017	P. O. Box 388 Valmy, NV 89438-0388 Phone: 775-635-6423 FAX: 775-635-6460 Web: http://www.newmont.com	NDM16 Newmont Form 10-K for 2016	1988 - Mine production started, but not certain when plant was built	1988		4518566	480405	11	27	Valmy 7.5' (1981)	Buffalo Mountain	Bill Janhunan
YES	Marigold Heap Leach	Silver Standard Resources, Inc.	Marigold Mine	Heap Leach	18,500 tons per day average for 25 years 1990-2014 64,700 tons per day in 2016	Oxide. ROM heap leach, ADR for gold recovery		S9, T33N, R43E	Mt. Diablo	Humboldt	gold silver	124 - MSHA 2017	P. O. Box 160 Valmy, NV 89438 Phone: 775-635-2317 FAX: 775-635-2551 Web: http://ir.silverstandard.com	NDM16 NI 43-101 Technical Report Nov. 2014 MD&A Feb. 2017 www.ssr.com	Mill ceased operation and was dismantled by 1998 Crushing circuit for the mill is now used for producing overliner for leach pad expansion	1988		4510716	487554	11	27	North Peak 7.5' (1984)	Battle Mountain	Dan Lampshire
YES	Twin Creeks Juniper Mill (Formerly Chimney Creek)	Newmont Mining Corp.	Twin Creeks Mine	Oxide Mill	3,000 tons per day	Oxide. SAG mill/Ball mill, Slurry combined with POX Slurry from Sage for cyanide leaching, ADR	Yes in certain cases	S5, T39N, R43E	Mt. Diablo	Humboldt	gold silver	168 (3 mills combined) - MSHA 2017	1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com	NDM16 Newmont Form 10-K for 2016	1993 - Mine production started, but not certain when mills were built	1993		4570311	487065	11	27	Dry Hills North 7.5' (1980)	Potosi	Bill Janhunan

