

PAN AMERICAN SILVER CORP  
Form 6-K  
February 03, 2014

Securities and Exchange Commission

washington, D.C. 20549

**FORM 6-K**

Report of Foreign Private Issuer

Pursuant to Rule 13a-16 or 15d-16 of

the Securities Exchange Act of 1934

For the month of, February 2014  
Commission File Number 000-13727

**Pan American Silver Corp.**

(Translation of registrant's name into English)

**1500-625 Howe Street, Vancouver BC Canada V6C 2T6**

(Address of principal executive offices)

Indicate by check mark whether the registrant files or will file annual reports under cover of Form 20-F or Form 40F:

Form 20-F ☐ Form 40-F ☒

Indicate by check mark if the registrant is submitting the Form 6-K in paper as permitted by Regulation S-T Rule 101(b)(1): \_\_\_\_\_

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Indicate by check mark if the registrant is submitting the Form 6-K in paper as permitted by Regulation S-T  
Rule 101(b)(7): \_\_\_\_\_

**DOCUMENTS INCLUDED AS PART OF THIS REPORT**

**Document**

- 1 Pan American Silver Corp., TECHNICAL REPORT, PRELIMINARY ECONOMIC ANALYSIS FOR THE EXPANSION OF THE LA COLORADA MINE, ZACATECAS, MÉXICO.

**Document 1**

TECHNICAL REPORT

PRELIMINARY ECONOMIC ANALYSIS FOR THE EXPANSION OF THE

LA COLORADA MINE

ZACATECAS, MÉXICO

Effective Date: December 31, 2013

PREPARED BY:

Michael Steinmann, P.Ge

Martin Wafforn, P.Eng

## Table of Contents

<b>1.0 SUMMARY</b>	<b>7</b>
1.1. Expansion Project	7
1.2. Property Description and Ownership	9
1.3. Geology and Mineralization	11
1.4. Status of Exploration	11
1.5. Development and Operations	12
1.6. Mineral Resources	12
1.7. Mineral Reserves	13
1.8. Qualified Person's Conclusions and Recommendations	14
1.9. Cautionary Note Regarding Forward-looking Information and Statements	16
1.10. Cautionary Note Regarding Decision to Proceed with Expansion	17
<b>2.0 INTRODUCTION</b>	<b>18</b>
2.1. Purpose and Background	18
2.2. Sources of Information	18
2.3. List of Qualified Persons	19
2.4. Personal Inspections	19
<b>3.0 RELIANCE ON OTHER EXPERTS</b>	<b>19</b>
<b>4.0 PROPERTY DESCRIPTION AND LOCATION</b>	<b>19</b>
4.1. Property Location	19
4.2. Mineral Tenure	20
4.3. Nature and Extent of Title	22
4.4. Royalties	22
4.5. Environmental Liabilities	22
4.6. Permits and Agreements	22
4.7. Significant Factors or Risks	24
<b>5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY</b>	<b>24</b>
5.1. Physiography	24
5.2. Access	24
5.3. Location and Transport	24
5.4. Climate	24
5.5. Local Resources and Infrastructure	25

<b>6.0</b>	<b>HISTORY</b>	<b>26</b>
6.1.	Prior Ownership	27
6.2.	Historic Exploration	27
6.3.	Historic Production	27

<b>7.0</b>	<b>GEOLOGICAL SETTING AND MINERALIZATION</b>	<b>27</b>
7.1.	Regional and Local Property Geology	27
7.2.	Mineralized Zones	30
<b>8.0</b>	<b>DEPOSIT TYPES</b>	<b>33</b>
<b>9.0</b>	<b>EXPLORATION</b>	<b>33</b>
9.1.	Surveys	34
9.2.	Channel Sampling	34
9.3.	Sampling Results	34
<b>10.0</b>	<b>DRILLING</b>	<b>35</b>
10.1.	Diamond Drilling	35
10.2.	Accuracy and Reliability	36
10.3.	Author's Opinion	36
<b>11.0</b>	<b>SAMPLE PREPARATION, ANALYSIS AND SECURITY</b>	<b>37</b>
11.1.	Sample Collection	37
11.2.	Laboratory	38
11.3.	Quality Assurance / Quality Control (QA/QC)	39
11.4.	Author's Opinion	42
<b>12.0</b>	<b>DATA VERIFICATION</b>	<b>43</b>
<b>13.0</b>	<b>MINERAL PROCESSING AND METALLURGICAL TESTING</b>	<b>43</b>
13.1.	Mineral Processing	43
13.2.	Laboratory Analysis	44
13.3.	2012 Metallurgical Test Results	44
13.4.	Metallurgical Testing	45
13.5.	Author's Conclusion and Recommendations	49
<b>14.0</b>	<b>MINERAL RESOURCE ESTIMATES</b>	<b>49</b>
14.1.	Method and Parameters	50
14.2.	Bulk Density	51
14.3.	Dilution and Ore Loss	51
14.4.	Disclosure Requirements	53
14.5.	Multiple Commodities	54
<b>15.0</b>	<b>MINERAL RESERVE ESTIMATE</b>	<b>54</b>

15.1. Method and Parameters	55
15.2. Classification	55
<b>16.0 MINING METHOD</b>	<b>56</b>
16.1. Underground Infrastructure	59
16.2. Life of Mine Plan (LOM)	63



<b>17.0 RECOVERY METHODS</b>	<b>65</b>
17.1. Crushing Plant	68
17.2. Oxide Plant	69
17.3. SULPHIDE PLANT	72
<b>18.0 PROJECT INFRASTRUCTURE</b>	<b>75</b>
<b>19.0 MARKET STUDIES AND CONTRACTS</b>	<b>77</b>
<b>20.0 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT</b>	<b>78</b>
20.1. Environmental Studies and Permits	78
20.2. Waste and Tailings Disposal	79
20.3. Social and Community	79
20.4. Closure Plan	79
<b>21.0 CAPITAL AND OPERATING COST</b>	<b>80</b>
21.1. Capital Costs	80
21.2. Operating Costs	84
<b>22.0 ECONOMIC ANALYSIS</b>	<b>86</b>
22.1. Production Base	86
22.2. Planned Production	87
22.3. Revenue	87
22.4. Costs	88
22.5. Cash Flow	88
<b>23.0 ADJACENT PROPERTIES</b>	<b>95</b>
<b>24.0 OTHER RELEVANT DATA AND INFORMATION</b>	<b>95</b>
<b>25.0 INTERPRETATION AND CONCLUSIONS</b>	<b>95</b>
25.1. Risks	95
<b>26.0 RECOMMENDATIONS</b>	<b>96</b>
<b>27.0 REFERENCES</b>	<b>97</b>
<b>28.0 CERTIFICATES of QUALIFIED PERSONS</b>	<b>99</b>



## List of Tables

Table 1: Capital Investment	8
Table 2: Npv and Payback	9
Table 3: La Colorada Mineral Resources as of December 31, 2013	13
Table 4: La Colorada Mineral Reserves as of December 31, 2013	14
Table 5: List of Qualified Persons	19
Table 6: Mining Claims	21
Table 7: Chalchihuites Rain and Evaporation (La Colorada Environmental Dept. 2013)	25
Table 8: Chalchihuites Historic Production	27
Table 9: Reconciliation By Year	34
Table 10: List Of Drilling Campaigns By Year	36
Table 11: Core Recovery By Year	36
Table 12: Predicted Metal Recoveries	43
Table 13: Metal Recoveries Achieved 2008 - 2013	44
Table 14: Achieved Head Grades 2008 - 2013	44
Table 15: Metallurgical Test Work Results 2012	45
Table 16: Compositated Metallurgical Test Sample Grades 2012	45
Table 17: Metallurgical Samples	47
Table 18: Sulphide Sample Analysis	47
Table 19: Oxide Sample Analysis	48
Table 20: Reagents for Sulphide Flotation Tests	48
Table 21: Flotation Test Results	48
Table 22: Cyanide Leach Test Results	48
Table 23: La Colorada Mineral Resources as at 31 December 2013	50
Table 24: Bulk Density	51
Table 25: La Colorada Mineral Reserves as of 31 December 2013	54
Table 26: Reserve Cut Offs	55
Table 27: Historic Production Areas at La Colorada	57
Table 28: La Colorada Mobile Mine Equipment Fleet	59
Table 29: Underground Mine Personnel	63
Table 30: La Colorada Long Term Plan	64
Table 31: Plant Production 2008-2012	66
Table 32: Oxide Circuit Recovery	67
Table 33: Sulphide Circuit Recovery	67
Table 34: La Colorada Crushing Equipment	68
Table 35: Oxide Plant Equipment	69
Table 36: Sulphide Plant Equipment	72
Table 37: Current Doré Refining and Concentrate Sales Contracts	77
Table 38: Annual Revenue from Metal Sales	78
Table 39: La Colorada Capital Spending Actual 2008-2013 (000\$)	81
Table 40: La Colorada Capital Spending During Expansion Project 2014-2017 (000\$)	82
Table 41: La Colorada Sustaining Capital Expenditure 2018-2027	83



Table 42: La Colorada Summary Operating Costs Actual 2008-2013	84
Table 43: La Colorada Operating Costs Long Term Plan 2013-2024	85
Table 44: Production Base for the Lom 2014-2027	87
Table 45: Npv Cash Flow and Capital Payback	89
Table 46: La Colorada Long Term Plan Cash Flow Sensitivity	90
Table 47: Summary Data from La Colorada Financial Model	91
Table 48: Summary Data from La Colorada Financial Model - Non Expansion Case	93

## List of Figures

Figure 1: La Colorada Location	10
Figure 2: La Colorada Mine Concessions	20
Figure 3: Chronology of Geological Events at La Colorada	29
Figure 4: Site Geology with Main Mineralized Structures	31
Figure 5: QA/QC Standard Results	40
Figure 6: La Colorada Laboratory Vs ALS Checks Samples	42
Figure 7: Development Dilution	52
Figure 8: Stope Dilution	53
Figure 9: La Colorada Mine General Site Plan with Infrastructure	56
Figure 10: La Colorada- Mining Sequence	58
Figure 11: Processing Rate (Actual and Estimated) By Material Type	65
Figure 12: Oxide Flow Diagram	70
Figure 13: Sulphide Flow Diagram	73

## 1.0 SUMMARY

This Technical Report refers to a Preliminary Economic Assessment (PEA) of the expansion of the La Colorada silver mine in Zacatecas, Mexico owned by Pan American Silver Corp.

### 1.1. Expansion Project

La Colorada's expansion project is envisaged to be built progressively, ramping up from the mining and processing rates of 1,228 tonnes per day (tpd) in 2013 to 1,800 tpd by the end of 2017. Once the expansion is complete, the PEA estimates that La Colorada's annual production capacity will grow 64% to approximately 7.7 million ounces of silver in 2018.

The mine's expansion will require the construction of new mining infrastructure, the development of new mining zones to reach deeper mineralization and the expansion of the sulphide ore processing plant. A new 600-metre deep bore hole shaft is planned between the main Candelaria area that contains the NC2 and HW veins, and the Estrella area that contains the Amolillo vein. The new shaft, which over the long term would be required whether or not the expansion project proceeds, will increase hoisting capacity to 2,300 tpd, accommodating ore and waste extraction as well as serving as the main access to working areas for mine personnel and materials. Preliminary engineering work for the new shaft and hoist has already been conducted and detailed engineering is recommended to begin in early 2014. Construction of the new shaft would then start early in 2015, following completion of sufficient underground development around the shaft bottom, and commissioning would follow in the second half of 2016. The shaft and associated hoisting equipment will be designed such that it can be deepened in the future if justified by future exploration success.

Mining at both the Estrella and Candelaria areas will continue utilizing the cut-and-fill methods currently being successfully employed. The capacity of the ventilation and dewatering systems will be increased to handle the mine's hot and wet ground conditions as mining operations extend at depth. The expansion plan also includes the addition of 22 new pieces of mining equipment to the fleet and the hiring of over 100 additional mining personnel.

Total throughput at La Colorada's processing plants will progressively increase from today's 1,228 tpd to 1,800 tpd by the end of 2017. The mine currently produces doré bars from a conventional cyanide leach plant for the oxide ore, and silver-rich lead and zinc concentrates from a floatation plant that treats the sulphide ore. Both circuits currently share a single crushing plant. While the oxide plant will not be modified due to La Colorada's oxide production remaining at current levels for the rest of the mine's life, the sulphide plant will be expanded to treat the increased sulphide ore feed.

Expansion of the sulphide plant to 1,500 tpd will be implemented through the installation of a new crusher and grinding mill. The existing zinc flotation cells will be converted to lead floatation and a new zinc floatation circuit will be built. The plan also includes an upgrade and expansion of the plant's dewatering circuits and installation of a new 115 kV power line connection to the national grid replacing the existing 33 kV lines. Work on the plant's expansion will commence in early 2015 and is scheduled to be completed by mid-2016.

The total incremental expansion capital over the next 4 years has been estimated at \$80 million, the majority of which is expected to be spent from 2014 to 2016. The sulphide plant expansion, additional mining equipment and accelerated development, plus several important infrastructure upgrades account for the largest portion of the incremental capital for the project. The economic analysis assumes that the expansion project can be completed without materially disrupting the current operation or ongoing exploration efforts.

Total capital that would be required to be invested at La Colorada over the next four years is estimated at \$163.8 million (excluding exploration), for both ongoing operations and the expansion project, as shown in Table 1:

Table 1: Capital Investment

Area (\$ Million)	2014	2015	2016	2017	2014-2017 LOM + Expansion Capital	2014-2017 Expansion Capital Only
Major Projects						
Shaft & Hoist Installation	\$8.8	\$23.0	\$8.5	—	\$ 40.3	—
Plant Expansion	\$3.6	\$33.6	\$8.7	—	\$ 46.0	\$ 46.0
Infrastructure Upgrades	\$6.5	\$9.4	\$0.1	—	\$ 16.1	\$ 11.9
Underground Development	\$2.0	\$2.6	\$2.1	\$1.7	\$ 8.4	\$ 4.8
Additional Mine Equipment	—	\$4.1	—	\$4.1	\$ 8.3	\$ 8.3
Initial Sulphide Tailings Expansion	\$5.0	—	—	—	\$ 5.0	—
Project Indirects	\$2.3	\$5.8	\$4.9	—	\$ 12.9	\$ 5.2
Sub Total Projects	\$28.2	\$78.6	\$24.4	\$5.8	\$ 137.0	\$ 76.1
Other Capital						
Normal Mine and Plant Sustaining Capital	\$5.8	\$3.8	\$5.2	\$5.5	\$ 20.3	\$ (0.3 )
Ongoing Tailings Dam Expansions	—	—	—	\$6.6	\$ 6.6	\$ 4.2
Sub-total Other Capital	\$5.8	\$3.8	\$5.2	\$12.1	\$ 26.9	\$ 3.9
Total Capital	\$34.0	\$82.3	\$29.6	\$17.9	\$ 163.8	\$ 80.0

The economics analysis for the PEA of the La Colorada expansion demonstrates that the project has the potential to be robust at current prices. Assuming a long term silver price of \$19 per ounce, and prices of \$1,850 per tonne of zinc and \$2,100 per tonne of lead, the expanded mine has the potential to generate estimated net revenues of \$1.4 billion and after tax, undiscounted net cash flow of \$372 million over the next 10-years 2014 through 2023, including the new Mexican mining taxes. The PEA estimates an after tax net present value (NPV) of \$38.6 million at a 10% discount rate, an estimated internal rate of return (IRR) of 22% and an estimated payback period of 2.5 years. Using the long term silver price assumption of \$22 per ounce that this Technical Report is based on, and prices of \$1,850 per tonne of zinc and \$1,950 of lead (base case), the expansion project's economic potential for the next 10 years becomes even more attractive with an estimated NPV of \$54.1 million at a 10% discount rate, an estimated IRR of 27% and an



estimated payback period of 2.2 years as shown in Table 2.

Table 2: NPV and Payback

Metal Price Assumptions	<b>Base Case</b>					
Ag Price - \$ Toz	\$19.00	\$22.00	\$25.00			
Zn Price - \$ DMT	\$1,850	\$1,850	\$1,850			
Pb Price - \$ DMT	\$2,100	\$1,950	\$2,100			
Au Price - \$ Toz	\$1,200	\$1,300	\$1,200			
Ten-Year Comparison (2014 - 2023)						
Net Revenue (US\$M)	\$1,443	\$1,624	\$1,817			
Undiscounted Net Cash Flow (US\$M)	\$372	\$489	\$614			
Total Mine 10% NPV (US\$M)	\$196	\$272	\$354			
Expansion 10% NPV (US\$M)*	\$38.6	\$54.1	\$71.7			
IRR	23	%	27	%	32	%
Payback Period (years)	2.5		2.2		2.0	
Life of Mine (2014 - 2027)						
Net Revenue (US\$M)	\$1,925	\$2,167	\$2,426			
Undiscounted Net Cash Flow (US\$M)	\$510	\$666	\$834			
Total Mine 10% NPV (US\$M)	\$243	\$333	\$429			
Expansion 10% NPV (US\$M)*	\$25.8	\$36.1	\$47.6			
IRR	22	%	27	%	32	%
Payback Period (years)	2.5		2.2		2.0	

\* Expansion 10% NPV is calculated based on the differential cash flow from expanding the mine versus status quo operation assuming the same tonnes and grade are mined

The PEA mine plan is based on La Colorado's estimated mineral reserves and resources as of December 31, 2012 adjusted for production information available as of mid-2013. The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the expanded mine plan, capital and operating cost estimates and economic evaluation, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

The updated mineral reserves and mineral resources as of 31 December, 2013 are presented in this report.

The expansion plan contemplates production down to the 740 level in the East side of the Candelaria area, over 200 meters below the current deepest 528 mining level and down to the 610 level of the Amolillo vein, nearly 250 meters

below the current deepest 365 mining level. Currently the deepest positive drill hole in the Candelaria area intercepted ore-grade mineralization down to the 1,010 level, over 270 metres below the deepest level designed in the expanded mine plan and down to the 735 level of the Amolillo structure (125 metres below the deepest level designed in the expanded mine plan).

## 1.2. Property Description and Ownership

Information in this section was excerpted and updated from Sharp, et.al. 2007.

The La Colorada mine is located in Chalchihuites district, Zacatecas State, Mexico, approximately 99 km south of the city of Durango and 156 km northwest of the city of Zacatecas. Figure 1 shows the La Colorada location, general co-ordinates: longitude 23°22'N and latitude 103°45'W. The La Colorada mine-site is accessible by road approximately 2½ hours southeast of the city of Durango. The road consists of 120 km of a paved two-lane highway (Highway 45), and 23 km of public, all weather gravel road. The access from Zacatecas takes approximately the same time on similar types of roads. Durango and Zacatecas are serviced by daily flights from México City, other major centers in México and direct flights from some cities in the United States.

Figure 1: La Colorada Location (La Colorada Geology Department, 2012)

The La Colorada property was acquired by Pan American Silver Corp. ("PAS") in April 1998, through its wholly owned Mexican subsidiary Plata Pan Americana S.A. de C.V. ("Plata"), following the 1997-98 exploration program while the property was under option. The La Colorada property is comprised of 56 claims (7 awaiting title) totalling 8,395 ha. In addition, PAS also has control over approximately 571 ha of surface rights covering the main workings, namely the Candelaria, Campaña, Recompensa and Estrella mines.

### 1.3. Geology and Mineralization

Information in this section was excerpted and updated from Sharp, et.al. 2007.

The La Colorada property is located on the eastern flanks of the Sierra Madre Occidental at the contact between the Lower Volcanic Complex and the Upper Volcanic Complex Supergroups. The La Colorada property lies 16 km southeast of Chalchihuites and 30 km south-southwest of Sombrerete, two mining camps with significant silver and base metal production from veins and associated skarn deposits (San Martin and Sabinas mines).

The oldest rocks exposed in the mine area are Cretaceous carbonates and calcareous clastic rocks of the Cuesta del Cura and Indidura formations. Overlying the calcareous rocks is a conglomerate unit containing clasts derived mostly from the subadjacent sedimentary rocks. In the Chalchihuites district this unit is called the Ahuichila formation and is of early Tertiary age.

Most of the outcrop in the mine area is represented by altered dacite, an intermediate to felsic volcanic rock type of the regional Lower Volcanic Complex. There are several subgroups within this unit, including plagioclase porphyry, crystal to crystal-lapilli tuffs, and volcanic breccias. Generally these sub-units are too small to map.

East to northeast striking faults form the dominant structures in the project area and control mineralization. Most of these faults dip from moderately to steeply to the south and juxtapose younger hangingwall strata against older footwall rocks. Evidence suggests down-dip motion on these faults; however, most of the faults were reactivated at some point so the movement direction during the initial formation is uncertain. Stratigraphic contacts are displaced from ten to over a hundred metres lower on down-dropped blocks.

The mineralized veins at La Colorada contain both oxide and sulphide material. The depth below surface and the permeability of the mineralized zone controls the level of oxidation in the veins. The most common sulphide minerals are galena, sphalerite, tetrahedrite, argentite, and pyrite.

### 1.4. Status of Exploration

The initial exploration program of PAS was completed between September 1997 and March 1998 to evaluate potential while the property was under an option agreement. With the encouraging results of that program, the decision was made to acquire the mine, which was completed in 1998.

A total of 230,218 m of exploration drilling (1,209 drill holes) has been completed by PAS between 1997 and 2013. For 2014 the exploration program is budgeted for 36,300 m of combined surface and underground diamond drilling. This program's objectives are to increase the confidence of the geological and grade continuity by infill drilling on known structures in order to upgrade inferred mineral resources to indicated mineral resources or measured mineral resources, outlining of new inferred mineral resources, and testing the main structures at depth.

### 1.5. Development and Operations

During 2013, the mine produced an average 418 tonnes per day (tpd) of oxide ore and 810 tpd of sulphide ore. Each type of ore is processed through separate circuits which share a single crushing plant. The mining method used is overhand cut and fill. Stopping is undertaken with hand held drills using horizontal drilling for safety reasons in oxides and vertical drilling in the more competent sulphide ore. Back fill comprises either broken waste rock or hydraulic tailings.

Development mining is either by hand held drill or electric hydraulic jumbo drill depending on the size of the excavation required. The mine currently has approximately two years of ore development ahead of stopping. This provides flexibility for planning, and scheduling.

Mine production has increased steadily as a result of increased sulphide ore production. Over the course of the last 5 years the overall production rate has increased from 890 tpd to 1,228 tpd as a result of sulphide ore production being doubled while the oxide ore production has declined slightly (475 tpd to 418 tpd). During this period of mine production growth, the mineral resources and mineral reserves have grown rapidly.

The maximum capacity of the mine in its existing configuration has now been reached and further increases to the mine production rate will require significant upgrades to the mine plant and infrastructure. The La Colorada expansion project plans to increase the overall production rate of the mine to 1,500 tpd starting in 2016 and to 1,800 tpd by the end of 2017.

The current El Aguila shaft hoists ore from both the Candelaria and Estrella mines from the 438 level to surface. This is an old shaft that has been deepened a number of times and was initially developed near surface on vein. Near surface historic (pre PAS ownership) stopping operations mined up to the shaft and although it is maintained on a regular basis, PAS took the decision to prohibit personnel transport in the shaft a number of years ago. The El Aguila shaft is currently operating at very close to its maximum capacity and has no capacity for hoisting waste (all development waste is currently used for backfill), or materials.

The existing sulphide and oxide plants share a crushing plant which is currently operating at close to its maximum capacity. The sulphide plant has a conventional flotation flowsheet comprised of crushing, grinding and selective lead and zinc froth flotation circuits to recover precious and base metals into separate lead and zinc concentrates. When PAS acquired the La Colorada property in 1998 the sulphide plant was rated at 120 tpd and produced a lead concentrate only. Since then the flowsheet has been modified to include the production of a zinc concentrate and the

capacity expanded to the current 810 tpd.

#### 1.6. Mineral Resources

Mineral resources at the La Colorada mine at December 31<sup>st</sup>, 2013 were estimated to be as shown in Table 3. This mineral resource estimate was prepared using metal prices of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc, and \$1,950 per tonne of lead and was prepared under the supervision of and reviewed by Michael Steinmann, P.Geo., EVP Corporate Development & Geology for PAS, who is a Qualified Person (“QP”) as that term is defined in National Instrument 43-101 – *Standards of Disclosure for Mineral Projects* (“NI 43-101”).



**Table 3: La Colorada Mineral Resources as of December 31, 2013****Measured and Indicated Resources**

Category	Tonnes (Mt)	Ag (ppm)	Ag Cont. (Moz)	Au (ppm)	Pb %	Zn %
Oxide Measured	0.2	168	0.8	0.17	N/A	N/A
Sulphide Measured	0.3	161	1.3	0.14	0.64	1.05
Measured Resources	0.4	164	2.2	0.15	0.40	0.65
Oxide Indicated	0.8	232	6.2	0.19	N/A	N/A
Sulphide Indicated	0.8	278	7.6	0.39	1.02	1.64
Indicated Resource	1.7	255	13.8	0.29	0.51	0.83
M&I Oxide	1.0	222	7.0	0.19	N/A	N/A
M&I Sulphide	1.1	251	8.9	0.33	0.93	1.50
Total M&I Resources	2.1	237	16.0	0.26	0.49	0.80

**Inferred Resources**

Category	Tonnes (Mt)	Ag (ppm)	Ag Cont. (Moz)	Au (ppm)	Pb %	Zn %
Oxide Inferred	0.7	153	3.2	0.17	N/A	N/A
Sulphide Inferred	2.2	298	21.3	0.49	1.74	2.81
Total Inferred Resources	2.9	265	24.5	0.42	1.34	2.17

**Notes:**

1. CIM definitions were followed for mineral resources
2. Grades are shown as contained metal before mill recoveries are applied.
3. PAS reports mineral resources and mineral reserves separately. Reported mineral resources do not include amounts identified as mineral reserves.
4. Mineral resources were diluted including minimum vein width of 2.18 m, planned mining dilution, and floor dilution for stope ore.  
Mineral resources have been estimated using a mining recovery of 85 to 95% (pillars are left in some thicker zones leading to lower mining recovery). Mineral resources were estimated based on the use of cut and fill mining methods.
6. Mineral resources were estimated using the polygonal method on longitudinal sections.
7. Mineral resources were estimated using a price of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc and \$1,950 per tonne of lead.
8. There are no known metallurgical, environmental, permitting, legal, title, taxation, socio economic, political, marketing or other issues expected to materially affect the estimate of mineral resources.
9. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

**1.7. Mineral Reserves**

Mineral reserves at the La Colorada mine at December 31<sup>st</sup>, 2013 were estimated to be as shown in Table 4.

This mineral reserve estimate was prepared using a price of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc, and \$1,950 per tonne of lead and was prepared under the supervision of and reviewed by Martin Wafforn, P.Eng., Vice President of Technical Services for PAS who is a QP as that term is defined in NI 43-101.

**Table 4: La Colorada Mineral Reserves as of December 31, 2013**

## Proven and Probable Reserves

Category	Tonnes (Mt)	Ag (ppm)	Ag Cont. (Moz)	Au (ppm)	Pb %	Zn %
Oxide Proven	0.7	350	7.8	0.32	N/A	N/A
Sulphide Proven	1.7	429	23.5	0.30	1.90	3.48
Proven Reserves	2.4	406	31.2	0.31	1.35	2.47
Sulphide Probable	1.3	378	16.2	0.29	N/A	N/A
Oxide Probable	2.8	377	34.0	0.44	1.92	3.47
Probable Reserves	4.1	378	50.2	0.39	1.30	2.35
Oxide Reserves	2.0	369	23.9	0.30	N/A	N/A
Sulphide Reserves	4.5	397	57.5	0.38	1.91	3.47
Total Reserves	6.5	388	81.4	0.36	1.32	2.40

**Notes:**

1. CIM definitions were followed for mineral reserves.
2. Grades are shown as contained metal before mill recoveries are applied.
3. PAS reports mineral resources and mineral reserves separately. Reported mineral resources do not include amounts identified as mineral reserves.  
La Colorada mineral reserves have been estimated at a cut off value per tonne of \$116.10 and \$126.10 below 600 level for Candelaria oxides, \$101.17 and \$111.17 below 600 level for Candelaria sulphides, \$100.79 for Estrella oxides, \$85.82 for Estrella sulphides and \$73.84 per tonne in the Recompensa mine (sulphide ore).
4. Mineral resources were diluted including minimum vein width of 2.18 m, planned mining dilution, and floor dilution for stope ore.
5. Mineral reserves were estimated using a mining recovery of 85 to 95% (pillars are left in some thicker zones leading to lower mining recovery). Mineral reserves were estimated based on the use of cut and fill mining methods.
6. Mineral reserves were estimated using the polygonal method on longitudinal sections.
7. Mineral reserves were estimated using a price of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc and \$1,950 per tonne of lead.
8. There are no known metallurgical, environmental, permitting, legal, title, taxation, socio economic, political, marketing or other issues expected to materially affect the estimate of mineral reserves.
- 9.

**1.8. Qualified Person's Conclusions and Recommendations**

Based on the site visits and reviews the qualified persons draw the following conclusions:

Sampling methods and protocols are consistent with industry standards.

The assaying is done using industry standard methods for the ore types and grades of the deposit.

The geology department has a QA/QC program for assay results, independent from the laboratory.

The geology database is in industry standard software using secure protocols.

There is good understanding of the geology, mineralogy and the deposit model.

Mineral resources are estimated utilizing an acceptable estimation methodology.

The parameters for the conversion of mineral resources to mineral reserves is based on observations at the operating mine and adjusted periodically based on reconciliation results.

Recoveries and cost estimates are based on actual operating data.

The exploration program has been highly successful increasing the estimated mineral reserves from 19.8 million silver ounces as of December 31<sup>st</sup>, 2005 to 81.4 million as of December 31<sup>st</sup>, 2013, net of production.

The cost estimates, projections of future production and economic analysis for the Preliminary Economic Analysis (PEA) to expand the La Colorada Mine have been conducted appropriately for this level of study.

The conceptual design, construction schedule and cost estimate for the new shaft and borehole hoisting system was conducted by Cementation Canada Inc. (Cementation), a company based in Ontario with expertise in shaft engineering and construction. The design allows for future deepening if economically justifiable.

The conceptual designs, construction schedules and cost estimates for the sulphide plant expansion, surface infrastructure and tailings dams were conducted by Procesos Mineros Metalurgicos S.A. de C.V. (PROMIMET), a company based in Guanajuato, Mexico with expertise in those areas and with a history of working at the La Colorada mine site.

The conceptual designs, construction schedules and cost estimates for the mine dewatering, mine ventilation, mine development and mining equipment required to develop the resources to depth and expand the mine production rate were conducted by the engineering staff at the La Colorada mine with assistance from PAS corporate technical staff.

As part of the overall expansion project PAS technical staff has subsequently increased the capital cost estimates to include owner's costs, project indirects and contingencies based on experience constructing other projects in Mexico and other countries.

There are no material issues with the local community or government.

La Colorada mine is certified clean industry by PROFEPA (Mexican federal environmental protection department).

All permits are current.

Recommendations:

Based on the results of the economic analysis presented in this Technical Report, the authors recommend that PAS proceed with the La Colorada Mine expansion project in the following general manner:

Establish an owner's project team to manage consultants and contractors

Continue to develop the access to the bottom of the planned new shaft location.

Proceed with detailed engineering of the shaft and thereafter the construction. The authors note that the upper part of the existing shaft was developed on vein and that stoping operations were conducted to the shaft. This precludes personnel transport in the existing shaft, precludes further deepening or capacity expansion and increases the risk of extended downtime to the operation. For these reasons the authors recommend that a new shaft be developed regardless of mine expansion.

Proceed with engineering of the sulphide plant and surface infrastructure expansion, finalize the flow sheet and then proceed with basic and detailed engineering, with construction to start in 2015.

Proceed with additional engineering to further define the optimal tailings storage locations and construction designs from an environmental and cost of storage perspective. It is further recommended that an expansion to the sulphide tailings storage facility in 2014 proceed as planned.

That planned expansions to the ventilation circuits are completed in 2014 and that ventilation recommendations are closely followed. It is recommended that further engineering and definition of the dewatering, ventilation, development, and mine equipment requirements are also conducted during 2014. The capital cost of the expansion project over the period 2014 – 2017 is shown in Table 1 and has been estimated to total \$137.0 million.

As the engineering progresses, update the capital cost estimates and check the economic viability prior to the start of the plant and infrastructure expansion in 2015.

The mine should consider the benefit to mine planning and mine geology efficiency of changing the resource estimation methodology to three dimensional modelling utilizing commercially available mining/geology software.

Continue with annual near mine exploration program.

#### 1.9. Cautionary Note Regarding Forward-looking Information and Statements

Certain of the statements and information in this Technical Report constitute “forward-looking statements” within the meaning of the United States Private Securities Litigation Reform Act of 1995 and “forward-looking information” within the meaning of applicable Canadian securities laws. All statements, other than statements of historical fact, are forward-looking statements. When used in this Technical Report, the words “estimates”, “expects”, “projects”, “plans”, “contemplates”, “calculates”, “objective”, “potential”, and other similar words and expressions, identify forward-looking statements or information. These forward-looking statements or information relate to, among other things: the future successful development of the La Colorada Mine; the estimates of expected or anticipated economic returns; future production of minerals and mine-life of the La Colorada Mine; future cash costs per ounce of silver; the price of silver and gold; the sufficiency of PAS’ current working capital, anticipated operating cash flow or its ability to raise necessary funds; the accuracy of mineral resource and mineral reserve estimates; estimated production rates for silver

and other payable metals produced at the La Colorada Mine; the cash and total costs of production; the estimate of metallurgical recoveries for silver and gold; the estimate for mining dilution; the estimated cost of and availability of funding necessary for sustaining capital and closure plans; and ongoing or future development plans and capital replacement, improvement or remediation programmes.



These statements reflect current views with respect to future events and are necessarily based upon a number of assumptions and estimates that, while considered reasonable, are inherently subject to significant business, economic, competitive, political and social uncertainties and contingencies. Many factors, both known and unknown, could cause actual results, performance or achievements to be materially different from the results, performance or achievements that are or may be expressed or implied by such forward-looking statements and information contained in this Technical Report and assumptions and estimates have been made based on or related to many of these factors. Such factors include, without limitation: fluctuations in spot and forward markets for silver, gold, base metals and certain other commodities (such as natural gas, fuel oil and electricity); fluctuations in currency markets (such as the Mexican Peso versus the United States Dollar); changes in national and local government, legislation, taxation, controls or regulations and political or economic developments, particularly in Mexico and in Canada; crime risks and hazards associated with the business of mineral exploration, development and mining (including environmental hazards, industrial accidents, unusual or unexpected geological or structural formations, pressures, cave-ins and flooding); development, mining or production plans are delayed or do not succeed for any reason; employee relations; relationships with and claims by local communities and indigenous populations; availability and increasing costs associated with mining inputs and labour; the speculative nature of mineral exploration and development, including the risks of obtaining necessary licenses and permits and the presence of laws and regulations that may impose restrictions on mining; diminishing quantities of grades of mineral reserves as properties are mined; global financial conditions; challenges to, or difficulty in maintaining, title to properties and continued ownership thereof; the actual results of current exploration activities, conclusions of economic evaluations, and changes in the parameters of the La Colorada Mine to deal with unanticipated economic or other factors; escalation of capital and operating costs; increased competition in the mining industry for properties, equipment, qualified personnel, and their costs; and, with respect to PAS, those factors identified under the caption “Risks related to Pan American’s business” in PAS’ most recent Form 40F and annual information form filed with the United States Securities and Exchange Commission and Canadian provincial securities regulatory authorities. Investors are cautioned against attributing undue certainty or reliance on forward-looking statements and information. Although PAS has attempted to identify important factors that could cause actual results to differ materially, there may be other factors that cause results not to be as anticipated, estimated, described, or intended. The companies do not intend, and do not assume any obligation, to update these forward-looking statements or information to reflect changes in assumptions or changes in circumstances or any other events affecting such statements or information, other than as required by applicable law.

#### 1.10. Cautionary Note Regarding Decision to Proceed with Expansion

PAS’s decision to proceed with expansion of the La Colorado mine as described herein is not based on a feasibility study of mineral reserves demonstrating economic and technical viability and as such may be subject to increased uncertainty and risks. The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the expanded mine plan, capital and operating cost estimates and economic evaluation, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.



## 2.0 INTRODUCTION

### 2.1. Purpose and Background

PAS prepared this technical report in accordance with the disclosure requirements of NI 43-101 to support disclosure of the PEA results which evaluated the potential viability of expanding production at the La Colorada Mine. This disclosure includes information of the mine expansion PEA study including mine plan, required upgrades to the infrastructure, updated mineral reserve and resource estimation and reports prepared by external consultants. The increased reserves due to aggressive drilling programs over the last several years have provided an opportunity to increase production which has been justified by the PEA.

The effective date of this Technical Report is 31 December, 2013. The drilling cut-off date for mineral resource estimation was 31 December, 2013. The geological, mining, and economic analyses to prepare the mineral resources and mineral reserve estimates was completed as of 31 December 2013. No new material information has become available between these dates and the signature date given on the certificate of the qualified persons. PAS is a silver mining and exploration company listed on the Toronto Stock Exchange (TSX:PAA) and the NASDAQ exchange (NASDAQ:PAAS).

The PEA mine plan is based on La Colorado's estimated mineral reserves and resources as of December 31, 2012 adjusted for production information available as of mid-2013. The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the expanded mine plan, capital and operating cost estimates and economic evaluation, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

Unless otherwise stated, all units are metric and currencies are expressed in US dollars (\$). All tonnages stated in this Technical Report are dry metric tonnes ("dmt") unless otherwise specified.

### 2.2. Sources of Information

Data, reports, tables, figures and other information used for the compilation of this Technical Report were obtained from personnel in the PAS offices in Vancouver, British Columbia, the Plata office in Durango, México and from the La Colorada Mine offices in Zacatecas, México unless stated otherwise. This Technical Report is based on work conducted by PAS geologists, engineers and metallurgists, as well as third party consultants retained by PAS.

Specifically, information and data for the mineral resource and mineral reserve estimates were obtained from La Colorada geology department personnel in México and information and data for matters pertaining to metallurgy and processing, cost estimates, environmental and geotechnical investigations, and economic analyses were provided by PAS.

The authors have used the reports and documents listed in section 27 of this Technical Report in the preparation of this Technical Report:

### 2.3. List of Qualified Persons

Table 5 lists the qualified persons and the sections they are responsible for.

**Table 5: List of Qualified Persons**

Qualified Person	Section Responsibility
Michael Steinmann	1-12, 14, 20, 23-28
Martin Wafforn	1-5, 13, 15-22, 25-28

### 2.4. Personal Inspections

Both qualified persons for the preparation of this Technical Report conduct regular site visits to PAS mining operations. Details of the most recent personal inspections are given:

Michael Steinmann last visited the La Colorada mine September 17<sup>th</sup> to 19<sup>th</sup>, 2013 to review and support the mine expansion and PEA work being done. His previous visits were January 22<sup>nd</sup> to the 23<sup>rd</sup>, 2013 to review the 2012 end of year resource estimate and April 28<sup>th</sup> to the 29<sup>th</sup> 2012 to collect information from planning, geology, safety, and plant personnel and to review the exploration programs for 2012.

Martin Wafforn last visited the La Colorada mine on October 25<sup>th</sup>, 2013 to discuss tailings dam and sulphide plant expansion options. This meeting was followed with meetings in Durango the following day to discuss the mine's operating budget for 2014. Prior visits to the mine in 2013 included from January 22<sup>nd</sup> to the 23<sup>rd</sup> to review the 2012 end of year reserve estimate; April 9<sup>th</sup> to 11<sup>th</sup> and from September 17<sup>th</sup> to 19<sup>th</sup> to work with the mine technical staff on developing plans to expand the mine to efficiently extract the new mineral resources being discovered in the Estrella and Candelaria mines. This work focused on expansions to the mine production areas, hoisting capacity via new shaft development, ventilation capacity and circuit expansion to depth, mine dewatering, sulphide plant expansion, tailings capacity and surface infrastructure requirements. In most cases this meant ensuring that mine staff directed engineering consultants to complete the necessary studies as detailed in this Technical Report.