OPERATING	PLANT NAME	OPERATOR	MINE	PROCESS TYPE	CAPACITY OR RECENT PRODUCTION SHORT TONS	SUMMARY DESCRIPTION	AVAILABLE FOR CUSTOM MILLING	LOCATION	MERIDIAN	COUNTY	COMMODITY	EMPLOYEES	ADDRESS	SOURCE	REMARKS	START DATE	MINING ENDED	UTMn	UTMe	ZONE	NAD	TOPOGRAPHIC MAP	DISTRICT	CONTACT
YES	Twin Creeks Sage Mill	Newmont Mining Corp.	Twin Creeks Mine and Turquoise Ridge Mine Concentrates from Newmont Mill 5 Foreign Concentrates Possible Future Concentrates from Cripple Creek	Autoclave	10,700 tons per day including 2,000 tons per day from Turquoise Ridge	Refractory. Grinding, POX, POX Slurry combined with ground Slurry from Juniper, cyanide leaching	Yes, concentrates for sulfur	S5, T39N, R43E	Mt. Diablo	Humboldt	gold silver	168 (3 mills combined) - MSHA 2017	1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com	NDM16 Newmont Form 10-K for 2016		Abt. 1996		4570156	486890	11	27	Dry Hills North 7.5' (1980)	Potosi	Bill Janhunan
NO	Twin Creeks Pinyon Mill (Formerly Rabbit Creek)	Newmont Mining Corp.	Twin Creeks Mine	Oxide Mill	N/A	Oxide. Tailing Impoundment Has Been Reclaimed	No	S31, T39N, R43E	Mt. Diablo	Humboldt	gold silver	168 (3 mills combined) - MSHA 2017	1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com	NDM16	1993 - Mine production started, but not certain when mills were built	1993		4562932	486190	11	27	Dry Hills South 7.5' (1980)	Potosi	Bill Janhunan
YES	Twin Creeks Heap Leach	Newmont Mining Corp.	Twin Creeks Mine	Heap Leach	Varies 200,000 to 2,000,000 tons per year	Oxide ROM Heap Leach	No	S31, T39N, R43E	Mt. Diablo	Humboldt	gold silver	168 (3 mills combined) - MSHA 2017	1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com					4569572	488686					Bill Janhunan
YES	Cortez Pipeline Mill	Barrick Cortez, Inc.	Cortez Hills Complex and Pipeline Complex Open Pit and Under-ground	Oxide Mill	14,000 tons per day 1.2 million tons per year of refractory ore shipped to Barrick Goldstrike for processing in the roaster	Oxide. SAG mill/ball mill grinding, grind thickener, CIC for thickener overflow, CIL, tailing CCD	No	S31, T28N, R47E	Mt. Diablo	Lander	gold silver	195 - MSHA 2017	HC 66 Box 1250 Crescent Valley, NV 89821-1250 Phone: 775-468-4400 FAX: 775-468-4496 Web: http://www.barrick.com	NDM16	1997 - Mine production started, Construction of the mill started in 1996	1997		4456676	524023	11	27	Tenabo 7.5' (1985)	Bullion	Nigel Bain
YES	Cortez Heap Leach	Barrick Cortez, Inc.	Cortez Hills Complex and Pipeline Complex Open Pit and Under-ground	Heap Leach	46,000 to 64,000 tons per day	Oxide. ROM heap leach, CIC for recovery	No	S31, T28N, R47E	Mt. Diablo	Lander	gold silver		HC 66 Box 1250 Crescent Valley, NV 89821-1250 Phone: 775-468-4400 FAX: 775-468-4496 Web: http://www.barrick.com	NI 43-101 Technical Report March 21, 2016	Operations ceased on Area 28 as the leach pad has reached maximum capacity Operations on Area 30 commenced in 2013 Operations commenced on Area 34 in March 2011	1997		4456676	524023	11	27	Tenabo 7.5' (1985)	Bullion	Nigel Bain
YES	Phoenix Mill	Newmont Mining Corp.	Phoenix Mine	Concentrator Oxide Mill	33,000 to 38,000 tons per day	Concentrator. Gyrotory crusher, cone crusher, SAG mill and ball mill grinding, gravity concentration; flotation, cyanidation and CIP on flotation tailing; carbon desorption and electrowinning; EW sludge melted off-site	Yes, would consider	S33, T31N, R43E	Mt. Diablo	Lander	gold silver copper concentrate	158 - MSHA 2017	1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com	NDM16	2005 - Latest mine production started; mined off and on since 1967; mill began operation in 2006. Current production is 100 wet tons of copper concentrate per day. Concentrate grade ranges from 15% to 20% copper. Concentrate is trucked to Dunphy, then railed to Glencore Noranda smelter in Quebec or to Port of Oakland or Port of Vancouver WA for ocean shipping to China. Shipping costs range from approximately \$80 per wet ton to more that \$160 per wet ton, depending on the routing and destination. Be aware of penalty elements in concentrates produced in Nevada.	2005		4484423	488426	11	27	Antler Peak 7.5' (1984)	Battle Mountain	Jerry Pfarr Megan Tibbals
NO	Phoenix Gold Heap Leach	Newmont Mining Corp.	Phoenix Mine	Heap Leach	N/A	Oxide ROM Heap Leach	No											4482059	486132					Jerry Pfarr Megan Tibbals