## 3.0 RELIANCE ON OTHER EXPERTS

The authors of this Technical Report have not relied upon other experts.

#### 4.0 PROPERTY DESCRIPTION AND LOCATION

##### 4.1. Property Location

The La Colorada property holdings in the Chalchihuites mining district are located in Zacatecas State, México, approximately 99 km south of the city of Durango and 156 km north-west of the city of Zacatecas. The La Colorada Mine property general coordinates are longitude 23°22'N and latitude 103°45'W. The La Colorada Mine consists of various mine workings, namely the Candelaria, Campaña, Recompensa and Estrella working areas.

#### 4.2. Mineral Tenure

The La Colorada claim holdings in the Chalchihuites mining district are comprised of 56 mining claims (7 awaiting title) totalling 8,395 ha. The extent of the mineral tenure where the mineral reserves and mineral resources are located and where mining takes place is shown in Figure 2. The claims have been surveyed by a licensed surveyor and filed with Direccion General de Minas government department.

Figure 2: La Colorada Mine Concessions (PAS, 2013)

Table 6 gives details of each claim, including the title number, total hectares, the annual maintenance cost, and the expiration date of each claim.

**Table 6: Mining Claims**

Claim Name	Title	Hectares	Pesos per Hectare	Total Pesos	Expiration date
Unif Victoria Eugenia	188078	286	125	35,629	21/11/2040
Victoria Eugenia I	204862	23	125	2,909	12/05/2047
Victoria Eugenia II	211166	49	125	6,112	10/04/2050
Victoria Eugenia III	204756	1	125	140	24/04/2047
Victoria Eugenia IV	217627	37	125	4,607	05/08/2052
Marieta	171833	9	125	1,123	14/06/2033
Cruz del Sur	170155	11	125	1,384	16/03/2032
Unificacion Canoas	211969	19	125	2,308	15/03/2023
San Cristobal	170095	10	125	1,247	15/03/2023
Ampl de San Cristobal	170097	29	125	3,633	15/03/2023
Unif el Conjuero	170592	45	125	5,598	01/06/2023
Tepozan Segundo	163260	14	125	1,689	03/09/2028
Ampl Al tepozan	182730	11	125	1,345	15/08/2038
Victoria 2	217628	17	125	2,087	05/08/2052
Victoria 3 Fracc A	217629	459	125	57,296	05/08/2052
Victoria 3 Fracc B	217630	14	125	1,767	05/08/2052
El Real	214498	20	125	2,495	01/10/2051
Nueva Era	214659	30	125	3,707	25/10/2051
La Reforma	218667	136	125	16,912	02/12/2052
Platosa	216290	41	125	5,119	29/04/2052
San Francisco	221728	8	125	967	29/01/2048
Victoria 5	226310	693	71	49,151	05/12/2055
Victoria Eugenia	211587	36	125	4,501	15/06/2050
San Francisco Fracc 1	223953	166	125	20,650	14/03/2055
San Francisco Fracc 2	223952	3	125	416	14/03/2055
La Cruz	211085	9	125	1,062	30/03/2050
Creston	213594	9	125	1,123	17/05/2051
Escalera Fracc 1	N/T	2	0	0	
Escalera Fracc 2	N/T	3	0	0	
Escalera Fracc 3	N/T	2	0	0	
Escalera Fracc 4	N/T	1	0	0	
Escalera Fracc 5	N/T	7	0	0	
Escalera Fracc 6	N/T	6	0	0	
Escalera Fracc 7	N/T	6	0	0	
El Real 2	228945	561	35	19,897	20/02/2057
Melisa	217670	70	125	8,678	05/08/2052
Lizette	221172	23	125	2,917	02/12/2053



Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Tres Flores	229893	14	35	484	25/06/2057
Fatima 1	233147	241	35	8,551	11/12/2058
Fatima	233977	288	18	5,082	12/05/2059
Fatima Fraccion	234041	0	18	2	21/05/2059
Fatima Fraccion 1	234042	3	18	61	21/05/2059
Fatima Fraccion 2	234043	1	18	14	21/05/2059
Fatima Fraccion 4	234044	1	18	16	21/05/2059
Fatima Fraccion 5	234045	7	18	125	21/05/2059
Fatima Fraccion 6	234046	3	18	49	21/05/2059
Fatima Fraccion 7	234047	0	18	5	21/05/2059
Fatima Fraccion 8	234048	4	18	70	21/05/2059
Jul	232538	25	35	876	25/08/2058
Manto 1	238175	19	9	166	08/08/2061
Manto 2	238757	1	9	7	24/10/2061
Pan Am	233733	4333	18	76,340	24/10/2061
El Cristo	228944	120	35	4,242	20/02/2057
Mississippi	195070	432	125	53,904	24/08/2042
Feryter	192967	38	125	4,780	18/12/2041
Eureka	N/T	1	0	0	
<b>TOTAL</b>		<b>8,395</b>		<b>421,241</b>	

Note:

<sup>1</sup> The Escalera Fracc 1, Escalera Fracc 2, Escalera Fracc 3, Escalera Fracc 4, Escalera Fracc 5, Escalera Fracc 6 and Escalera Fracc 7 claims are awaiting grant of legal title.

#### **4.3. Nature and Extent of Title**

The above listed claims, with the exceptions of the Escalera Fracc group of claims, are wholly owned by PAS through its wholly owned Mexican subsidiary, Plata. Concessions Escalera Fracc 1, 2, 3, 4, 5, 6 and 7 were staked, however, the Direccion General de Minas (DGM), the department of the Mexican Government which issues concessions, has registered these claims under two different names, as listed above and also as Laurita. The DGM will need to decide which of the two valid claims to cancel. These claims are not material to the La Colorada mineral reserves and mineral resources estimate or the mine operation and the decision either way does not affect the mine operation or the current economics of the mine in any way. Eureka is a small claim recently acquired and title number has not yet been assigned.

In addition, Plata also has control over approximately 751 ha of surface rights covering the mine workings, namely the Candelaria, Campaña, Recompensa and Estrella Mines, all of which form part of the La Colorada Mine. The concession Unificada Victoria Eugenia contains all of the mineral resources and mineral reserves, most of the mine workings, part of the mine plant, buildings and offices, the San Fermin Mine portal, the Candelaria Mine portal, the Recompensa Mine portal, the Estrella Mine workings, and the El Aguila shaft.

The Veta Dos portal, and some of the mine workings are located on Victoria 2. Victoria 3 Fraccion B also contains some mine workings. The tailings dam and storage area are located on Victoria 5 and Victoria 3 Fraccion A. The remainder of the mine plant, buildings and offices are located on Victoria 3 Fraccion A.

#### **4.4. Royalties**

The Mexican Federal Government has implemented a precious metal royalty beginning in January 2014. The rate is 0.5% on gold and silver revenues. The La Colorada mine is not subject to any other royalties, back-in rights, payments or other agreements and encumbrances known to PAS.

#### **4.5. Environmental Liabilities**

An Environmental Impact Statement and risk assessment was authorized by the Mexican federal environmental authority in November of 1999. On November 8, 2010 the authorization was renewed for an additional 5 years effective October 22, 2010. To the best of the authors' knowledge, Plata is currently in compliance with all applicable environmental laws. Known environmental liabilities are associated with mining disturbances. The cost of closure of

the La Colorada Mine is discussed in section 20.4.

**4.6.**

**Permits and Agreements**

**Foreign Trade Services Department**

On September 19, 2005, Plata was designated by the Mexican Ministry of Economy as an “ALTEX”, or high level exporting company, and was registered as such with the Mexican Ministry of Economy under Certificate No. 2005/5838. That certificate was last reissued on May 25th, 2012. As an ALTEX, Plata is entitled to carry out importing and exporting activities in relation to its operations and to obtain fiscal benefits and refunds related to such activities.

### **National Registry of Foreign Investment**

To the best of the authors' knowledge, Plata is in compliance with the quarterly and annual filing requirements of this registry.

### **Federal Labour Delegation**

To the best of the authors' knowledge, Plata is in compliance with the requirements of the applicable labour laws of Mexico, and all registrations, as required, for the Federal Labour Delegation, in the State of Zacatecas, have been filed.

### **Federal Board of Conciliation and Labour Arbitration**

To the best of the authors' knowledge, there are no labour lawsuits against Plata.

### **Real Estate**

To the best of the authors' knowledge, title to the concessions held by Plata associated with La Colorada have been registered in the Public Registry of Property of Sombrerete, Zacatecas and are free of any liens or encumbrances.

### **Ministry of Finance**

To the best of the authors' knowledge, all filings with the Mexican Ministry of Finance in respect of income and sales taxes have been made on time and as prescribed.

**Mexican Social Security Institute (“IMSS”)**

To the best of the authors’ knowledge, Plata is in compliance with the payment of dues to IMSS in respect of both employer and employee withholdings.

**General Management of the Federal Registry of Firearms and Explosives (Secretaria de la Defensa Nacional (“SEDENA”))**

Plata was granted General Permit (2917-Zacatecas) in 2000 authorizing the purchase, storage and use of explosives subject to Plata continuing to meet permit requirements. This is revalidated on an annual basis; the last permit is effective as of January 1<sup>st</sup>, 2014. To the best of the authors’ knowledge, Plata is in compliance with the monthly reporting requirements of this permit.

**Federal Bureau of Environmental Protection (Secretaria de Medio Ambiente y Recursos Naturales: SEMARNAT) and National Ecology Institute (Instituto Nacional de Ecología: Dirección General de Ordenamiento Ecológico e Impacto Ambiental)**

Following submission of an environmental impact statement, named the Manifestación de Impacto Ambiental-Modalidad General (“EIS”) and environmental risk assessment study, named the Estudio de Riesgo Ambiental Modalidad Análisis de Riesgo, the federal environmental authority granted approval (“the Dictamen”) for new project construction under D.O.O.DGOEIA.- 007244 on November 11, 1999. Plata received a second continuation of this permit for a period of 5 year, effective from October 22, 2010.

**National Water Commission (Comisión Nacional del Agua: Conagua)**

Mining generates tailings, which are materials considered to be potentially hazardous wastes. Plata filed an application to become a hazardous waste generator in January 1999 and the required permit was received March 26, 2001. This permit does not have an expiry but requires regular reporting which is in good standing.

Plata holds a permit (Concesión 03ZAC103761/11EQGE02) dated September 19, 2002, which permits the discharge of waters into the subsurface of the La Colorada property. Pursuant to a new National Waters Law (Ley de Aguas Nacionales), Plata is permitted to make use of waters obtained from the exploitation of a mine without having to apply to the National Water Commission for a permit or authorization.

#### **4.7. Significant Factors or Risks**

No significant factors or risks which could affect access, title, or the right or ability to perform work on the property are known to PAS.

### **5.0 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE AND PHYSIOGRAPHY**

Information in this section was excerpted and updated from Sharp, et.al. 2007.

#### **5.1. Physiography**

The physiography of the region is characterized by wide flat valleys and narrow, relatively low mountains ranges and hills. Elevations near the Candelaria, Recompensa and Campaña Mine sites are between 2,100 m and 2,550 m above sea level.

#### **5.2. Access**

The La Colorada mine is accessed primarily from Durango by a continuously maintained 120 kilometre all-weather, paved, two lane highway (Highway 45) and a 23 kilometre public, all-weather, gravel road. The mine is also accessible from the city of Zacatecas by similar types of roads.

#### **5.3. Location and Transport**

La Colorada is located in a major silver mining region of Mexico. The cities of Durango and Zacatecas are the major industrial and supply centers for the region. Flights to both cities are scheduled daily from México City and other major commercial and industrial centers in México.

The closest municipality to the La Colorada property is the city of Chalchihuites, which is 16 km northwest of La Colorada Mine, with a population of approximately 1,000.

#### **5.4.**

#### **Climate**

The climate is arid to semi-arid and vegetation typically includes mesquite and cactus. The rainy season is from July to September.

Table 7 gives the precipitation statistics measured at the local government weather station. Winter temperatures are around freezing at night. The mine operates throughout the entire year.

**Table 7: Chalchihuites Rain and Evaporation (La Colorada Environmental Dept. 2013)**

Averages from 1966 to 2011 in millimetres

Month	Max rain in 24 hours	Max rain per month	Evaporation
January	14	34	135
February	8	33	144
March	3	44	198
April	2	15	214
May	14	30	231
June	71	74	173
July	133	105	129
August	141	56	140
September	98	74	107
October	31	44	135
November	12	33	114
December	14	25	133

**5.5.****Local Resources and Infrastructure**

The La Colorada mine surface infrastructure is located on PAS owned land. No additional surface rights are anticipated being required over the life of the mine.

La Colorada has agreements in place with the national power utility, Comisión Federal de Electricidad (CFE), for the supply of 12.5 megawatts (MW) of power, an amount sufficient for the current operating plans. Electrical power is brought to the mine substation from the national power grid at 34.5 kilovolts (kV). A second, independent 34.5 kV transmission line was constructed to the mine in 2007 to meet increasing ventilation and dewatering demands and address power outages that resulted in part due to reliance on a single transmission line. Power is stepped down to 13.2 kV at the mine for distribution.

The mine also maintains three 1.2 MW diesel generators onsite to provide backup power for mine dewatering pumps during power outages. The reliability of power supplied by the national grid improved significantly with the second 34.5 kV line however, the diesel generators are still required from time to time, particularly in the rainy season.



The expansion project contemplates the construction of a new 42 kilometer long 115 KV power line along the existing power line right of way to the mine from Somberete at an estimated cost of \$6.8 million. There is another 115 KV line under construction in the region and there is a possibility of a shorter 17 kilometer route to connect with this line. However, for the purpose of this PEA, the longer route to Somberete was selected.

La Colorada operates two separate tailings storage facilities (TSF). Both are permitted for oxide and sulphide ores however at present, oxide ore is stored in dam 6 and sulphide ore is stored in dam 7.

Initial construction of dam 6 was completed in June, 2003 and it has been raised several times since then. This dam is fully lined to reduce the risk of leakage as sodium cyanide is used in the treatment of the oxide ores. The life of mine plan presented in this PEA estimates that storage capacity will be required for a further 2.0 million tonnes of oxide tailings. The economic analysis for this PEA estimates a cost of \$4 per tonne for storage of oxide tailings which is sufficient for the required expansion of dam 6.

Construction of the initial phase of dam 7 was completed in 2011. The second lift was completed in 2013 and the third lift is planned for 2014. The life of mine plan presented in this PEA estimates that storage capacity will be required for a further 6.6 million tonnes of sulphide tailings. The economic analysis for this PEA estimates a cost of \$3 per tonne for the storage of sulphide tailings in dam 7.

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

The authors have recommended that additional engineering studies are undertaken in 2014 to determine if other options such as dry stacking of oxide tailings in dam 6, discontinuation of the liner in dam 7 and center line or upstream construction methods for dam 7 may prove to be environmentally and economically more efficient for tailings storage.

Waste disposal is currently not necessary as 100% of waste rock is used as backfill material for the cut and fill stope mining. The scoping study for the new shaft provided additional hoisting capacity for waste should the mining method change in the future or if it becomes economically attractive to use more sulphide tailings as backfill underground.

Water for the mining operation is supplied from the underground mine dewatering. As permitted by Mexican law, underground water is pumped to the surface and stored in head tanks for use in the milling process and for domestic services. Underground water is also pumped to a water treatment plant, which was constructed in 2002 and upgraded in 2008, to provide potable water. The current water supply is adequate for existing and planned future requirements of the mine.

A long history of silver mining in Zacatecas State has resulted in an experienced workforce in the region. La Colorada also has a camp on site to house 302 workers and provides daily transport locally for employees. The surface infrastructure portion of the expansion project includes capital cost estimates to provide additional camp accommodation and transportation for the estimated additional 138 employees that will be required.

## **6.0 HISTORY**

The production history of the Chalchihuites district began during pre-colonial times when indigenous people produced silver and malachite. The village of Chalchihuites was founded during the 16th century Spanish colonization, and intermittent exploitation of the mineral deposits in the area commenced. By the 19th century, the Spanish mines were operating continuously and important silver production was recorded. The Mexican War of Independence curtailed production from this and many other silver producing areas between 1910 and 1920.

**6.1.**

**Prior Ownership**

The La Colorada claims have changed hands several times, often with several companies owning different claims that now form the La Colorada mine:

1925 Dorado Family

1929 Candelaria y Canoas S.A. (“Candelaria Co.”), a subsidiary of Fresnillo S.A.,

1935 La Campaña de Industrias Peñoles

1949 Compañía Minas Victoria Eugenia S.A. de C.V. (“Eugenia”)

1994 Minas La Colorada S.A. de C.V. (“Minas”)

1997 Under option to Plata, the wholly owned subsidiary of PAS

1998 Plata, the wholly owned subsidiary of PAS

**6.2.**

**Historic Exploration**

Exploration prior to PAS’ ownership consisted of 131 diamond drill holes for a total of 8,665 m completed by Minas. Historical exploration was in the form of development drifting on vein followed by exploitation. This work was successful to identify the structures but was limiting in estimating mineral reserves and mineral resources. The lack of information ahead of mining made mine planning risky.

Only four historic holes, for which PAS had core available for reassay, were used in Mineral Resource and Mineral Reserve estimation.

### 6.3.

### Historic Production

Historic production of the Chalchihuites district is believed to be on the order of 30 million ounces of silver and 39,000 ounces of gold. The relative distribution of metal by ore type is given in Table 8.

**Table 8: Chalchihuites Historic Production**

Ore type	Mt	Au (ppm)	Ag (ppm)	Pb (%)	Zn (%)
Veins	1.0	0.6	600	1.5	1.5
Breccia	2.0	0.3	150	3.0	3.0

**note:**

see Table 27 for La Colorada historic production from 2005 – 2013

## 7.0 GEOLOGICAL SETTING AND MINERALIZATION

Information in this section was excerpted and updated from Sharp, et.al. 2007.

### 7.1.

### Regional and Local Geology

The La Colorada property is located on the eastern flanks of the Sierra Madre Occidental at the contact between the Lower Volcanic Complex and the Upper Volcanic Supergroup. The La Colorada property lies 16 km southeast of Chalchihuites and 30 km south-southwest of Sombrerete, two mining camps with significant silver and base metal production from veins and associated skarn deposits.

The oldest rocks exposed in the mine area are Cretaceous carbonates and calcareous clastic rocks of the Cuesta del Cura and Indidura formations. Overlying the calcareous rocks is a conglomerate unit containing clasts derived mostly from the subadjacent sedimentary rocks. In the Chalchihuites district this unit is called the Ahuichila Formation and is of Early Tertiary age. Figure 3 is the chronological order of geological events at La Colorada Mine.



Most of the outcrop in the mine area is represented by intermediate to felsic volcanic rocks (dacites) of the regional Lower Volcanic Complex. There are several subgroups within this unit, including plagioclase porphyry, crystal to crystal-lapilli tuffs, and volcanic breccias. Generally these sub-units are too small or inconsistent to be mapped.

The stratigraphically highest rock unit in the mine area are felsic tuffs within the Upper Volcanic Sequence. These tuffs unconformably overlie the dacite along the southern property boundary and are distinctly maroon coloured and show varying degrees of welding.

Thirteen breccia pipes have been mapped at surface or in underground workings. All of the pipes are located along or to the south of the HW and NC2 vein complexes. The pipes are round to ovoid in shape, up to 100 m in diameter, and can extend vertically more than 400 m below the surface. The breccias contain clasts of limestone and dacite (often mineralized) in an altered dacite matrix. Clasts of vein material have been found in the breccias suggesting that they postdate the vein emplacement.

The structures present at La Colorada represent a deformational sequence comprising at least three significant events, including Laramide folding and faulting, post-Laramide east to northeast trending faulting, and regional tilting events.

**Figure 3: Chronology of Geological Events at La Colorada (Sharp, 2007)**

Regional deformation during the Laramide Orogeny, which occurred between 80 and 35 million years ago, is expressed by the widespread development of folds and contractional faults within the Cretaceous-aged stratified sequence. These units show an abundance of folds and faults cutting shallowly to steeply across bedding where the rock units are exposed in the western portion of the La Colorada property and in the underground workings.

East to northeast striking faults form the dominant structures in the project area and play a strong role in local mineralization. Most of these faults dip moderately to steeply to the south and juxtapose younger hangingwall strata against older footwall rocks. Evidence suggests down-dip motion on these faults; however, most of the faults have been reactivated at some point, making the movement direction during the initial formation uncertain. Stratigraphic contacts are displaced from ten to over a hundred metres lower on down dropped blocks.

The dacite unit displays an eastward tilting that may reflect displacements on regional, orogen-parallel structures outside of the project area. This tilting probably reflects the final episode of deformation. The structural model for La Colorada, in which the mineralization and alteration occurred, is a low horizontal stress tectonic setting. In this regime, the four pre-existing steeply dipping structures were favourably orientated for re-activation and subsequent emplacement of mineralizing hydrothermal fluids. The dominantly eastern strike of the veins indicates slightly greater extension in a northerly direction. The north and north-easterly dipping faults accommodated mostly transverse movement associated with the dilation of the steeply dipping, easterly striking structures.



## **7.2.**

## **Mineralized Zones**

There are four dominant styles of mineralization at La Colorada, including breccia pipes, vein-hosted mineralization, replacement mantos within limestone, and deeper seated transitional mineralization.

Mineralization in the breccia pipes generally has lower silver values and elevated base metal values. The majority of the Campaña Breccia was historically bulk mined with reported grades of 80 ppm Ag and 5% combined Pb and Zn. Mineralization is associated with intense silicification and occurs as disseminated galena and sphalerite with minor chalcopyrite and bornite. Sulphides are found in both the clasts and the matrix. These breccia pipes do not form part of the estimated mineral reserves or mineral resources.

Most mineralized veins on the property strike east to northeast and dip moderately to steeply to the south. Veins occur in the dacite and limestone units and cut across the bedding and contacts with little change in the width or grades of the vein. Mineralized widths in the veins are generally less than 2 m, but may be significantly wider. The HW corridor strikes east-west, dips moderately to the south, with average widths up to 15 m, but most of the mineralization of economic significance is located in quartz veins which are on average 1 to 2 m wide. In some cases the vein fillings consist of quartz, calcite, and locally barite and rhodochrosite. Where the veins are unoxidized, galena, sphalerite, pyrite, native silver and silver sulfosalts are present. The major mineralized veins are strongly brecciated and locally oxidized, obscuring original textural features. Less deformed veins show mineralogical layering, crystal-lined open vugs, and hydrofracture vein breccias, indicating typical multi-stage growth.

The depth to the surface and the permeability of the mineralized zone control the level of oxidation in the veins. These factors result in an uneven, but generally well-defined reduction oxidation (redox) boundary.

Manto style mineralization is found near vein contacts where the primary host rock is limestone. This style of mineralization was mined at Recompensa and can also be seen in areas of the Candelaria Mine.

The deep seated transition mineralization, also known as NC2 Deep, consists of both vein type mineralization and more diffuse stockwork and breccia zones. Lewis ( 1998) theorized that there are seven distinct zones within the transitional zone, and these can be sub-grouped into three main categories:

vein mineralization, including the down dip extension of HW and NC2 and veins in the hangingwall and footwall of both;

- a peripheral stockwork vein zone that envelopes the NC2 structure; and
- sub-horizontal mantos-like stockwork zones in the NC2 hangingwall.

Deep drilling in 2009 and 2012 has defined a restricted manto replacement body at the 1000 m level and remains open to depth. This new body has low precious metal (Ag-Au grades) and higher base metal (Pb-Zn grades). It is adjacent to the known vein system which continues at that depth.

Figure 4 is a geological map showing the main mineralized structures.

**Figure 4: Site Geology with Main Mineralized Structures (PAS, 2013)**

## Candelaria System

**HW vein and HW corridor** – The average orientation is 60°/075° (dip/dip direction). The HW vein is a one to two metre thick vein which transitions from oxide ore to sulphide ore at various depths along strike. This structure is cut by the Candelaria breccia at the east, but does continue on the other side. The strike length is over 1.1 km where it exits the La Colorada claims package. Mineral reserves are estimated down to the 700 level. Mineral resources are estimated to the west and inferred material below the 700 level.

The HW corridor consists of four additional structures. Two structures are brecciated-altered zones in the hangingwall of the HW vein, named the HW-footwall and HW-hangingwall. The other two structures of the footwall side are named FW and Intermedia 3, which are controlled by a broad mineralized shear in limestone containing one or more quartz veins parallel to the orientation of the shear. The majority of the silver mineralization in these structures is found in the quartz veins which average 2 m width at medium grades and widen up to 7 m at the intersections with the HW vein.

**NC2 and splits** – Average orientation 60°/135°. NC2 is a 1 to 7 m wide sulphide vein that contains a large part of the current sulphide resources. It has a strike length of over 900 m where it is cut by a trachyte dyke. 2012 drilling and drifting have confirmed its continuation in both width and grade on the other side of the dyke where it remains open to the east. NC2 is developed down to the 468 level and has been drilled to below the 600 level where inferred mineral resources have been estimated.

NC1, NC4, NC5, NC6, Intermedia 1 and Intermedia 2 are narrow (1.0 to 1.50 m) splits from vein NC2. They are formed due to extensional fracturing on the east side of the mine. They average in strike length between 50 to 140 m. Estimated mineral reserves are located between the 405 and 528 level.

**NC3** – Average orientation 80°/175°. NC3 is a narrow (0.80 to 1.0 m average width), high grade split from NC2 vein to the southwest with a strike length of 200 m. It is currently developed below the 468 level. Estimated mineral reserves are located between the 320 and 528 levels with inferred mineral resources below the 528 level.

**4235** – Average orientation 65°/165°. 4235 is approximately 1 m wide split of the NC3 vein with 140 m of strike length which dips in the opposite direction to the major veins. It has been exposed by development on the 295 level, recently developed on the 408 level and contains a small amount of mineral reserves.

**Santa Juana** – Average orientation 60°/145°. Part of the extensional fractures system between HW-NC2 and Amolillo vein, this vein has an average of 1 m width with a strike length from 200 m. This structure contains a small quantity of oxide mineral resources.

**Veta 2** – Average orientation 60°/132°. A split on the south side of NC2, it has an average width of 1 m and a strike length from 300 m. This structure contains estimated oxide and sulphide mineral reserves between the 200 and 240 levels and mineral resources below the 240 level.

**La Libertad** – Average orientation 60°/160°. A parallels structure to the HW vein located 500 m to the south with an average width of 1.0 to 1.5 m and strike length of 400 m. This vein has small old mine workings near surface. It contains estimated inferred mineral resources.

**San Fermin** – Average orientation 65°/160°. San Fermin is a breccia at the junction of Santa Juana, San Juan and HW structures. It is sub-parallel to the HW vein, with an average width of 11 m and a strike length from 130 m.

#### Amolillo System

**Amolillo** – Average orientation 59°/150°. Amolillo is an oxide vein transitioning to sulfide ore at depth. It is located 500 m north of the NC2 and HW vein complex and to the east (approximately along strike) of the Recompensa vein with an average width of 1.5 m with a known strike of 1350 m and remains open on three sides. The vein lies mostly within dacite host rock transitioning into limestone hosted at depth. Significant drilling was completed during both 2012 and 2013 that resulted in a significant increase to the estimated mineral resource and mineral reserves.

#### Recompensa System

**Recompensa** – Average orientation 75°/355°. Recompensa is a combination of vein and manto mineralization located more than 1 km northwest of the NC2 and HW vein complex. The vein mineralization is narrow (less than 1 m and averages 1.8 m for the economic zone). Recompensa contains mostly sulphide material.

**Erika Vein** – Average orientation 85°/350°. Erika is a hangingwall split from the Recompensa vein and narrow (less than 1 m and averages 1.0 m for the economic zone). It contains only sulphide material.

### 8.0 DEPOSIT TYPES

La Colorada represents a typical epithermal silver/gold deposit, with a transition in the lower reaches of the deposit to a more base metal predominant system. The geological model used for exploration as well as the mineral resource estimation is that of an epithermal vein deposit. A local analogy of this type of deposit is the San Martin Mine, where

earlier in the mine life epithermal veins were mined and now the mine production comes from skarn mineralization hosted by the same limestone unit found in La Colorada Mine.

Deep drilling completed in 2012 confirmed the current vein structures containing similar grades down to 1500 m elevation (above sea), approximately 1,000m below surface. Skarn mineralization or indications of skarn mineralization have not yet been encountered. Further study is required to confirm the possibility of skarn mineralization or alteration at depth.

## **9.0EXPLORATION**

The La Colorada mine had been mined for several decades prior to any specific exploration work. During that time most major structures became known through mine development. The production mapping and sampling data were used by mine geologist to design the diamond drilling programs which comprises the bulk of the Plata exploration programs since 1997. For those reasons, there have been little surface sampling or geophysics and other surveys.

## 9.1.

## Surveys

During the September 1997 to March 1998 exploration program a geophysical survey was conducted by Plata as part of the project evaluation. The survey comprised orientation surveys using in-house very low frequency (VLF) capacity and induced polarization (IP) techniques. The results of both techniques were believed to be successful and included in the interpretation of mineralized structures.

## 9.2.

## Channel Sampling

Channel sampling is performed in all ore development workings and stopes. That information is used for ore control purposes and to collect close spaced data for mineral resource estimation. Channel sampling is performed every 3 m in development headings and every 5 m in stopes by sampling crews under the supervision of the section mine geologist.

The procedure is to measure the distance from a survey station where the samples are to be taken. Two parallel lines perpendicular to the structure are marked across the back or roof. Those lines are separated into individual sample width, usually at the lithological contacts, and marked with short paint lines. Vein and wall rock are sampled separately. The sampler uses a hammer and chisel to take a representative, approximately 2 kg sample, across the marked location. Samples are taken regardless of expected grade. A sample tag is inserted into the sample bag and the bag is closed to prevent contamination.

## 9.3.

## Sampling Results

The channel sample data is used to reconcile the mineral reserve to mined ore on a monthly basis. The results of these reconciliations are usually within  $\pm 5\%$ . The channel sample results are also used to predict mill feed grade, reconciled to the plant head grade monthly, which are usually in the  $\pm 2\%$  range. Reconciliation results since 2010 are listed in Table 9. Channel sample results are used, either on their own or in conjunction with diamond drill results for estimation of proven and probable mineral reserves or measured and indicated mineral resources.

**Table 9: Reconciliation by Year**

Reserve

Mined

Plant



Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Year	tonnes	Ag (ppm)	tonnes	Ag (ppm)	tonnes	Ag (ppm)
2010	346,898	395	346,898	406	345,697	379
2011	382,046	368	402,745	385	404,533	369
2012	396,542	356	420,163	376	417,957	370
2013	434,603	388	448,075	381	448,659	361

## **10.0 DRILLING**

### **10.1.**

#### **Diamond Drilling**

All drilling at La Colorada is diamond core drilling. Drilling is performed using the industry standard wire line method from both surface and underground. The work is performed by either company employees with a company owned drill or by specialized drilling contractors. All diamond drilling is performed under the supervision of the La Colorada mine geology department.

The only drilling done prior to PAS were 131 holes completed by Minas in 1997. Of those only four holes, which were re-assayed by PAS, were used in the mineral resource and mineral reserve estimate.

PAS' initial program was from September 1997 to March 1998 while the property was under option from Minas. Drilling completed during that program included 2,039 m of underground core drilling, and 3,953 m of surface core drilling. Based on the results of this program the decision to acquire the property was made.

Since that first program PAS has used diamond drilling for exploration purposes. From 2007 to present, the objectives of the annual drilling programs are: to test potential at wide spacing and estimate inferred mineral resources, followed by infilling at tighter spacing to increase confidence allowing an upgrade to indicated and measured mineral resources. The measured and indicated mineral resources could then be converted to mineral reserves should they be economically minable.

Under PAS' management, as of 31 December, 2013, over 230 km length of core drilling has been completed. Between 1997 and September 2007, PAS drilled 154, NQ sized holes from surface and 225 holes from underground. Underground holes were drilled BQ size until 2000 when drilling in the HW corridor was changed to HQ size to improve core recovery. From 2008 to present the surface hole size has been increased to HQ and underground to HQ, NQ and BQ sizes depending on location and/or depth of the holes.

Table 10 lists the drill campaigns by year as surface drilling, underground drilling and total in both hole count and metres.



**Table 10: List of Drilling Campaigns by Year**

Year	Surface Drilling		Underground Drilling		Total Drilling	
	# of Holes	Metres	# of Holes	Metres	# of Holes	Metres
1997 <sup>1</sup>	6	1,026	8	1,477	14	2,503
1998	28	8,026	28	7,853	56	15,879
1999	11	2,650	49	5,104	60	7,754
2000	-	-	42	5,228	42	5,228
2002	4	963	-	-	4	963
2005	17	2,380	-	-	17	2,380
2006	46	7,446	20	1,437	66	8,883
2007	33	4,608	61	5,056	94	9,664
2008	50	4,481	85	11,187	135	15,668
2009	27	4,564	102	13,522	129	18,086
2010	12	5,527	109	17,515	121	23,042
2011	22	8,921	82	13,902	104	22,822
2012	43	20,535	98	19,163	141	39,698
2013	81	31,935	145	25,713	226	57,648
Total	380	103,062	829	127,156	1,209	230,218

Notes: <sup>1</sup> These holes were drilled prior to PAS acquiring ownership of the La Colorada property.

## 10.2.

## Accuracy and Reliability

There were some problems of core recovery for underground drilling in the HW corridor prior to 2000 which was rectified by increasing the drilling core size from BQ to HQ. That change improved both core recovery and core quality. The sample data is considered by the author to be acceptable for mineral resource and mineral reserve estimation purposes. Available core recovery records begin in 2006 and are stated by year in Table 11.

**Table 11: Core Recovery by Year**

Year	Core Recovery
2006	93 %

2007	93	%
2008	90	%
2009	89	%
2010	94	%
2011	93	%
2012	96	%
2013	96	%

### **10.3.**

### **Author's Opinion**

In the opinion of the authors of this Technical Report the samples are of an acceptable quality for mineral resource and mineral reserve estimation. To the best of the authors' knowledge, core recovery issues were rectified and the number and location of the affected holes are not material to the current mineral resource and mineral reserve estimate.

## **11.0 SAMPLE PREPARATION, ANALYSIS AND SECURITY**

Channel samples taken underground and core samples drilled either from underground or surface rigs are both used in mineral resource and mineral reserve estimations. Channel sample from underground are brought directly from one of the portals to the on-site laboratory. Core samples come from the core shack, which is fenced and locked when there are no geology department employees present.

Upon being transferred to the laboratory a work order accompanies the samples. The work order is signed by a geology representative and, upon reception and verification of the samples, signed by the laboratory representative with two copies staying at the laboratory and the original being returned to the geology department.

Results are safeguarded using a secure database for which each user has only the access he or she requires. The geology database is directly linked to the laboratory information management system (LIMS) eliminating the need to manually enter or import the results. The samples are also labeled with bar codes which are read at regular points from reception of the sample through to the final results within the laboratory.

### **11.1.**

#### **Sample Collection**

##### **Drill Core**

The core is brought to the surface core shack and cleaned prior to logging by a geologist using industry standard methods. The geologist marks the beginning and end of the samples to be taken with a china marker. Each core box is photographed with a sign identifying the hole number, box number and the from and to depth of the core within the box. The digital photos are stored on the network drive for future reference.

Trained staff then cut the core of the marked samples in half using a diamond blade equipped saw. One half of the core is placed in a sample bag, and the other half is returned to the core box and stored in the core library. A two piece sample tag with bar code is filled out with information relevant to the sample. One half of the tag is inserted in the sample bag with the half core and the other section is used for scanning into the geology database. The samples are transported to the laboratory at the end of each shift or as needed during the shift. The core shack area is enclosed by a chain link fence and locked when no geology staff are present.

## Channel Samples

The channel location is measured from a survey point. Two parallel lines are painted perpendicular to the structure strike, across the width of the drift or stope. The width from the left wall to the right wall is separated into individual samples based on lithology. One member of the sampling team holds the bag to catch the sample while the other takes the sample with a hammer and chisel. A two part sample tag is filled with relevant information with one half going in the sample bag and the other half brought to the office to be scanned into the geology database. The samples are transported from underground directly to the laboratory.

## **11.2.**

## **Laboratory**

All samples are prepared and analysed at the La Colorada mine laboratory, which is not a certified laboratory. The steps followed at the laboratory for each sample are as follows:

The samples are received at the laboratory with a corresponding work order signed by a geology employee. The work order lists the samples sent and the analysis to be completed. The laboratory representative verifies the delivery for sample condition, corresponding number sequence and quantity. Once satisfied with the delivery he or she signs the work order confirming receipt of the samples. One copy is returned to the geology office and the remaining two copies remain at the laboratory.

The samples are logged into laboratory information management system (LIMS) using a bar code reader.

Each sample bag is emptied into clean drying pan. The pans are placed in sequential order in a drying oven set between 110°C to 120°C. The drying time ranges from 3 to 5 hours depending on the humidity of the sample.

The dried samples are crushed to minus a 1/4 inch using a TM Engineering Terminator jaw crusher followed by a cone crusher. The resulting material size is 70% at minus 10 mesh. The crusher is cleaned with compressed between each samples and silica blank material is passed thru the crusher every 20 samples.

A 300 g portion of the sample is split using a Jones Splitter. A ring pulveriser is then used to reduce the particle size to at least 90% at -140 mesh. The pulverised sample is placed in an envelope which is labelled with a barcode sample sticker.

The samples are transferred to the weighing station where a 10g quantity is separated. The precise weight is automatically entered into LIMS by a direct connection to the scale and barcode reader. The sample rejects and remaining pulp are returned to geology and store for QA/QC checks by both internal and external laboratories.



The samples are analysed for gold and silver by fire assayed with gravity finish and for base metals (Pb, Zn, Cu, Fe, Mn) by acid digestion with atomic absorption finish.

All instruments, including scales and the atomic absorption spectrometer, are linked to LIMS eliminating manual data entry. The LIMS database transfers the results directly to the geology database. These processes eliminate transcription and other data entry related errors. La Colorada mine assay laboratory has an internal QA/QC program that includes the use of certified reference materials and blanks which are inserted into every batch of samples for both the AA and fire assay processes as control samples. Synthetic certified standards are also used to calibrate the AA equipment as per the standard operating procedures of the laboratory.

External laboratories, at this time, are used for check assaying pulps as part of the QA/QC program. In the past the following laboratories were used for analysing exploration samples:

ITS Bondar Clegg, 130 Pemberton Ave., North Vancouver, BC, Canada. This laboratory is registered to ISO 9001: 2000 for the “provision of assay and geochemical analytical services” by QMI Quality Registers. This laboratory has also received ISO 17025 accreditation from the Standards Council of Canada. This laboratory was acquired by ALS Chemex on December 01, 2001.

ALS Chemex, 212 Brooksbank Ave., North Vancouver, BC, Canada. This laboratory is registered to ISO 9001: 2000 for the “provision of assay and geochemical analytical services” by QMI Quality Registers. This laboratory has also received ISO 17025 accreditation from the Standards Council of Canada.

Luismin Laboratories, De Selenio y Aluminio, Cd Industrial Durango, Durango, México. Prior to 2003 Luismin laboratory was certified under ISO 9000. In February, 2006 the laboratory was acquired by SGS SA and operates as SGS de México S.A. de C.V. Laboratorio de Durango. The laboratory is currently in the process of re-certification.

ALS Chemex de México, Ignacio Salazar 688, Hermosillo, Sonora, México. This laboratory is used for sample preparation with prepared samples sent to the ALS Chemex laboratory in North Vancouver, British Columbia, Canada. This laboratory is registered to ISO 9001: 2000 for the “provision of assay and geochemical analytical services”.

ALS Guadalajara, Francisco Silva Romero 1140 San Carlos Guadalajara Jalisco 44460 Mexico. This laboratory is registered to ISO 9001: 2000 for the “provision of assay and geochemical analytical services”.

### **11.3. Quality Assurance / Quality Control (QA/QC)**

The La Colorada mine geology department conducts a QA/QC program that is independent from the laboratory. The program includes insertion of standards and blanks, and pulp checks. The pulp checks are performed both with an external laboratory and by changing the sample numbers and resending them the mine laboratory.