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YES	Phoenix Copper Dump Leach	Newmont Mining Corp.	Phoenix Mine	Copper Dump Leach	Varies with the mine plan	ROM Copper Dump Leach, SX/EW	No	S33, T31N, R43E	Mt. Diablo	Lander	copper cathode		1655 Mountain City Hwy. Elko, NV 89801 Phone: 775-778-4000 FAX: 775-778-4360 Web: http://www.newmont.com		Production is 1,000,000 to 2,000,000 pounds per month			4484423	488426	11	27	Antler Peak 7.5' (1984)	Battle Mountain	Jerry Pfarr Megan Tibbals
YES PARTIAL (LEACH ONLY)	Borealis	Borealis Mining Co., LLC Elko Mining Group, LLC	Borealis Mine	Heap Leach	N/A	Oxide. Heap rinsing and carbon processing	Yes, carbon stripping only	S17, T6N, R29E	Mt. Diablo	Mineral	gold silver	5 - MSHA 2017	P.O. Box 549 Hawthorne, NV 89415 Phone: 775-341-0042 FAX: 604-608-3262		1981 - Mine production started, but not certain when mill was built	1981	1990	4249914	345881	11	27	Corey Peak 7.5' (1989)	Borealis	Lisanna Lewis
YES PARTIAL (LEACH ONLY)	Denton-Rawhide Heap Leach	Rawhide Mining, LLC	Denton-Rawhide Mine	Heap Leach	850 tons per hour, estimated 14,000 tons per day	Oxide. Two stage crushing, heap leaching, Merrill-Crowe and CIC	No	S9, T13N, R32E	Mt. Diablo	Mineral	gold silver	49 - MSHA 2017	P. O. Box 2070 Fallon, NV 89407 Phone: 775-945-1015 FAX: 775-945-1213		1989 - Mine production started, but not certain when mill was built	1989		4317745	379905	11	27	Rawhide 7.5' (1980)	Rawhide	Ruben Beruman
YES	Round Mountain Heap Leach	Round Mountain Gold Corp.	Round Mountain Mine (Smoky Valley Common Operation)	Heap Leach	Oxide. 55,000 tons per day (2016), 53,700 tons per day (2017)	Heap Leach, ADR Circuit for gold recovery	N/A	S25, T10N, R43E	Mt. Diablo	Nye	gold silver	266 (Combined mill and plant) - MSHA 2017	P. O. Box 480 Smoky Valley Mine Rd. Round Mountain, NV 89405 Phone: 775-377-2366 FAX: 775-377-3224 Web: http://www.kinross.com	NDM16 Kinross Gold Annual Reports for 2016 and 2017	1976 - Mine production started, but not certain when plant was built	1976		4283301	490982	11	27	Round Mountain 7.5' (1971)	Round Mountain	
YES	Round Mountain Mill	Round Mountain Gold Corp.	Round Mountain Mine (Smoky Valley Common Operation)	Oxide Mill	Oxide. 9,940 tons per day (2016), 10,024 tons per day (2017)	Crushing, grinding, gravity concentration(?), cyanide leaching, ADR	N/A	S25, T10N, R43E	Mt. Diablo	Nye	gold silver	266 (Combined mill and plant) - MSHA 2017	P. O. Box 480 Smoky Valley Mine Rd. Round Mountain, NV 89405 Phone: 775-377-2366 FAX: 775-377-3224 Web: http://www.kinross.com	NDM16 Kinross Gold Annual Reports for 2016 and 2017		1997		4283233	491489	11	27	Round Mountain 7.5' (1971)	Round Mountain	
YES	Coeur Rochester Heap Leach	Coeur Rochester, Inc.	Rochester Mine	Heap Leach	48,000 tons per day past 3 years 2015-2017 ~60,000 tons per day total material mined	Oxide. Crushing, Heap Leach, Merrill-Crowe for silver and gold recovery	Yes, if the circumstances and economics are right	S15, T28N, R43E	Mt. Diablo	Pershing	silver gold	109 - MSHA 2017	P. O. Box 1057 Lovelock, NV 89419 Phone: 775-273-7995 FAX: 775-273-7423 Web: http://www.coeur.com	NDM16 Coeur Mining Form 10-K for 2016 Episode 18 of 1 in 100MM www.coeur.com	1986 - Mine production started, but not certain when plant was built	1986		4460282	403112	11	27	Rochester 7.5' (1987)	Rochester	Dana Sue Kimball
YES	Florida Canyon Heap Leach	Florida Canyon Mining, Inc. Rye Patch Gold Corp.	Florida Canyon	Heap Leach	24,000 tons per day	Oxide. Crushing, heap leaching, CIC, ADR	No	S3, T31N, R33E	Mt. Diablo	Pershing	gold silver	27 - MSHA 2017	P. O. Box 330 Imlay, NV 89418 Phone: 775-538-7300 FAX: 775-538-7324 Web: http://www.jipangu.co.jp	Rye Patch Amended NI 43-101 Technical Report Jan. 2017	1986 - Mine production started, but not certain when plant was built	1986	2011	4492215	395336	11	27	Star Peak 7.5' (1987)	Imlay	Rusty Hufford
NO	Comstock Heap Leach	Comstock Mining, Inc.	Lucerne Pit	Heap Leach	Permitted Capacity: 10,950 tons per day Actual Operating Rate: Average 1,780 tons per day	Oxide. Crushing, heap leach, Merrill-Crowe for silver and gold recovery	No	S6, T16N, R21E	Mt. Diablo	Storey	gold silver	4 - MSHA 2017	P. O. Box 1118 1200 American Flat Rd. Virginia City, NV 89440 Phone: 775-847-5272 FAX: 800-750-5740 Web: http://www.comstockmining.com	NDM16 Comstock Mining Form 10-K for 2017	Mining at Lucerne ceased in 2015 and leaching continued until the end of 2016	1990s		4350425	269764	11	27	Virginia City 7.5' (1994)	Comstock	
YES	Bald Mountain Mooney North Heap Leach	KG Mining, Inc.	Bald Mountain Mine	Heap Leach	55,000 to 60,000 tons per day combined for North and South Plants	Oxide. ROM Heap Leach, CIC, DR Plant Out of Service; Loaded Carbon Processed at Round Mountain or Barrick Goldstrike	Not Now - May Consider in the Future	S29, T24N, R58E	Mt. Diablo	White Pine	gold silver mercury	71 (3 plants combined) - MSHA 2017	P. O. Box 2706 Elko, NV 89803 Phone: 775-237-7100 FAX: 775-237-7101 Web: http://www.kinross.com	NDM16	2006: Barrick acquired from Placer Dome 2016: Kinross acquired from Barrick	1999		4442147	630785	11	27	Big Bald Mountain 7.5' (1990)	Bald Mountain	Joe Kemp
YES	Bald Mountain Mooney South Heap Leach	KG Mining, Inc.	Bald Mountain Mine	Heap Leach				S32, T24N, R58E	Mt. Diablo	White Pine	gold silver mercury	71 (3 plants combined) - MSHA 2017	P. O. Box 2706 Elko, NV 89803 Phone: 775-237-7100 FAX: 775-237-7101 Web: http://www.kinross.com	NDM16	2006: Barrick acquired from Placer Dome 2016: Kinross acquired from Barrick	2012		4441390	630625	11	27	Big Bald Mountain 7.5' (1990)	Bald Mountain	Joe Kemp
YES (LEACH ONLY)	Bald Mountain Heap Leach 2	KG Mining, Inc.	Bald Mountain Mine	Heap Leach	N/A Currently No Fresh Ore to the Heaps		No	S14, T24N, R57E	Mt. Diablo	White Pine	gold silver mercury	71 (3 plants combined) - MSHA 2017	P. O. Box 2706 Elko, NV 89803 Phone: 775-237-7100 FAX: 775-237-7101 Web: http://www.kinross.com	NDM16 Kinross Gold Annual Report for 2016 & 2017	2006: Barrick acquired from Placer Dome 2016: Kinross acquired from Barrick	Abt. 1985		4423057	617006	11	27	Cold Creek Ranch NW 7.5' (1990)	Bald Mountain	Joe Kemp