The standard results are reviewed daily by the onsite geologist and presented in graphs showing warning lines at 2 standard deviations and action lines at 3 standard deviations. If a standard returns a result outside the action line, appropriate measures are taken by the laboratory like re-calibration of equipment and re-analyzing of the sample batch affected by the failed standard. The QA/QC results are reviewed monthly by Michael Steinmann P.Geol. The graphs in Figure 5 are the results of the oxide and sulphide standards analysis which demonstrate acceptable accuracy of the mine laboratory for silver analysis. Figure 6 is a graph of the pulp checks with an external laboratory showing acceptable precision for silver analysis.

**Figure 5: QA/QC Standard Results**

40



**Figure 6: La Colorada Laboratory Vs ALS Checks Samples**

**11.4.**

**Author's Opinion**

It is the author's opinion that the sample preparation, analysis, and security are to industry standard. Further the results of the QA/QC program demonstrate that the laboratory repeatability and accuracy is acceptable for mineral resource and mineral reserve estimation. It is the author's opinion that adequate measures are taken if problems are identified by the QA/QC program.

## 12.0

## DATA VERIFICATION

The La Colorada geology database was audited by an external independent consultant, over several site visits, who was contracted by the author of this technical report. Only minor transcription errors were found. Any discrepancies in the data were verified with the original core logs or channel sample records and corrected.

The database software has built in validation tools that are used regularly along with visual verifications on plans and sections. Assay data is transferred directly from LIMS to the geology database eliminating possible errors from manual data entry.

It is the authors' opinion that the data quality and reliability is to industry standard and sufficient for use in mineral resource and mineral reserve estimation and mine planning.

## 13.0

## MINERAL PROCESSING AND METALLURGICAL TESTING

### 13.1.

### Mineral Processing

Two distinct types of ore are being treated at the La Colorada mine, oxide ore and sulphide ore. Bench scale metallurgical testing and full-scale plant operations have determined optimum processing methods of cyanidation for the oxide ore and selective lead/zinc sulphide flotation for the sulphide ore. Table 12 illustrates the metal recovery estimates of the predicted head grades for La Colorada life of mine ("LOM") plan based on metal recoveries achieved in previous years and confirmed by bench scale metallurgical testing.

Table 12: Predicted Metal Recoveries

2014 – 2024 Projected Plant Recoveries			
Sulphide Plant	<i>Silver Rec. %</i>	92.9	%
	<i>Gold Rec. %</i>	67.1	%
	<i>Pb Rec. %</i>	85.4	%

<b>Oxide Plant</b>	<b><i>Zn Rec. %</i></b>	82.3	%
	<b><i>Silver Rec. %</i></b>	77.2	%
	<b><i>Gold Rec. %</i></b>	69.2	%

#### Historical Plant Performance

Table 13 and Table 14 show the actual metal recoveries and actual grades achieved in the process plant during 2008, 2009, 2010, 2011, 2012 and 2013. The silver and other metals processed in the sulphide plant are recovered in the form of concentrates that are further treated at third party smelters. The silver and gold from the oxide plant is recovered in the form of doré bars that are further refined at third party refineries.



Table 13: Metal Recoveries Achieved 2008 - 2013

		2008		2009		2010		2011		2012		2013
	Tonnes	166,076		151,334		180,265		235,181		263,867		296,165
Sulphide Plant	Silver Rec. %	92.2	%	91.2	%	92.2	%	93.0	%	93.2	%	93.1
	Gold Rec. %	68.4	%	76.2	%	73.4	%	73.6	%	70.1	%	65.9
	Pb Rec. %	77.1	%	83.4	%	83.3	%	86.0	%	85.6	%	85.1
	Zn Rec. %	67.8	%	71.2	%	77.8	%	80.6	%	82.1	%	82.1
	Tonnes	211,768		173,582		165,432		169,352		155,724		152,494
Oxide Plant	Silver Rec. %	81.8	%	81.9	%	83.1	%	83.5	%	82.4	%	82.0
	Gold Rec. %	77.2	%	76.9	%	75.1	%	73.1	%	69.1	%	69.3

Table 14: Achieved Head Grades 2008 - 2013

		2008		2009		2010		2011		2012		2013
	Tonnes	166,076		151,334		180,265		235,181		263,867		296,165
Sulphide Plant	Silver ppm	397		414		390		400		397		379
	Gold ppm	0.43		1.22		0.68		0.45		0.41		0.25
	Lead %	0.79	%	0.96	%	0.91	%	0.12	%	1.26	%	1.32
	Zinc %	1.61	%	2.14	%	0.21	%	2.36	%	2.61	%	2.78
	Tonnes	211,768		173,582		165,432		169,352		155,724		152,494
Oxide Plant	Silver ppm	351		357		366		326		333		301
	Gold ppm	0.42		0.47		0.35		0.41		0.39		0.30

## 13.2.

## Laboratory Analysis

The metallurgical balance requires metal concentration information from the feed material, the final product, tailings and at various sampling points throughout the process. Two distinct analytical processes are used to determine those values. Head and tails grade analysis uses the procedure outlines in section 12.2 while slurry samples are analyzed as described below.

Slurry samples from the plant are received at the laboratory as solids suspended in solution. Those samples are taken to be representative and considered to be of good quality. Both the solids and the liquid contain metal concentrations and must both be analyzed independently. A rotary wet splitter is used to separate the solids from the liquids. The decanted solution is then analyzed using a lead boat or Chiddy method with atomic absorption (“AA”) finish for gold. Silver concentrations are high enough for analysis directly by AA. The solids are filtered, rinsed with neutral water,

dried, and then fire assayed with gravimetric finish.

Base metals analysis for ore material is performed by acid digestion with AA finish. Analysis of base metals in the concentrates is be done by volumetric titration due to the high base metal grades.

Doré and concentrate samples are taken by drilling and auguring respectively. The samples are handled as described in section 12.2.

### 13.3. 2012 Metallurgical Test Results

Table 15 and Table 16 shows the metallurgical testing results conducted with composite samples that are representative of the life of mine plan (LOM). Testwork was conducted at the metallurgical laboratory of the La Colorada mine under typical conditions.

Table 15: Metallurgical Test Work Results 2012

Sulphide Ore	Silver Rec. %	92.8 %
	Gold Rec. %	70.8 %
	Pb Rec. %	86.9 %
	Zn Rec. %	87.4 %
Oxide Plant	Silver Rec. %	80.6 %
	Gold Rec. %	76.3 %

Table 16: Composited Metallurgical Test Sample Grades 2012

Sulphide Plant	Silver ppm	415
	Gold ppm	0.37
	Lead %	2.53 %
	Zinc %	4.75 %
Oxide Plant	Silver ppm	353
	Gold ppm	0.41

## 13.4.

## Metallurgical Testing

The metallurgical assumptions used for the economic analysis in this Technical Report are based on historic plant performance and confirmed by metallurgical bench scale testing of samples collected to represent the LOM planned feed schedule. Bench scale metallurgical testing and full-scale plant operations have determined the optimum processing methods are cyanidation for oxide ore and selective lead/zinc sulphide flotation for sulphide ore at the La Colorada Mine. Projected future metal recoveries in the LOM plan are based on historic recoveries and confirmed by metallurgical testing conducted at La Colorada metallurgical laboratory. Historic metallurgical testwork was described by Sharp, et.al. 2007, and is summarized here in chronological order.

## 1999 Testwork

During 1999, metallurgical testwork is reported to be concentrated on flotation and cyanidation leach testing. Fresh samples of vein material were obtained from the 295 level drift and from diamond drill intercepts for both the oxide and sulphide ore types. These samples were representative of the mineralogy of the two ore types, namely sulphide ore and oxide ore.

Selective flotation tests were conducted by Process Research Associates Ltd. (“PRA”) on both ore types, as well as gravity plus cyanidation tests for the oxide ore.

Cyanide leach testing was conducted on oxide ore from a narrow zone above the 295 level drift. The grind used for the test was approximately 80% minus 70 micron. Silver recovery after 96 hours leaching was 92.7% from a head grade of 649 ppm of Ag. Gold recovery after 96 hour leaching was 89.5% from a head grade of 1.64 ppm of Au.

The sulphide ore test floated a clean bulk Ag-Pb concentrate with relatively high recoveries. Initially the production of a zinc concentrate in the test resulted in depressing the zinc, which reported to the lead concentrate. This problem was improved by additional tests with collectors. It was shown that flotation recovery and mineralogical conduct are affected by grind size and reagent use. With those test results the projected sulphide ore metal recoveries from the combined lead and zinc concentrates were 91.25% Ag and 85.8% Au, the Pb recovery of 85% in the lead concentrate, and Zn recovery of 80% in the zinc concentrate.

Bond work index tests were run for both oxide and sulphide ores from narrow veins. Results ranged from 15.9 to 20.0 kilowatt hours per tonne, with the majority of samples needing approximately 18 kilowatt hours per tonne. All flotation testwork after the initial scoping tests were conducted with a grind of 80% minus 74 micron targeted.

#### 2000 Testwork

Testwork in 2000 was conducted by PRA in Vancouver, BC, Canada, on the NCP corridor drill core samples (Process Research Associates, May 2000). The work consisted of locked cycle bottle roll tests starting with flotation followed by cyanidation.

Six drill holes were shipped to PRA's Vancouver facilities for testing consisting of drill holes PIC 35, 36, 37, 39, 40 and 41. All samples, except PIC 35, were complete mineralized intercepts. The drill holes were characterized geologically to represent material that ranged from mostly oxide to mixed oxide and sulphide mineralization.

Locked cycle bottle roll cyanidation testing results after 96 hours leaching were 83.8% recovery from a head grade of 266 ppm for silver, 69.5% recovery from a head grade of 0.40 ppm for gold from the oxide sample, 79.9% recovery from a head grade of 658 ppm for silver, and 69.0% recovery from a head grade of 0.70 ppm gold from the mixed sample.

Flotation testwork was conducted on each drill core samples and also on both composite samples. The oxide and mixed ore composites were subjected to separate flotation test for lead and zinc concentrates. Results from flotation of both the oxide and mixed samples were poor, especially the oxide samples. Silver recoveries in combined lead concentrate and zinc concentrate were 15.7% and 76.7% for the oxide and mixed sample respectively. These results confirm that the preferred method for treatment of oxide ore is cyanidation.

#### Pre-operational Oxide Plant Bench Scale Testing

Bench scale metallurgical test-work conducted prior to the commissioning of the oxide cyanidation plant in mid-2003 was completed at the La Colorada metallurgical laboratory and two independent commercial laboratories averaging 84.4% Ag recovery and 82.5% Au recovery.

#### 2012 Testwork

Additional testing has been conducted on-site with samples representing the LOM planned feed. The samples used were the laboratory rejects (the part of the crushed sample split not used for analysis) of mineralized drill core. The testwork was conducted at the La Colorada metallurgical laboratory.

## Representativity of LOM Samples for Metallurgical Testing 2012

The objective of the program was determining the metallurgical response of the different veins which are in the mineral reserve inventory of the La Colorada Mine over the LOM. The samples were selected on the premise that the main variations in mineralogical assembly (galena-sphalerite-chalcopryrite) and metal values of Ag-Au-Pb-Zn-Cu change relative to depth. The sampling methodology is considered an acceptable representation of the mineral reserves of the La Colorada Mine. General samples criteria and silver grades are presented in Table 17.

Table 17: Metallurgical Samples

Sample	Mine	Mineral Type	Level Taken	Ag (ppm)	Weight (kg)
1	Candelaria	Sulphide	360, 370, 390, 425, 405, 438	355	80
2	Candelaria	Sulphide	445, 453, 468, 483, 498	495	157
3	Candelaria	Sulphide	528	474	284
4	Candelaria	Sulphide	558, 600	357	78
5	Candelaria	Oxide	423, 468, 498	376	56
6	Estrella	Oxide	245, 275, 305	440	80
7	Estrella	Oxide	335, 365, 395, 435	264	69
8	Estrella	Sulphide	435, 535	269	61
9	Recompensa	Sulphide	175	350	26

## Sample Analysis, Test conditions and Results with LOM samples

Sample content for important metals are presented in Table 18 for the sulphide samples and in Table 19 for the oxide samples. Test conditions in the flotation circuit were targeting a grind size of 70% passing 200 mesh. The reagents additions for the flotation tests are presented in Table 20.

Table 18: Sulphide Sample Analysis

Sample Number	Au(ppm)	Ag(ppm)	Cu(%)	Pb(%)	Zn(%)	Fe(%)	Mn(%)
1	0.20	355	0.13	1.37	2.71	2.82	0.39

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

2	0.28	495	0.19	2.01	4.18	3.07	0.69
3	0.30	474	0.22	3.25	5.15	2.97	0.86
4	0.73	357	0.31	3.54	7.39	3.57	0.92
8	0.16	269	0.08	1.40	1.79	2.42	0.42
9	0.24	350	0.18	4.28	4.56	2.61	2.50

47



Table 19: Oxide Sample Analysis

<b>Sample Number</b>	<b>Au(ppm)</b>	<b>Ag(ppm)</b>	<b>Cu(%)</b>	<b>Pb(%)</b>	<b>Zn(%)</b>	<b>Fe(%)</b>	<b>Mn(%)</b>
5	0.53	376	0.08	0.76	0.75	2.13	0.32
6	0.49	440	0.09	1.23	1.70	2.41	0.64
7	0.33	264	0.08	1.06	1.80	2.75	0.62

Table 20: Reagents for Sulphide Flotation Tests

<b>Added</b>	<b>Complex 10% ppm</b>	<b>Aerophina 3407 direct ppm</b>	<b>Frother No. 603 ppm</b>	<b>Xanthate at 1% ppm</b>	<b>Copper Sulphate al 10 % ppm</b>	<b>Lime ppm</b>
Mill	500	36				
Rougher		36	41	30		
Pb Cleaner	70					
Zn Rougher			14	31	600	2100
<b>TOTAL</b>	<b>570</b>	<b>72</b>	<b>55</b>	<b>61</b>	<b>600</b>	<b>2100</b>

Test results of each of the two sample types were consistent within their category. Summary of the test results are presented in Table 21 for sulphide samples and Table 22 for oxide samples.

Table 21: Flotation Test Results

<b>Sulphide Samples</b>	<b>Recoveries, %</b>			
	<b>Au</b>	<b>Ag</b>	<b>Pb</b>	<b>Zn</b>
1	65.1	91.9	82.1	84.2
2	70.0	95.4	85.8	87.7
3	72.3	92.6	88.1	85.2
4	78.1	91.3	91.8	93.7
8	56.2	92.3	86.4	79.1
8	68.3	92.8	80.2	87.7

Table 22: Cyanide Leach Test Results

Oxide Sample	Retention Time	NaCN Concentration	Recovery		Consumption	
			Au (%)	Ag (%)	NaCN kg/ton	CaO kg/ton
5	96 Hrs.	0.10% NaCN	78.0	76.7	1.53	4.8
6	96 Hrs.	0.10% NaCN	83.3	83.5	1.53	4.8
7	96 Hrs.	0.10% NaCN	69.2	78.1	1.22	4.8

## Continuous Testwork and Control

Metallurgical test programs are being conducted annually with representative samples to further evaluate the metallurgical variability, optimize metal extractions, reduce operating costs, and increase productivities.

### 13.5. Author's Conclusion and Recommendations

The metallurgical testing programs have shown:

The primary characteristic of the ore deposit that controls the metallurgical responsiveness either in the cyanidation or flotation circuit is the degree of oxidation.

The metallurgical performance of either the cyanidation or flotation circuits are inversely proportional to the intensity of grinding with marked metallurgical improvements obtained with finer grinds.

The amount of clay material in the ore and the intensity of grinding can negatively impact the performance of the thickening wash circuit in the oxide plant.

The concentration of "true-free" cyanide in the leaching and Merrill Crowe circuits is crucial to optimum cyanidation plant performance.

Additional flotation studies conducted on-site support the conclusions of the various historical laboratory test results presented above and support the estimations for future recoveries based on previous year's operational results.

## Recommendations

Metallurgical performance in the existing plants is well established at La Colorada. The authors recommend continuing the ongoing metallurgical testing program and that any variation in the mineralization identified by the geology department or the process department be tested as part of the program.

For the sulphide plant expansion, it is recommended that updated comminution testing is conducted to confirm Bond Work indices, and SAG testing (JK drop weight test and subject to requirement MacPherson test) for crushing and grinding circuit design.

Solid / liquid separation testing (thickening and filtration) testing of oxide tailings may be required if further studies indicate that dry stack storage is a viable option.

#### 14.0

#### MINERAL RESOURCE ESTIMATES

Mineral resources quoted in this Technical Report have been estimated using accepted industry practices and are in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum definitions on mineral resources and mineral reserves.

Mineral resources at the La Colorada mine as of December 31st, 2013 were estimated to be as shown in Table 23.

Table 23: La Colorada Mineral Resources as at 31 December 2013

**Measured and Indicated Resources**

<b>Category</b>	<b>Tonnes (Mt)</b>	<b>Ag (ppm)</b>	<b>Ag Cont. (Moz)</b>	<b>Au (ppm)</b>	<b>Pb %</b>	<b>Zn %</b>
Oxide Measured	0.2	168	0.8	0.17	N/A	N/A
Sulphide Measured	0.3	161	1.3	0.14	0.64	1.05
<b>Measured Resources</b>	<b>0.4</b>	<b>164</b>	<b>2.2</b>	<b>0.15</b>	<b>0.40</b>	<b>0.65</b>
Oxide Indicated	0.8	232	6.2	0.19	N/A	N/A
Sulphide Indicated	0.8	278	7.6	0.39	1.02	1.64
<b>Indicated Resource</b>	<b>1.7</b>	<b>255</b>	<b>13.8</b>	<b>0.29</b>	<b>0.51</b>	<b>0.83</b>
M&I Oxide	1.0	222	7.0	0.19	N/A	N/A
M&I Sulphide	1.1	251	8.9	0.33	0.93	1.50
<b>Total M&amp;I Resources</b>	<b>2.1</b>	<b>237</b>	<b>15.9</b>	<b>0.26</b>	<b>0.49</b>	<b>0.80</b>

**Inferred Resources**

<b>Category</b>	<b>Tonnes (Mt)</b>	<b>Ag (ppm)</b>	<b>Ag Cont. (Moz)</b>	<b>Au (ppm)</b>	<b>Pb %</b>	<b>Zn %</b>
Oxide Inferred	0.7	153	3.2	0.17	N/A	N/A
Sulphide Inferred	2.2	298	21.3	0.49	1.74	2.81
<b>Total Inferred Resources</b>	<b>2.9</b>	<b>265</b>	<b>24.5</b>	<b>0.42</b>	<b>1.34</b>	<b>2.17</b>

**Notes:**

1. CIM definitions were followed for mineral resources
2. Grades are shown as contained metal before mill recoveries are applied.
3. PAS reports mineral resources and mineral reserves separately. Reported mineral resources do not include amounts identified as mineral reserves.
4. Mineral resources were diluted including minimum true vein width of 2.18 m, planned mining dilution, and floor dilution for stope ore.  
Mineral resources have been estimated using a mining recovery of 85 to 95% (pillars are left in some thicker zones leading to lower mining recovery). Mineral resources were estimated based on the use of cut and fill mining methods.
6. Mineral resources were estimated using the polygonal method on longitudinal sections.
7. Mineral resources were estimated using a price of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc and \$1,950 per tonne of lead.
8. There are no known metallurgical, environmental, permitting, legal, title, taxation, socio economic, political, marketing or other issues expected to materially affect the estimate of mineral resources.
9. Mineral resources that are not mineral reserves do not have demonstrated economic viability.

Mineral resources were estimated using the polygonal method. This method, with some parameter updates, has been consistent since PAS took ownership of the property. The grades and tonnage of the structures are estimated based on the data collected and analysed from both diamond drilling and underground channel samples. The data is plotted on sections and plans, for review and interpretation by the geologist. Once the data is confirmed to represent the appropriate structure a long section is produced of each structure to visualize each structure in its entirety. The data is processed using Excel software structure by structure which is then combined to arrive at the total mineral resource estimate tonnage and grades.

The mineral resources are updated annually with new information and updated geological interpretations.

## 14.2.

## Bulk Density

The bulk density of the oxide ore and sulphide ores are a function of the lead and zinc grade contained within the ore. The calculations are derived based on 302 samples which were measured for bulk density at the ALS-Chemex laboratory in Vancouver, Canada. Table 24 shows the bulk density formulas used to estimate the tonnes of mineral reserves and mineral resources for the La Colorada Mine.