OPERATING	PLANT NAME	OPERATOR	MINE	PROCESS TYPE	CAPACITY OR RECENT PRODUCTION SHORT TONS	SUMMARY DESCRIPTION	AVAILABLE FOR CUSTOM MILLING	LOCATION	MERIDIAN	COUNTY	COMMODITY	EMPLOYEES	ADDRESS	SOURCE	REMARKS	START DATE	MINING ENDED	UTMn	UTMe	ZONE	NAD	TOPOGRAPHIC MAP	DISTRICT	CONTACT
NO - In Construction	Vantage Heap Leach	KG Mining, Inc.	Vantage Basin	Heap Leach	Production in Q1 2019	Oxide. ROM Heap Leach, CIC	N/A		Mt. Diablo	White Pine	gold		P. O. Box 2706 Elko, NV 89803 Phone: 775-237-7100 FAX: 775-237-7101 Web: http://www.kinross.com	Kinross MD&A Feb. 2018 and Nov. 2017 Kinross Annual Report 2016	Total expected to be processed: 68 million tons			4400581	626912					Joe Kemp
YES	Robinson Concentrator	KGHM International, Ltd.	Robinson Mine - Ruth Pit Producing Copper/Gold Concentrate and Molybdenum Concentrate Ship Approximately 300,000 Wet Tons of Copper Concentrate per year	Concentrator	46,000 tons per day	Concentrator. SAG Mill/Ball Mill, Flotation	Yes, Will Consider	S8, T16N, R62E	Mt. Diablo	White Pine	copper gold molybdenum	147 - MSHA 2017	P. O. Box 382 4232 West White Pine County Rd. 44 Ruth, NV 89319 Phone: 775-289-7000 FAX: 775-289-7349 Web: http://kgm.com	NDM16	Total Shipping Cost for Concentrate Ranges from \$100 to \$110 per wet ton Montana Resources might be a customer of a smelter in Nevada Concentrate Grade Ranges from 17% to 22% Copper	1995		4347779	671583	11	27	Riepetown 7.5' (1958)	Robinson	Zane Jordan Greg Hurless Amanda Hilton
YES	Aurora Mill	Klondex Mines, Ltd.	Processing Loaded Carbon from Hollister Produced at Midas Mill Possible Future Hollister Mine	Oxide Mill	350 tons per day (limited by permit)	Oxide. Crushing, milling, CIL	Yes	S19, T5N, R28E	Mt. Diablo	Mineral	gold silver		360 Western Rd., Suite 1 Reno, NV 89563 Phone: 775-284-5757 FAX: 775-284-5756 Web: http://www.klondexmines.com	NDM16; Klondex Form 10-K for 2016; www.klondexmines.com, Klondex Form 10-Q, Q3 2017; Klondex AR 2017	Nov. 2013: Mine Temporary Shut Down; Waterton Global Resource Management, Inc., now Carlin Resources; Early 2014: processed and sold gold from stockpiles at mill; dates for Aurora Mine; Feb. 2017 reprocessing tailing from the Aurora Mill. The Aurora Mill was formerly know as the Esmeralda Mill	1930s	1998	4240220	334720	11	27	Aurora 7.5' (1989)	Aurora	Matt Dusenbury
NO	Gold Bar Mill	Ely Gold and Minerals, Inc. - optioned to Fremont Gold Ltd. 9/2017	Gold Bar Mine	Oxide Mill	3,500 tons per day for oxide 2,000 tons per day for refractory	Oxide or Refractory. Grizzly, wet screen, impact crusher, SAG mill, ball mill, hybrid Leach/CIL, ADR	N/A Plant may not be fully intact and no remaining space for tailing	S27, T22N, R49E	Mt. Diablo	Eureka	gold silver		2833 - 595 Burrard St. Box 49195 Vancouver BC, V7X 1K8 Phone: 604-488-1104 Web: https://elygoldinc.com	Western Mining History	Dates are of beginning and ending of mining according to MI; UTM's from Google Map; uncertain if Ely Gold owns mill	1984	1994	4399827	547827	11	27	Bartine Ranch NW 7.5'	Antelope	Dennis Moore Dennis Appelhaus
NO Under Construction	Gold Bar Heap Leach	McEwen Mining Inc.	Gold Bar Mine	Heap Leach	Projected 8,000 tons per day	Oxide. Combined ROM and Screened with Fines Agglomerated, Truck Stacking and Conveyor Stacking, Heap Leach, CIC and ADR for Gold Recovery	N/A	Township 22 North, Range 50 East, Sections 01, 02, 03, 04, 09, 10, 11, 12, 13, 14, 15; and □ Township 23 North, Range 50 East, Section 34	Mt. Diablo	Eureka	gold silver		150 King Street West Suite 2800 Toronto, ON M5H 1J9 Canada info@mcewenmining.com Toll Free 1-866-441-0690 FAX: 647-258-0408 Web: mcewenmining.com	NI 43-101F1 Technical Report March 2018			4402551	558183						