Table 24: Bulk density

<b>Ore Type</b>	<b>Bulk density ore</b>	<b>Bulk density wallrock</b>
Oxides and Sulphides	$= 2.7 + (\%Pb + \%Zn) * 0.0237$	2.70

## 14.3.

## Dilution and Ore Loss

Dilution is applied for several different circumstances and reasons. First a minimum of 2.18 m true width is applied to the structure. This provides a minimum horizontal width of 2.4 m in order to permit access for the scoop trams. Veins of less than 2.18 m true thickness have added wall dilution to a total of 2.18 m true thickness. Planned dilution is then added to account for the mining method. Different quantities are used for the development phase and the stoping phase as shown in Figure 7 and Figure 8. Additional dilution of 3% is applied to account for backfill which is inadvertently mucked each lift during the cut and fill stoping. An additional 5% unplanned dilution is also applied which correlates to the reconciliation results.

Ore loss is considered to be between 5% and 15% depending on vein width (i.e. mining recovery is assumed to be between 85% and 95%). This figure is based on experience and observation at the La Colorada Mine and takes into account losses of ore in permanent pillars, losses into the backfill and other losses such as those that may be caused by ground failures or other geomechanical conditions. The mine workers attempt, where possible, to recover all pillars, however, some crown pillar ore and some safety pillars inevitably remain to ensure safe working conditions for the miners in the stopes.

Figure 7: Development Dilution (La Colorada Geology Dept., 2010)



Figure 8: Stope Dilution (La Colorada Geology Dept., 2010)

#### 14.4.

#### Disclosure Requirements

The mineral resource was estimated with the data cut off of December 31<sup>st</sup>, 2013. It was completed by the mine geology department at the mine site and under the supervision of the authors of this Technical Report.

Resource classifications follow the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) guidelines. Classifications are based on proximity and density of geological and grade information, as well as the complexity of the geological interpretation.

Measured mineral resource blocks are adjacent to mine excavations, either development or stopes, which have been channel sampled as described in item 9.2. Projected distances for measured resources are 50 m vertical and 30 m horizontal.

Indicated mineral resource blocks are adjacent to measured blocks. They extend 30 m vertically from measured blocks, but do not extend horizontally further than measured blocks. Indicated blocks are also estimated where diamond drilling confirms grade and geological continuity and holes are spaced 50 m or closer to each other or to channel samples.

Inferred mineral resource blocks are estimated where there is sufficient data, geological and grade, to reasonably assume continuity but not enough to confirm or verify said continuity.

## 14.5.

## Multiple Commodities

The procedure used to handle multiple commodities in the estimation is to give monetary value for each metal based on their respective grades and add them to give the total value per unit of weight. The term used for this is value per tonne (VPT). The VPT is calculated based on the net smelter return (NSR). The factors taken into account are the value paid for each metal, insurance, penalties, treatment cost, refining and transport, and are described in more detail in Section 19, Market Studies and Contracts. The VPT is a factor which is applied to the estimated value of each metal.

## 15.0

## MINERAL RESERVE ESTIMATE

Mineral reserves in this Technical Report have been estimated using accepted industry practices and are in accordance with the Canadian Institute of Mining, Metallurgy and Petroleum definitions on mineral reserves.

The mineral reserves were estimated with the data cut off of December 31<sup>st</sup> 2013. The estimate was completed by the mine geologists, at the La Colorada mine site, under the supervision of the authors of this Technical Report.

Mineral reserves at the La Colorada mine as of December 31<sup>st</sup>, 2013 were estimated to be as shown in Table 25.

Table 25: La Colorada Mineral Reserves as of 31 December 2013

**Proven and Probable Reserves**

<b>Category</b>	<b>Tonnes (Mt)</b>	<b>Ag (ppm)</b>	<b>Ag Cont. (Moz)</b>	<b>Au (ppm)</b>	<b>Pb %</b>	<b>Zn %</b>
Oxide Proven	0.7	350	7.8	0.32	N/A	N/A
Sulphide Proven	1.7	429	23.5	0.30	1.90	3.48
<b>Proven Reserves</b>	<b>2.4</b>	<b>406</b>	<b>31.2</b>	<b>0.31</b>	<b>1.35</b>	<b>2.47</b>
Sulphide Probable	1.3	378	16.2	0.29	N/A	N/A
Oxide Probable	2.8	377	34.0	0.44	1.92	3.47
<b>Probable Reserves</b>	<b>4.1</b>	<b>378</b>	<b>50.2</b>	<b>0.39</b>	<b>1.30</b>	<b>2.35</b>
Oxide Reserves	2.0	369	23.9	0.30	N/A	N/A
Sulphide Reserves	4.5	397	57.5	0.38	1.91	3.47
<b>Total Reserves</b>	<b>6.5</b>	<b>388</b>	<b>81.4</b>	<b>0.36</b>	<b>1.32</b>	<b>2.40</b>

**Notes:**

1. CIM definitions were followed for mineral reserves.
2. Grades are shown as contained metal before mill recoveries are applied.
3. PAS reports mineral resources and mineral reserves separately. Reported mineral resources do not include amounts identified as mineral reserves.  
La Colorada mineral reserves have been estimated at a cut off value per tonne of \$116.10 and \$126.10 below 600 level for Candelaria oxides, \$101.17 and \$111.17 below 600 level for Candelaria sulphides, \$100.79 for Estrella oxides, \$85.82 for Estrella sulphides and \$73.84 per tonne in the Recompensa mine (sulphide ore).
4. Mineral resources were diluted including minimum vein true width of 2.18 m, planned mining dilution, and floor dilution for stope ore.
5. Mineral reserves were estimated using a mining recovery of 85 to 95% (pillars are left in some thicker zones leading to lower mining recovery). Mineral reserves were estimated based on the use of cut and fill mining methods.
6. Mineral reserves were estimated using the polygonal method on longitudinal sections.
7. Mineral reserves were estimated using a price of \$22.00 per ounce of silver, \$1,300 per ounce of gold, \$1,850 per tonne of zinc and \$1,950 per tonne of lead.
8. There are no known metallurgical, environmental, permitting, legal, title, taxation, socio economic, political, marketing or other issues expected to materially affect the estimate of mineral reserves.
- 9.

## 15.1.

## Method and Parameters

Mineral resources are converted to mineral reserves if they can be economically mined. Some mineral resources may not be converted to mineral reserves for various reasons including poor location, accessibility, mining recovery, or because the grade of the resource is not economic to mine. The estimated full break even production costs, when the expansion project has been completed have been used to define the economic limit. The actual production costs from the previous year and the budgeted costs for the current year have been used as a basis for this calculation. This is a change from previous methodology where the variable costs were calculated from the actual costs of the previous year to define the economic limit. In order to account for the increased costs of pumping and ventilation in the hot, wet conditions at depth, separate cut off grades have been calculated for the Candelaria oxides and sulphides between the 600 and 740 levels. The cut off value for the different structure and/or ore types are as stated in Table 26.

Table 26: Reserve Cut Offs

Location /Ore Type	VPT Cut Off for Dec 31, 2012	VPT Cut Off for Dec 31, 2013
Candelaria Oxides above 600 level	\$ 98.49	\$ 116.10
Candelaria Oxides 600 to 740 level		\$ 126.10
Candelaria Sulphides above 600 level	\$ 82.92	\$ 101.17
Candelaria Sulphides 600 to 740 level		\$ 111.17
Estrella Oxides	\$ 99.10	\$ 100.79
Estrella Sulphides	\$ 83.53	\$ 85.82
Recompensa Sulphides	\$ 73.84	\$ 73.84

## 15.2.

## Classification

Mineral reserve classifications follow the Canadian Institute of Mining, Metallurgy and Petroleum (CIM) guidelines. Classifications are based on proximity and density of geological and grade information, as well as continuity.

Proven mineral reserve blocks are those measured mineral resource blocks, and probable mineral reserve blocks are those Indicated mineral resource blocks, that are economic and are mineable. The grade of the proven or probable mineral reserve block must be equal to or higher than the VPT cut off for the respective location shown in Table 26. The proven or probable mineral reserve block must also be located such that it can support the cost of the development and infrastructure necessary to mine that block. In the deeper parts of the La Colorada mine the provision of ventilation and pumping water are significant costs. The author (M. Wafforn) has placed limits on the depth to which a measured or indicated mineral resource block may be converted to a proven or probable mineral

reserve block until data is available to allow a reasonable projection of those costs. For the December 31, 2013 estimate of mineral reserves, the deepest mineral reserves are to the 678 level in the west part of the NC2 and HW veins in Candelaria. The deepest mineral resource included in the LOM plan is to the 738 level in the west part of the Candelaria mine. PAS continues to monitor water inflows, rock temperature and ambient air quality in order to determine future ventilation and pumping requirements and costs. The increased capital and operating costs necessary to purchase and install a system for mine refrigeration is not expected to be required in order to mine the mineral reserves presented in this Technical Report, although with continued exploration success at depth it is a possibility in the future (Orellana Wiarco, 2010, 2011 and 2012).

16.0

MINING METHOD

La Colorada produces oxide and sulphide ores from three separate underground mines: Candelaria accessed via Las Minas and San Fermin portals, Estrella and Recompensa. The El Aguila shaft is used for extracting mineral from the Candelaria mine and in 2012 a ramp was developed between the Candelaria and Estrella mines that allow the extraction of mineral from the Estrella mine via the shaft. Figure 9 is a general site plan showing the location of the three mines relative to one another and surface infrastructure.

Figure 9: La Colorada Mine General Site Plan with Infrastructure (PAS, 2013)

In prior years, oxide ore accounted for 60% of the total tonnes processed. In 2013, sulphide ore accounted for 66% of the tonnes processed and going forward, sulphide ore will account for nearly 77% of total tonnes processed due to depletion of the oxide resource as mining progresses deeper.

In all three mines, overhand cut and fill stoping is used for ore extraction. Mechanized and semi-mechanized overhand cut and fill mining method as used at La Colorada is also employed at many underground mines, especially in Mexico. This method of mining is considered safe and efficient for the type of geologic conditions found at La Colorada.

Cut and fill stoping requires good-to-fair stability of the footwall and hanging wall surrounding the ore zone. When these conditions are present, cut and fill stoping provides improved ore recovery and selectivity from irregular, steeply dipping veins. The method also provides ground support by backfilling the voids creating by mining with development rock or mill tailings as ore extraction advances. The backfill also provides a stable floor to work from. All of the conditions for efficient cut and fill stoping are present in the La Colorada Mine and the method is applied in all mining areas.

Table 27 provides actual mine production data by ore type and total ore for years 2005 through 2013.

Table 27: Historic Production areas at La Colorada

Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	T
Oxide Ore										
Tonnes Mined	211,854	213,187	211,714	211,769	173,582	165,432	169,352	155,724	152,407	1
Ag g/t	513	539	429	351	357	365	324	333	301	3
Au g/t	0.55	0.59	0.51	0.42	0.47	0.33	0.37	0.39	0.30	0
Sulphide Ore										
Tonnes Mined	0	20,557	119,353	166,075	151,334	180,265	235,181	263,867	295,668	1
Ag g/t	0	462	451	397	414	390	400	397	379	4
Au g/t	0.00	0.50	0.45	0.43	1.22	0.68	0.45	0.41	0.25	0
Pb%	0.00	1.05	0.76	0.79	0.95	0.91	1.18	0.79	1.32	1
Zn%	0.00	1.51	1.50	1.61	2.14	2.09	2.36	1.64	2.78	2
Total Ore										
Tonnes Mined	211,854	233,744	331,067	377,844	324,916	345,697	404,533	419,591	448,659	3
Ore Type										
Oxide	100	% 91	% 64	% 56	% 53	% 48	% 42	% 37	% 34	% 5
Sulphide	0	% 9	% 36	% 44	% 47	% 52	% 58	% 63	% 66	% 4
Ore Source										
Candelaria	100	% 100	% 82	% 77	% 72	% 82	% 79	% 79	% 75	% 8
Estrella	0	% 0	% 18	% 22	% 18	% 6	% 11	% 13	% 23	% 1
Recompensa	0	% 0	% 0	% 1	% 10	% 12	% 9	% 8	% 1	% 5

Overhand cut and fill stoping begins at the bottom of the ore zone and works upward in horizontal slices that follow the strike, dip and width of the ore zone. Prior to mining, stopes are developed by preparing access, water drains and

ventilation raises. Ore extraction begins by cutting a slice from the bottom of the ore zone and removing the broken ore from the stope. As each successive slice of the stope is taken, the void below is backfilled to support the hanging wall and foot wall and to provide a stable working platform for mining the next ore slice. At La Colorada, individual slices through the ore zone are designed to be 2 meters thick.

Figure 10 presents the typical La Colorada mining sequence. (1) The cut sequence begins with drilling. Using ore broken in the previous advance as a work platform, miners use jacklegs and stopers to drill blastholes into the face above the work platform. (2) After drilling, blasting agent is loaded into the holes, the material is broken and dropped to the floor below. This material then becomes the working platform for advancing the cut. (3) After blasting, and after the atmosphere in the stope is determined to be safe, roof support is completed by removing loose rocks from the newly exposed area and installing rock bolts. (4) As the drill face advances, broken ore is removed from the stope. Ore removal lags approximately 10 meters behind the drill platform to provide a safe working distance between drilling and ore extraction. (5) The “fill” sequence is completed by bringing in backfill material and placing in the void created by ore extraction. The advancing face of the backfill material is separated from the ore to limit ore dilution. The complete cut and fill cycle is made up of steps 1 through 5, which are repeated to advance the length of the planned stope. Each cycle of the full sequence results in an approximate 2.5 meter advance. Typically, blasting occurs twice per shift in each active stope. Mining is conducted on two ten hour shifts per day, seven days per week.



Figure 10: La Colorada- Mining Sequence (La Colorada Planning Dept. 2012)

### Ground Support

Typical ground support at La Colorada is split set friction rock bolts, with the addition of cemented rock bolts, mesh, and shotcrete as needed in specific areas. In areas with high clay content, cement grout cartridges are inserted into the split set bolts in order to improve their pull out strength.

During ground support operations, drillers are required to set mechanical roof jacks for additional roof support.

### Mine Equipment

Mining equipment used at La Colorada consists of single-boom electric hydraulic drill jumbos and hand operated jackleg type drills for drilling; 1.5 cubic meter, 2.0 cubic meter and 3.75 cubic meter scoop trams for tramming ore and rock backfill to and from stopes; and low-profile 9-tonne to 12-tonne capacity haul trucks for underground ore haulage. Table 28 lists the current La Colorada fleet of mobile mining equipment and the estimated post expansion fleet.

Table 28: La Colorada Mobile Mine Equipment Fleet

Type	Description	Manufacturer and Model	Current Number in Fleet	Estimated post Expansion Fleet
Drill Jumbo	Single Boom Rock Drill	Atlas Copco S1 D	3	5
Scoop Tram	1.5 C. Meter Scoop	Sandvik LH 203 & Toro 151D	14	20
Scoop Tram	3.0 C. Meter Scoop	Sandvik LH 307 & Toro 6	6	10
Haul Truck	15 Tonne Load	Sandvik TH315 & EJC 417	7	11
Scissor Lift	3.5 Meter Lift	Normet 6330 X	1	3
Personnel Trans.	Light transport	Kubota RTV900	24	26
Tractor	Personnel and Service	Various	24	26

## 16.1.

## Underground Infrastructure

## Mine Access and Development

Personnel and equipment access into all mines is by a decline ramp. The Candelaria Mine and the Estrella Mine have two access ramps each; the Recompensa Mine is accessed by a single ramp.

Main access ramps and haulage drifts are designed to be 3.5 m wide by 3.5 m high with a maximum gradient of 15%. Cross cuts to access ore stopes are designed to be 2.4 m wide by 2.4 m tall. In the ore stopes, minimum cut dimensions are 2.4 m wide by 2.0 m tall. The first cut ore extraction and backfill ramps into the stopes are carried at a maximum grade of 22%. Secondary egress from a stope is required at each 100 m of stope length. Main levels at Candelaria have a vertical interval of 30 meters in order to provide dewatering in advance of mining. Main levels at Estrella are planned to be at 45 meter vertical intervals as the area has been dewatered by pumping of the Candelaria mine.

Mine development occurs concurrently with stope mining to provide an uninterrupted flow of ore to the mill. At the time of this report, La Colorada has approximately 24 months of ore developed ahead of production stoping.

## Ore Streams

At La Colorada, ore is segregated into oxide or sulphide types for processing. Mixed ore, a combination of the two ore types that occurs in transition zones, is typically processed through the oxide circuit.

Both primary ore types, oxide and sulphide, are shipped to the mill from the Candelaria Mine. The majority of ore produced from the Estrella Mine is shipped and treated as oxide, however small zones of sulphide ore have been encountered and shipped to the mill in the past. All ore produced from the Recompensa Mine is treated as sulphide.

#### Ore Transport to Surface

Ore extracted from the Candelaria Mine is hoisted to the surface through the El Aguila Shaft. The ore is dumped from the 438 haulage level into one of two 300 t underground dump pockets. The two bins are used to segregate sulphide and oxide/mixed ore. Ore from the dump pockets is transferred to a skip and hoisted approximately 450 m to surface, where it is dumped into one of two 200 t coarse ore storage bins, which again correspond to ore type. The ore is removed from the bins and hauled to the appropriate mill crusher stockpile by 12 t surface haul trucks. When required, Candelaria ore can be hauled up to the surface using one of the mine access ramps.

Ore extracted from the Estrella and Recompensa Mines is hauled to the surface by the La Colorada underground mine truck fleet. Estrella and Recompensa ores are stockpiled on the surface near the mine portals. The ore is then reclaimed from the stockpile and hauled to the appropriate mill crusher stockpile by 12 t surface haul trucks.

In 2007, the Candelaria ore hoist was replaced to increase hoisting capacity and provide improved reliability. The current hoist is a 1.68 m diameter double drum, two skip unit powered by a 400 horsepower (hp) drive. Each skip carries approximately 3 t per trip, with the actual load dependent on the density of the material hoisted. The hoist system is capable of delivering approximately 1,200 t per day to the surface. Mechanical and electrical availability of the hoist system exceeds 85%.

#### New Shaft

Cementation completed a scoping study into new borehole hoisting shaft in January, 2013 the results of that study are as summarized in this section (Project 100796, Rev 2 for Pan American Silver Corp. La Colorada Mine Borehole Hoisting Scoping Study, January 25, 2013 by Cementation Canada Inc.). The estimate is based on a 5 meter final excavation diameter borehole from surface to 618 meters below surface where the underground mine will provide access for attaching the reamer and removing the rock cuttings from the reaming process. Borehole shaft steel sets will be anchored using 1 meter concrete rings spaced every 6 meters. The reamed borehole walls will be self-supporting requiring only local ground support typically bolts and screen between the concrete rings. Borehole cables will be limited to leaky feeder, hoist control cable, signal cable and a ground conductor. The shaft will contain 2 conveyances running in balance on fixed steel guides, with a single deck cage (14 man capacity) under one skip. As there will be no ladder way in the shaft, a small hydrostatic escape hoist will be provided for emergency egress during shaft inspection.

The borehole will be as vertical as possible with a maximum permissible borehole deviation of 600 mm included in the excavation diameter. Hole deviation from vertical during the pilot hole drilling process will be minimized with the use of rotary directional drilling equipment located directly behind the pilot bit. The deviation is often corkscrew in nature due to the spiraling travel of the pilot hole bit as it bores downward. As the reaming head of the raise drill machine will follow the pilot hole this will result in small undulations in the bore hole wall over the length of the hole. This is mitigated in the hoisting system design by including an allowance in the final borehole excavation diameter to accommodate the deviation. Cementation recently completed a similar project of a 460 meter pilot hole with a maximum deviation through the length of the bore hole of less than or equal to 75 mm.

The hoisting design criteria was to provide the capacity for 2,300 tonnes per day from 1,000 meters deep with time provided for men and materials. The shaft design has been deliberately oversized in order to avoid it becoming a

future choke point and to provide the capacity in case it is deepened in the future. Hoisting time of 4 hours per shift (based on operating 2 – 12 hour shifts per day) has been reserved for winder inspection/testing and personnel movement of up to 125 persons per shift. Rock hoisting will be 14.4 hours per day (based on 90% winder availability). Hoist will be a double drum 3.048 meter diameter hoist. The skips will operate in balance and be 5.8 tonne capacity, hoisting rope will be 1 3/8” diameter 1,770 MPa. Hoisting speed from 1000 meter level will be 12.19 m/s, this will be reduced to 11.18 m/s when hoisting from the 600m horizon in order to reduce power costs. The initial study had concluded the 5 tonne capacity skips would be sufficient, however when PAS asked for additional capacity Cementation estimated that the resultant effect of the skip capacity change would have an insignificant result on the project cost estimate per “Memo re project 100796 re hoisting capacity by Cementation dated October 16, 2013”.

A 36 meter high open frame steel construction headframe will be required, with skips dumping directly to a 250 tonne capacity ore bin. The chute arrangement will be such that waste will pass over the ore chute and onto a pad on the ground. The ore bin will have a chute for either conveyor loading or truck loading. The collar house will be an open sided structure 5.6 meters wide by 10 meters long and 10.5 meters high with a structure with suspended monorails for conveyance removal. The hoist house will be of steel frame construction with an attached electrical control room.

Underground rock handling will be via 2 dumps located on the 558 level. The dumps will have grizzlies with 300 mm by 300 mm openings that will allow truck dumping and a fixed rock breaker on each dump. Below each grizzly will be a 300 tonne capacity rock bin feeding a common transfer conveyor via chute and pan feeder arrangements on the 588 level. The transfer conveyor will feed a transfer gate that in turn feeds twin 5.8 tonne capacity chutes. The transfer conveyor and loading pocket will be amenable to full automation.

#### Dewatering

The Candelaria Mine requires dewatering to mine the deeper levels of the mine. Dewatering of the Estrella and Recompensa Mines is not required for mining (as the Candelaria mine is deeper).

The Candelaria pump station is currently located on the 558 level, which will support mining until the next main pump station is constructed at or about the 660 level of the mine. The pump station is comprised of sixteen 150 hp pumps, which includes a set of fully redundant standby units for periods of peak flows and maintenance. The pumps are connected to the mine power distribution system, with three 1.2 MW generators located on surface for backup. Water from the mine is collected in and pumped from a 7,000 m<sup>3</sup> sump. Mine dewatering during 2012 was approximately 50% of installed capacity averaging 605 m<sup>3</sup> of water per hour.

#### Mine Ventilation

La Colorada has an engineered air ventilation network at all three mines to prevent build-up of dangerous gasses, provide fresh air to the mines, and to cool hot areas.

Up to a point, excess heat in a mine can be dealt with in the same manner as contaminant gasses by providing enough ventilating air volumetric flow rate to reduce heat to an acceptable level. When the heat becomes so high that it is no

longer economic to provide increasing ventilating air volumetric flow rate then refrigeration of the ventilating air is considered.

The heat sources in a mine include the heat generated by diesel and electrical equipment, heat transferred from the rock, oxidation of minerals, auto compression of air, people and in the case of La Colorada heat from ground water. The Candelaria mine (the deepest) is divided with oxide mineralization to the west and sulphide mineralization to the east. The veins in both zones are permeable and allow water flow, in the deeper levels the water in the sulphide areas currently flows into the mine at 44° C and the water in the oxide areas is 36° C.

The mine ventilation system is designed to deal with the heat in the mine and the conclusion of the ventilation studies, conducted by a third party consultant, is that refrigeration of the ventilating air will not be required to develop and mine the mineral reserves stated in this technical report (Orellana Wiarco, 2012). However, as mineralization at the La Colorada mine has been shown by diamond drilling information to extend some 425 meters below the deepest level being developed at the time of this report it is possible that refrigeration will be required beyond the mine life presented in this technical report.

The Candelaria Mine has two 2.4 m bored ventilation raises, current ventilation volume is 286,000 CFM.

Ventilation for the Estrella mine is currently provided by a single 150,000 cfm exhaust fan on a 2.4 m diameter bored raise as well as via the access ramp and the 360 level access to the Candelaria mine. An additional 3.1 m diameter ventilation raise has been bored and is currently being supported. When completed a second primary exhaust fan will be in place for the Estrella mine.

Ventilation for the Recompensa mine is provided by a single 170,000 cfm fan.

#### Stope Backfill

Wherever possible waste development rock is stored underground for use as backfill in the cut and fill stopes.

In 2011, La Colorada commissioned a new hydraulic backfill plant to provide material for backfilling sulphide stopes in the Candelaria Mine. The plant processes sulphide mill tailings to separate a coarse size fraction for use as backfill underground. Plant equipment includes cyclones, a slurry pumping station, slurry stock tank and agitator. The plant is located at the Candelaria mill and backfill is returned to the mine through the El Aguila shaft.

Cement is added to the first section of backfill placed at the bottom of the stopes to facilitate mining of ore left in pillars between stopes.

#### Power



Electrical power is distributed underground at 4.16 kV and 2.30 kV. Local transformers reduce the voltage to 480 v as needed.

#### Compressed Air and Drill Water

Compressed air for mining is supplied by electric powered air compressors located on the surface at each mine. The Candelaria Mine compressed air plant is comprised of two compressors, each capable of supplying 45 ft<sup>3</sup> per minute of air. The compressed air plants at the Estrella and Recompensa Mines are comprised of one compressor at each mine, each capable of supplying 45 ft<sup>3</sup> per minute of air. Compressed air is distributed underground through a network of steel pipes.

Water for drilling is provided by the mine dewatering system. Water is distributed throughout the mines via a network of steel and high density polyethylene (HDPE) pipes.

16.2.

Life of Mine Plan (LOM)

Long Term Production Plan

La Colorada reviews and updates mineral reserves and long term production plans on an annual basis. Planning at La Colorada relies on historical productivities achieved at the property for ore extraction and stope development. Mining of individual ore stopes is scheduled to provide reasonably consistent ore quality for processing and maintaining consistent silver production levels.

The current long term plan spans the period from 2013 to 2027 inclusive. In this plan, the rate of extraction increases to 1,800 tpd in 2018 from the 1,250 tpd projected for 2014. The plan includes provisions for ongoing underground development to support the planned extraction. The Candelaria Mine supplies 66% of total mill feed going forward, the Estrella mine supplies 34% of the mill feed and 0% is sourced from the Recompensa Mine.

The mine plan projects that material shipped to the mill will be 23% oxide and 77% sulphide during the remainder of the currently planned mine life.

Upon completion of the expansion in 2018, the mine plan projects shipping an average of 400 tonnes per day of oxide materials and 1,400 tonnes per day of sulphide materials to the mill for the remainder of the planned mine life.

Underground mine personnel, including mining, development, maintenance, and supervision, is currently 395. This is planned to increase to 533 in 2018 with the completion of the mine expansion as shown in Table 29.

Table 29: Underground Mine Personnel

Underground Personnel	Current	Additional	Post Expansion
Equipment Operator	54	45	99
Driller	184	48	232
Mechanical	58	18	76
Electrical	14	9	23
Shift Supervisor	13	6	19
Mechanical Supervisor	3	6	9
Electrical Supervisor	1	6	7
Others	68	0	68
Total	395	138	533

Table 30 presents selected data summarizing the current long term mine plan.

Table 30: La Colorada Long Term Plan

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Oxide										
Tonnes Mined	146,000	146,000	146,400	146,000	146,000	146,000	146,400	146,000	146,000	146,000
Ag g/t	307	333	316	383	401	367	380	392	392	401
Au g/t	0.35	0.35	0.34	0.39	0.44	0.48	0.47	0.45	0.46	0.47
Sulphide										
Tonnes Mined	310,250	310,250	402,700	401,325	511,000	511,006	512,400	511,000	511,000	511,000
Ag g/t	397	389	379	360	410	421	418	417	407	410
Au g/t	0.26	0.27	0.29	0.29	0.31	0.29	0.31	0.36	0.42	0.43
Pb%	1.51	1.37	1.53	1.60	2.26	2.06	2.45	2.28	1.73	1.73
Zn%	2.73	2.63	2.81	2.86	3.98	3.53	4.37	4.46	2.83	2.83
Total										
Tonnes Mined	456,250	456,250	549,100	547,325	657,000	657,006	658,800	657,000	657,000	657,000
Material										
Type										
Oxide	32	% 32	% 27	% 27	% 22	% 22	% 22	% 22	% 22	% 22
Sulphide	68	% 68	% 73	% 73	% 78	% 78	% 78	% 78	% 78	% 78
Material										
Source										
Candelaria	78	% 73	% 76	% 73	% 80	% 80	% 73	% 68	% 67	% 67
Estrella	22	% 27	% 24	% 27	% 20	% 20	% 27	% 32	% 33	% 33
Recompensa	0	% 0	% 0	% 0	% 0	% 0	% 0	% 0	% 0	% 0
Development										
Meters	4,795	4,844	5,098	5,309	5,245	4,990	4,571	4,768	4,904	4,904
Site										
Headcount										
Employees	618	619	672	672	725	730	732	740	745	745
Contractors	114	84	82	80	80	80	35	0	0	0

The PEA mine plan is based on La Colorado's estimated mineral reserves and resources as of December 31, 2012 adjusted for production information available as of mid-2013. The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the expanded mine plan, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.



## 17.0

## RECOVERY METHODS

Ore processing at La Colorada is comprised of separate oxide and sulphide circuits. Except for a common crushing plant, the two ore processing streams operate independently. The daily processing capacity of the oxide plant is 650 tpd and the capacity of the sulphide plant is currently 750 tpd. The crushing plant currently does not have sufficient capacity to supply both plants to their maximum capacity.

Mixed ore from the mine, comprising material mined from the transition zone between the oxide and sulphide zones, is typically treated as oxide ore for processing.

Ore processing is conducted on two twelve hour shifts per day, seven days per week. The crushing plant is also staffed for two twelve hour shifts per day, seven days per week; however, eighteen hours of operation is typically sufficient to maintain mill feed.

### Ore Processing Rate

The ore processing rate at La Colorada has steadily increased over time. In 2003, the year before startup of the oxide processing plant, La Colorada processed a total of 56,000 tonnes of ore. In 2007, 331,000 tonnes of ore was processed and in 2013 449,000 tonnes of ore was processed.

In addition to increasing processing rates, the relative mix of oxide and sulphide ore processed at La Colorada is also changing with time. In 2003, 100% of the ore processed was sulphide. In 2007, 64% of the total ore processed was treated as oxide. In 2013, 66% of the total ore processed was treated as sulphide. This trend of increasing sulphide ore will continue as oxide mineral reserves become depleted at La Colorada. Figure 11 is a chart that shows, in both actual and estimated numbers, annual tonnes processed and the relative breakdown of mill feed by ore type for the years 2001 through 2027 inclusive.

Figure 11: Processing Rate (Actual and Estimated) by Material Type



Table 31 summarizes ore processing production statistics realized during the years 2008 through 2013.

Table 31: Plant Production 2008-2012

Year	2008	2009	2010	2011	2012	2013	Total	
Oxide								
Tonnes Processed	211,769	173,582	165,432	169,352	155,724	152,494	1,028,353	
Ag g/t	351	357	366	326	333	301	340	
Au g/t	0.42	0.47	0.35	0.41	0.39	0.30	0.39	
Ag Recovery, %	81.8	81.9	83.0	83.5	82.4	82.0	82.41	
Au Recovery, %	77.9	76.9	75.0	73.1	69.1	69.3	73.86	
Ag Produced, t oz	1,956,649	1,629,647	1,616,583	1,481,688	1,371,153	1,207,675	9,263,395	
Au Produced, t oz	2,209	2,014	1,393	1,611	1,270	1,029	9,526	
Sulphide								
Tonnes Processed	166,075	151,334	180,265	235,181	263,867	296,165	1,292,887	
Ag g/t	397	414	390	400	397	379	394	
Au g/t	0.43	1.22	0.68	0.45	0.41	0.25	0.52	
Pb%	0.79	0.95	0.91	1.18	1.26	1.32	1.11	
Zn%	1.61	2.14	2.09	2.36	2.61	2.78	2.35	
Ag Recovery, %	92.2	91.2	92.2	93.0	93.2	93.1	92.65	
Au Recovery, %	68.7	76.2	73.5	73.6	70.0	65.9	70.77	
Pb Recovery, %	77.2	83.4	83.5	86.0	85.7	85.1	83.94	
Zn Recovery, %	68.5	71.2	78.0	80.6	82.1	82.1	78.21	
Ag Produced, t oz	1,954,182	1,838,209	2,084,986	2,814,095	3,059,958	3,358,702	15,110,132	
Au Produced, t oz	1,565	4,540	2,919	2,493	2,309	1,550	15,375	
Pb Produced, dmt	1,011	1,205	1,366	2,388	2,766	3,324	12,060	
Zn Produced, dmt	1,835	2,311	2,940	4,466	5,599	6,759	23,910	
MaterialType								
Processed								
Oxide	56	% 53	% 48	% 42	% 37	% 34	% 44	%
Sulphide	44	% 47	% 52	% 58	% 63	% 66	% 56	%
Combined Production								
	3,910,831	3,467,856	3,701,569	4,295,783	4,431,111	4,566,377	24,373,527	



Ag Produced, t							
oz							
Au Produced, t	3,774	6,554	4,312	4,104	3,578	2,579	24,901
oz							
Pb Produced, dmt	1,011	1,205	1,366	2,388	2,795	3,324	12,089
Zn Produced, dmt	1,835	2,311	2,940	4,466	5,538	6,759	17,090
Overall Recoveries (Pb & Zn Sulphide Only)							
Ag Recovery, %	86.7	86.6	88.0	89.5	89.6	89.8	88.2
Au Recovery, %	73.8	76.4	74.0	73.4	69.7	66.4	59.2
Pb Recovery, %	77.2	83.4	83.5	86.0	85.7	85.1	83.9
Zn Recovery, %	68.5	71.2	78.0	80.6	82.1	82.1	78.2

#### Metallurgical Recovery

Metallurgical recoveries at La Colorada have been relatively constant over the past six years of production. For the period from January 2008 through the year end 2013, silver recovery has averaged 82.4% from the oxide processing circuit and 92.7% from the sulphide processing circuit.

Metallurgical recoveries at La Colorada are tracked by ore type and ore zone. Recoveries assumed for the long term plan are based on actual recoveries achieved for each ore type, ore zone and results from metallurgical testing. Recoveries are assigned to each ore type and ore zone identified in the mine plan and the overall recovery reported for a given period is a function of the planned processing mix. Table 32 and Table 33 provide historic and projected recoveries for each payable metal by ore type.

Table 32: Oxide Circuit Recovery

Year	Ag Recovery, %		Au Recovery, %	
	Actual	LTP	Actual	LTP
2008	81.8 %	—	77.9 %	—
2009	81.9 %	—	76.9 %	—
2010	83.0 %	—	75.0 %	—
2011	83.5 %	—	73.1 %	—
2012	82.4 %	—	69.1 %	—
2013	82.0 %	—	69.3 %	—
2014	—	78.8 %	—	69.2 %
2015	—	78.3 %	—	69.2 %
2016	—	78.4 %	—	69.2 %
2017	—	78.5 %	—	69.2 %
2018	—	78.6 %	—	69.2 %
2019	—	77.4 %	—	69.2 %
2020	—	75.7 %	—	69.2 %
2021	—	76.2 %	—	69.2 %
2022	—	75.0 %	—	69.2 %
2023	—	75.0 %	—	69.2 %
2024	—	75.0 %	—	69.2 %
2025	—	75.0 %	—	69.2 %
2026	—	75.0 %	—	69.2 %
2027	—	82.4 %	—	69.2 %
Average	82.4 %	77.1 %	73.9 %	69.2 %

Table 33: Sulphide Circuit Recovery

Year	Ag Recovery, %		Au Recovery, %		Pb Recovery, %		Zn Recovery, %	
	Actual	LTP	Actual	LTP	Actual	LTP	Actual	LTP
2008	92.2	—	68.6	—	77.2	—	68.5	—
2009	91.2	—	76.2	—	83.4	—	71.2	—
2010	92.2	—	73.5	—	83.5	—	78.0	—
2011	93.0	—	73.6	—	86.0	—	80.6	—
2012	93.2	—	70.0	—	85.7	—	82.1	—
2013	93.1	—	65.9	—	85.1	—	82.1	—
2014	—	92.9	—	67.1	—	85.4	—	82.3
2015	—	92.9	—	67.1	—	85.4	—	82.3
2016	—	92.9	—	67.1	—	85.4	—	82.3
2017	—	92.9	—	67.1	—	85.4	—	82.3

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

2018	—	92.9	—	67.1	—	85.4	—	82.3
2019	—	92.9	—	67.1	—	85.4	—	82.3
2020	—	92.9	—	67.1	—	85.4	—	82.3
2021	—	92.9	—	67.1	—	85.4	—	82.3
2022	—	92.9	—	67.1	—	85.4	—	82.3
2023	—	92.9	—	67.1	—	85.4	—	82.3
2024	—	92.9	—	67.1	—	85.4	—	82.3
2025	—	92.9	—	67.1	—	85.4	—	82.3
2026	—	92.9	—	67.1	—	85.4	—	82.3
2024	—	92.9	—	67.1	—	85.4	—	82.3
Avg	92.7	92.9	70.8	67.1	83.9	85.4	78.2	82.3

## Hydraulic Backfill Plant

La Colorada constructed and commissioned a new hydraulic backfill plant in 2011. The new plant:

Provides an alternative to the use of development waste for stope backfill. The discovery of additional mineral reserves and mineral resources means that there continues to be a good supply of development waste. However, when the development eventually winds down the hydraulic backfill can be utilized.

- Reduces storage and re-handle cost of development waste underground.

- Improves stope cycle times by providing a ready source of backfill material.

- Reduces the cost of surface tailings storage by returning sulphide tailings underground versus building additional surface storage capacity.

Operation of the plant and use of sulphide tailings for backfill underground has been reviewed and approved by the Mexican regulatory agencies responsible for this activity.

Planned manpower for ore processing, including plant and tailings operations, plant maintenance and supervision, totals 106 regular employees through the year 2019, the period when the oxide and sulphide plants are running. Processing of oxide ore is scheduled to end in the year 2019, and planned manpower for ore processing decreases to 86 for the balance of the current long term plan. Planned manpower levels are consistent with current staffing levels.

### 17.1.

### Crushing Plant

A single, two-stage crushing plant is used to crush oxide and sulphide ore at La Colorada. The material is batched through the plant, and after crushing, the product is stored separately by process type (oxide versus sulphide). Table 34 lists the major crushing equipment installed at La Colorada. A description of unit operations is provided in the following sections.

Table 34: La Colorada Crushing Equipment

<b>Equipment Type/Function</b>	<b>Manufacturer</b>	<b>Description</b>	<b>Number in Circuit</b>
Primary Feeder	Svedala	FW 434 apron feeder	1
Primary Crusher	Minyu	600 mm x 900 mm jaw	1
Secondary Crusher	Symons	1.3 m short head cone	1
Final Product Size Classifier	Deister	1.8 m x 4.3 m vibrating screen	1

Ore is reclaimed from the coarse ore stockpile by loader and passed through a stationary grizzly with 600 mm x 900 mm openings for sizing prior to crushing. Primary crushing is performed with a 900 mm x 600 mm jaw crusher. Product from the jaw crusher is conveyed to a 1.8 m x 4.3 m vibrating screen for size classification. Material off the screen oversize deck reports to a 1.3 m secondary cone crusher in a closed loop for further size reduction.

Depending on material type, the screen undersize material reports to a fine ore stockpile (oxide) or fine ore bin (sulphide) for grinding. Material is directed to the proper fine ore stockpile or bin by a diverter gate and pant leg chute.

## 17.2.

## Oxide Plant

The oxide plant is a conventional cyanide leach flowsheet comprised of crushing, grinding, leaching, Merrill Crowe zinc precipitation and on-site refining to produce precious metal doré. Construction of the oxide plant began in July 2002 and the first production of doré occurred in August 2003. The oxide plant was originally designed for a rated capacity of 600 t per day; however incremental operating improvements realized since start-up have provided an additional 50 t per day in oxide ore processing capacity over original design.

Table 35 lists the major equipment used for processing oxide ore at La Colorada and Figure 12 provides the current flow sheet for the oxide plant.