OPERATING	PLANT NAME	OPERATOR	MINE	PROCESS TYPE	CAPACITY OR RECENT PRODUCTION SHORT TONS	SUMMARY DESCRIPTION	AVAILABLE FOR CUSTOM MILLING	LOCATION	MERIDIAN	COUNTY	COMMODITY	EMPLOYEES	ADDRESS	SOURCE	REMARKS	START DATE	MINING ENDED	UTMn	UTMe	ZONE	NAD	TOPOGRAPHIC MAP	DISTRICT	CONTACT	
NO	Crown Point Mill	Crown Point Holdings Corporation		Oxide Mill	125 tons per day	Oxide. Crusing, ball mill grinding, cyanidation, counter current decantation, Merrill Crowe	N/A			Storey	gold silver		P. O. Box 115 Virginia City, NV 89440 Phone: 707-843-0895 info@crownpoinmill.com	info@crownpoinmill.com	Mill ceased operations in 1942. Mill was upgraded in late 1980s by The Art Wilson Co. Current owners have attempted to permit an renewed operation, but has encountered local resistance. Estimated cost to further update the plant is \$2 to \$3 million. In the past there have been discussions with miners to custom process ores.	1930s	1942								Clayton Mitchell
NO	Taylor Mill	Silver Predator Corp.	Taylor Mine - silver and gold Ward Mine - copper, lead, and zinc	Oxide Mill Concentrator	1,320 tons per day	Primary crusher, secondary and tertiary crushers, 8 ball mills, leaching and CCD, flotation	N/A	T14N, R65E		White Pine	silver gold		13403 N. Government Way Suite 212 Hayden, ID 83835 Phone: 208-635-5415 Web: www.silverpredator.com	NI 43-101 Technical Report March 18, 2013									Taylor		

For additional information on Nevada's mineral resources and mineral industries, please see the following:

Mining Applications on "Open Data" Web Page: <https://data-nbmg.opendata.arcgis.com/>

Mining District Files: <https://gisweb.unr.edu/MiningDistricts/>

Reno Mineral Resources: <https://gisweb.unr.edu/RenoMinerals/>

43-101 Reports: <https://gisweb.unr.edu/43-101Reports/>

NBMG Publications (selected publications listed below): <http://pubs.nbmg.unr.edu/>

Statewide Commodity Publications

Antimony (B61)

Barite (B98)

Copper (M100, B65)

Fluorspar (B93)

Gypsum (B103)

Iron (B53)

Mercury (B41)

Montmorillonite, bentonite,
and fuller's earth (B76)

Nevada active mines and energy producers (OF17-1)

Oil and gas (B104, OF01-7, OF04-1,
OF11-2, OF11-6, M162)

Radioactive minerals (B81, OF06-19)

Talcoses minerals (B84)

Thermal waters (B91, M161, M151)

Tungsten (B105)

Zeolites (B79)

County Mineral Resource Bulletins

Carson City (B75)

Churchill (B83)

Clark (B62)

Douglas (B75)

Elko (B106)

Esmeralda (B78)

Eureka (B64)

Humboldt (B59)

Lander (B88)

Lincoln (B73)

Lyon (B75)

Mineral (B58)

Nye (B77, B99B)

Pershing (B89)

Storey (B70)

Washoe (B70)

White Pine (B85)

Other Publications

Index to geothermal well files housed at NBMG (L-5)

Gold and silver resources in Nevada (M149)

Geothermal resources (M161, M151, B91)

Industrial mineral deposits (M142)

Major mines of Nevada 2016 (P-28)

Outline of Nevada mining history (SP15)

Mining districts of Nevada (R47)

NBMG maintains an open-file office with the following information available to the public:

- NBMG, USGS, USBM, and DOE open-file reports on Nevada geology and mineral resources
- petroleum and geothermal exploration and production
- mining district records and maps
- mineral resources and reserves
- mineral resource assessments
- core and cuttings library
- wilderness study area reports
- general geologic studies
- indexes and ordering information for maps, air photos, and remote sensing imagery

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