Table 35: Oxide Plant Equipment

<b>Equipment Type/Function</b>	<b>Manufacturer</b>	<b>Description</b>	<b>Number in Circuit</b>
Ball Mill	Norberg	2.9 m x 3.4 m	1
Ball Mill	Norberg	2.4 m x 3.0 m	1
Leach Thickeners	Eimco	7.9 m x 2.4 m	2
Leach Tanks w/ Mixers	Philadelphia (Mixers)	7.6 m x 8.4 m	11
Countercurrent Rinse Tanks	Eimco	7.9 m x 2.4 m	4

Figure 12: Oxide Flow Diagram (La Colorada Processing Dept., 2012)

### Crushing

Crushing equipment and operations are the same for oxide and sulphide ore. After crushing oxide ore, the final crushed ore product is delivered to a fine ore stockpile, where it is held for processing through the oxide circuit.

### Grinding

Crushed ore is reclaimed from the fine ore stockpile by a 610 mm variable speed belt feeder and conveyed to a 2.9 m x 3.4 m ball mill that is charged with 76 mm diameter grinding balls for grinding. Product from this mill is pumped to a bank of 510 mm diameter cyclones for size classification. Cyclone underflow, the coarser grinding product, reports to a second 2.4 m x 3.0 m ball mill that is charged with 64 mm diameter balls for additional grinding. Cyclone overflow, the finer grinding product, reports to the primary leach thickener ahead of the leach circuit. Product from the second mill returns to the cyclone for classification to form a closed loop within the grinding circuit. The grinding feed rate is automatically controlled by a belt scale installed on the ball mill feed conveyor. Dilute cyanide solution is used in the grinding circuit to initiate leaching of gold and silver.

## Leaching

Following grinding, slurry from the cyclone overflow reports to a 7.9 m x 2.4 m primary leach thickener. Clear solution overflow from this thickener reports to the pregnant solution tank and slurry underflow reports to a series of seven agitated leach tanks. Normally, five of the seven tanks are used for leaching and two tanks are on standby. The slurry passes through each tank in series for leaching and after passing through the active leach tanks, the slurry reports to a 7.9 m x 2.4 m intermediate leaching thickener. Clear solution overflow from the thickener reports to the pregnant solution tank and the slurry underflow reports to a series of four additional agitated leach tanks for continued leaching. Residence time within the leaching circuit is approximately 117 hours for 400 t per hour processed through nine active leach tanks.

## Rinsing and Tails Disposal

After exiting the leach tank, the leached solids are sent through a four stage, countercurrent rinsing process comprised of four 7.9 m x 2.4 m thickeners to further recovery of precious metals and reduce cyanide content in the tailings before sending to a tailings storage facility. The rinse process is counter-current: solids are introduced to rinse stage 1 and pass sequentially from rinse stage 1 to rinse stage 4; and fresh water is introduced at rinse stage 4 and the rinse solution flows in the opposite direction from rinse stage 4 to rinse stage 1. Clear solution from the stage 1 rinse tank reports to the mill water tank for re-use in the recovery process. Slurry from the stage 4 rinse tank reports to a lined tailings storage facility.

Tailings at the storage facility are distributed in a manner to form a “beach” of solids and direct clear solution to a solution recovery pumping station. Solution recovered from the tailings storage facility is returned to the plant for re-use.

## Merrill Crowe Precipitation

The dissolved silver and gold is removed from the pregnant leach solution by the Merrill Crowe Zinc Precipitation Process. Pregnant solution from the pregnant solution tank is first pumped through a set of clarifiers to remove suspended solids and produce the very clear solutions needed for efficient precipitation. After clarification, the solution passes through a vacuum tower to remove dissolved oxygen. Zinc dust is added to the solution stream when exiting the vacuum tower, which results in the immediate precipitation of gold, silver and other dissolved metals. The solution with the now solid metal precipitate then passes through a set of plate and frame filter presses to separate the



metal precipitate from the solution stream. After leaving the filter press, the process solution, now termed barren solution, is returned to the oxide plant process water tank for re-use in the recovery process.

## Refining

After filtering, the filtered precipitate is mixed with refining fluxes and heated to approximately 980°C in a gas fired furnace in order to melt and separate the contained metal from impurities. After melting, the molten metal is poured into molds and allowed to solidify into doré bars for shipping. Doré bars produced at La Colorada typically contain 98% precious metal, primarily silver, and 2% impurities.

Monitoring for lead, mercury, arsenic, cadmium and other potential health risks is performed on refinery workers and inside the refinery on a regular basis. La Colorada takes action to reduce exposures to acceptable limits when an issue is identified and no significant exposures are known to exist at the time of this report.

## 17.3.

## SULPHIDE PLANT

The sulphide plant has a conventional flotation flowsheet comprised of crushing, grinding and selective lead and zinc froth flotation circuits to recover precious and base metals into separate lead and zinc concentrates. The original sulphide plant was in place when PAS acquired the La Colorada property in 1998, at that time it was rated at 120 t per day and produced lead concentrate only. In June 2002, La Colorada expanded sulphide processing capacity to 200 t per day through the addition of a second ball mill for grinding and addition of new flotation cells for increased throughput and to recover a separate zinc concentrate. Since that time, La Colorada has implemented a number of equipment, flow sheet and operating improvements within the sulphide plant to achieve the current 750 t per day processing capacity. A description of the sulphide plant is provided in this section.

Table 36 lists the major equipment used for processing sulphide ore at La Colorada. Figure 13 provides the current flow sheet for the sulphide plant.

Table 36: Sulphide Plant Equipment

<b>Equipment Type/Function</b>	<b>Manufacturer</b>	<b>Description</b>	<b>Number in Circuit</b>
Primary Feeder	Svedala	FW 434 Apron Feeder	1
Primary Crusher	Minyu	600 mm x 900 mm Jaw	1
Secondary Crusher	Symons	1.3 m Short Head Cone	1
Final Product Size Classifier	Deister	1.8 m x 4.3 m Vibrating Screen	1

### Crushing

Crushing equipment and operations are the same for sulphide and oxide ore. After crushing sulphide ore, the final crushed ore product is delivered to a fine ore bin, where it is held for processing through the sulphide circuit.

## Grinding

Crushed ore is reclaimed from the fine ore bin by a 610 mm variable speed belt feeder and conveyed to two ball mills that operate in parallel for grinding. Sulphide Ball Mill #1 is a 1.8 m diameter x 2.4 m long mill that is charged with 64 mm diameter grinding balls; Sulphide Ball Mill #2 is a 2.6 m diameter x 3.7 m long mill that is charged with 76 mm diameter grinding balls. Product from this mill is pumped to a bank of four 510 mm diameter cyclones for size classification. Cyclone underflow is returned to the ball mills for additional grinding to form a closed loop within the grinding circuit. Cyclone overflow reports to the lead flotation circuit. The grinding feed rate to both mills is automatically controlled by belt scales installed on the ball mill feed conveyors.

Figure 13: Sulphide Flow Diagram (La Colorada Processing Dept., 2012)

### Lead Flotation

Properly sized grinding product flows by gravity from the grinding cyclone classifiers to the lead flotation circuit. This circuit is comprised of a single 42.5 m<sup>3</sup> rougher flotation machine, followed by one 28.3 m<sup>3</sup>, three 9.9 m<sup>3</sup> and one 4.2 m<sup>3</sup> flotation machines arranged to provide two cleaner and one scavenger stages in the circuit. Cyclone overflow reports to the rougher flotation machine and flotation reagents added. Flotation concentrate from the rougher cell reports to the lead flotation cleaner circuit; tailings from the rougher cell reports to the lead scavenger circuit. Flotation concentrate from the two stage cleaner circuit reports to the lead concentrate thickener; tailings from the two stage cleaner circuit are returned to the lead rougher machine. Tailings from the lead scavenger circuit report to the zinc flotation circuit conditioning tank.

### Zinc Flotation

Tailings from the lead scavenger circuit report to the zinc flotation circuit conditioning tank where the reagents necessary for zinc flotation are added. Following the conditioning tank, the zinc flotation equipment and process are similar to the lead flotation circuit.

The zinc flotation circuit is comprised of a single 42.5 m<sup>3</sup> rougher flotation machine, followed by one 28.3 m<sup>3</sup>, three 9.9 m<sup>3</sup> and one 4.2 m<sup>3</sup> flotation machines arranged to provide two cleaner and one scavenger stages in the circuit. Cyclone overflow reports to the rougher flotation machine and flotation reagents are added. Flotation concentrate from the rougher cell reports to the zinc flotation cleaner circuit; tailings from the rougher cell reports to the zinc scavenger circuit. Flotation concentrate from the two stage cleaner circuit reports to the zinc concentrate thickener; tailings from the two stage cleaner circuit are returned to the zinc rougher machine. Tailings from the zinc scavenger circuit report to the tailings system feed box for classification and disposal.

## Tailings Disposal

Tailings from the zinc scavenger circuit report to the tailings system feed box for classification and disposal. Slurry is pumped from the tailings system feed box to a bank of two 510 mm diameter tailings sizing cyclones for classification into two sizes. Coarser material from the cyclones is directed to the hydraulic backfill plant feed tank for re-use underground as backfill in sulphide stopes. Less coarse material from the cyclones is directed to a single 9.0 m x 2.4 m tailings thickener for ultimate disposal at a lined tailings storage facility. Clear solution from the tailings thickener is used in preparation of the hydraulic backfill or returned to the sulphide plant process water tank for re-use in the recovery process.

## Concentrate Thickening and Filtering

Two flotation concentrates are produced: lead and zinc. Concentrate thickening and filtering is performed in two parallel circuits, one for each product. In each circuit, the final flotation concentrate from each flotation circuit reports to a 4.6 m x 2.4 m concentrate thickening tank, (one tank for each product.) After thickening, the slurry underflow product reports to a plate and frame filter press for dewatering. After filtering, the filter cake is removed from the press and stored in a concentrate holding area for shipping to a smelter. Clear solution overflow from the concentrate thickeners is returned to the sulphide plant process water tank for re-use in the recovery process.

Monitoring for lead, mercury, arsenic, cadmium and other potential health risks is performed on workers assigned to concentrate handling operations on a regular basis. La Colorada takes action to reduce exposures to acceptable limits when an issue is identified and no significant exposures are known to exist at the time of this report.

## Sulphide Plant Expansion

As detailed in the report “Evaluación Económica Preliminar Ampliación Planta de Beneficio de Sulfuros a 1500 TMPD Unidad Minera La Colorada Chalchihuites, Zac. By PROMIMET, December, 2013” the expansion of the sulphide plant considers increasing the sulphide processing capacity to 1,500 tonnes per day.

Ore from the new shaft will be conveyed to a 100 tonne capacity ore bin and fed via a 42” apron feeder to a new 36”x42” jaw crusher. The minus 6” material will then be conveyed to a stockpile with a live capacity of 1 day of operation and

from there fed to a new 20' diameter by 9' long, 1,500 HP SAG mill which will act as the primary mill and the existing ball mill will act as the secondary mill. The design capacity of the grinding circuit will be 68 tonne per hour (tph) based on an availability of 92%. Specific gravity and moisture content are 2.8 and 3.0 respectively. The average work index is 13.60 kilowatt hours per tonne and the target grind size is 147 microns.

The expanded lead flotation circuit will essentially be comprised of the existing lead and zinc flotation circuits with the existing 9 m diameter tailings thickener being utilized as the new lead concentrate thickener. The lead circuit is designed to produce 1.51 tph of concentrate.

A new zinc flotation circuit will be constructed comprising a 3.6 m diameter conditioning tank; a bank of 5 by 30 cubic metre capacity rougher flotation cells, and for cleaner flotation 6 by 4.2 cubic metre rectangular cells. The zinc flotation circuit will be designed to produce 2.64 tph of concentrate from the second cleaning stage. A new 8 meter diameter concentrate thickener will be required based on 1.17 tonnes per square meter per day producing an underflow containing 60% solids. A new concentrate filtration system (similar to that currently in use) will be installed to produce a filter cake with 9% moisture content. A new 21 meter diameter tailings thickener will be required based on 0.18 tonnes per square meter per day producing thickener underflow at 55% solids.

The expanded sulphide flotation plant will be covered with an open sided steel structure as well as new plant offices and control room.

## 18.0

## PROJECT INFRASTRUCTURE

### Roads

The La Colorada mine is accessed primarily from Durango by a continuously maintained 120 km all-weather, paved, two lane highway with four lane sections (Highway 45) and a 23 km public, all-weather, gravel road. The mine is also accessible from the city of Zacatecas by similar types of roads.

Consumables and other material are transported to the mine from Durango on the above described road. Doré is shipped via armored vehicle and concentrates in covered trucks by a contractor specializing in secure transport of valuables.

### Power

La Colorada has agreements in place with the national power utility, Comisión Federal de Electricidad (CFE), for the supply of 12.5 MW of power. Electrical power is brought to the mine substation from the national power grid at 34.5 kV. A second, independent 34.5 kV transmission line was brought to the mine in 2007 to meet increasing ventilation and dewatering demands and address power outages that resulted in part due to reliance on a single transmission line. Power is stepped down to 13.2 kV at the mine for distribution.

The mine also maintains three 1.2 MW diesel generators onsite to provide backup power for mine dewatering pumps during power outages. The reliability of power supplied by the national grid improved significantly with the second 34.5 kV line and the need for site generated power is now minimal.

As detailed in the report “Resumen Infraestructura (de superficie) by PROMIMET, December 3, 2013”, the expansion project contemplates the construction of a new 115 KV power line to meet the increased electrical demand. There is a 115 KV power line in construction in the region to supply power to the Del Toro mine, and PROMIMET has estimated the cost of a 17 kilometer line to connect with this line to be \$2.8 million with a further \$2.1 million for a new substation and \$1 million for contingencies. As it is not currently known if it would be possible to utilize this new power line, for the purpose of this PEA, a longer 42 kilometer route to Somberete along the existing power line right of way was selected. The cost of this power line was estimated by PROMIMET to be \$6.8 million.



The expansion plan infrastructure estimate includes \$144k plus contingency for the provision of voltage regulators.

#### Water

Water for the mining operation is supplied from the underground mine dewatering. As permitted by Mexican law, underground water is pumped to the surface and stored in head tanks for use in the milling process and for domestic services. Underground water is also pumped to a water treatment plant, which was constructed in 2002 and upgraded in 2008, to provide potable water. The current water supply is adequate for existing and planned future requirements of the project.

#### Tailings Storage

La Colorada operates two separate tailings storage facilities (TSF). Both are permitted for oxide and sulphide ores however at present, oxide ore is stored in dam 6 and sulphide ore is stored in dam 7.

Initial construction of dam 6 was completed in June, 2003 and it has been raised several times since then. Dam 6 is fully lined for environmental reasons because sodium cyanide is used in the treatment of the oxide ores. The life of mine plan presented in this PEA estimates that storage capacity will be required for a further 2.0 million tonnes of oxide tailings. The economic analysis for this PEA contemplates a cost of \$4 per tonne for the storage of oxide tailings which is estimated to be sufficient to store these tailings in dam 6.

Construction of the initial phase of dam 7 was completed in 2011. The second lift was completed in 2013 and the third lift is planned for 2014. The cost of the third lift has been estimated at \$5.0 million as discussed in the “Memos from PROMIMET to Ing. Raymundo Cerna re Construcción Etapa Tres Presa de Jales Siete dated from November to December, 2013”.

The life of mine plan presented in this PEA estimates that storage capacity will be required for a further 6.6 million tonnes of sulphide tailings. The economic analysis for this PEA estimates a cost of \$3 per tonne for the storage of sulphide tailings in dam 7. The authors have recommended that additional engineering studies are undertaken in 2014 to determine if other options such as dry stacking of oxide tailings in dam 6, discontinuation of the liner in dam 7 and center line or upstream construction methods for dam 7 may prove to be environmentally and economically more

efficient for tailings storage.

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the capital and operating cost estimates, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

19.0

MARKET STUDIES AND CONTRACTS

La Colorada is a mature operation with a demonstrated history of doré and concentrate sales. PAS has not completed any recent market studies beyond the review of potential refining and smelting options as existing contracts for doré refining and concentrate smelting expire.

All precious metal doré produced at La Colorada is sent to arm's length refineries for refining. The doré is refined by one of two precious metals refineries under fixed term contracts. PAS generally retains the risk and title to the precious metals throughout the process of refining and therefore the operation is exposed to the risk that the refineries will not be able to perform in accordance with the refining contract and that the mine may not be able to fully recover its precious metals in such circumstances. PAS maintains insurance coverage against the loss of precious metals at mine sites, in-transit to refineries and while at the refineries.

After refining, the silver and gold is sold in the spot market to various bullion traders and banks. Credit risk is present with these transactions because payment is not received at the time of delivery, a typical element of spot sale contracts.

At the date of this report, PAS has not hedged the price of silver of future production and therefore PAS is fully exposed to fluctuations in the price of silver. This strategy may have a material adverse effect upon financial performance, financial position and results of operations.

All lead and zinc concentrate produced at La Colorada is sold to arm's length smelters and concentrate traders under negotiated fixed term contracts. Credit risk is present with these transactions as the delivered concentrate has a value greater than the payment received at the time of delivery. Additionally, should any of the smelters or traders not honor supply arrangements, or should any of them become insolvent, the mine may incur losses for products already shipped and be forced to sell its concentrates in the spot market or it may not have a market for its concentrates and therefore future operating results may be materially adversely impacted. Table 37 summarizes the doré refining and concentrate sales contracts currently in place at La Colorada.

Table 37: Current Doré Refining and Concentrate Sales Contracts

**Contract**

<b>Mine Product</b>	<b>Contract With</b>	<b>Quantity</b>	<b>Duration</b>	<b>Terminates</b>
Doré	Johnson Matthey, Inc.	36 mt / year	36 months	Dec-2014
Lead Concentrate	MK Metal Trading GmbH	7,200 dmt / year	12 months	Jan-2015
Zinc Concentrate	METAGRI S.A. de C.V.	9,600 dmt / year	24 months	Dec-2014

To date, PAS has not experienced difficulty with renewing existing or securing new contracts for the sale of the La Colorada doré or concentrates, however, there can be no certainty it will always be able to do so or what terms will be available in the future.

PAS regularly reviews the terms of smelting and refining agreements and terms are considered to be within industry norms.

Table 38 summarizes revenue from metal sales realized by PAS from La Colorada for the last full five calendar years.

Table 38: Annual Revenue from Metal Sales

Year	Product	Quantity	Revenue <sup>1, 2</sup>
2013*	Doré	Silver: 1,204,655 t. oz; Gold 985 t. oz	\$29.9 million
	Lead Concentrate	8,094 tonnes (Net Smelter Return)	\$72.9 million
	Zinc Concentrate	12,022 tonnes (Net Smelter Return)	\$10.7 million
2012*	Doré	Silver: 1,371,153 t. oz; Gold: 1,270 t. oz	\$44.3 million
	Lead Concentrate	6,610 tonnes	\$88.1 million
	Zinc Concentrate	9,507 tonnes	\$10.5 million
2011	Doré	Silver: 1,368,405 t. oz; Gold: 1,320 t. oz	\$49.9 million
	Lead Concentrate	5,935 tonnes	\$88.2 million
	Zinc Concentrate	7,410 tonnes	\$9.5 million
2010	Doré	Silver: 1,554,500 t. oz.; Gold: 1,718 T. Oz.	\$31.5 million
	Lead Concentrate	3,769 tonnes	\$36.7 million
	Zinc Concentrate	5,175 tonnes	\$5.2 million
2009	Doré	Silver: 1,500,221 t. oz.; Gold 1,525 t. oz.	\$23.5 million
	Lead Concentrate	3,994 tonnes	\$27.7 million
	Zinc Concentrate	4,350 tonnes	\$3.1 million

\*2012 and 2013 from production based report (PBR)

Table 19.2 Revenue from Metal Sales (Source: PAS AIF Year Ending Dec 31, 2011, page 51)

<sup>1</sup> Consists of sales to arm's length customers.

<sup>2</sup> Calculated as gross revenue less treatment and refining charges.

## 20.0 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL OR COMMUNITY IMPACT

The La Colorada Mine is within an area of historic mining activity. The mine was constructed and is operated using internationally recognized methods and practices designed to minimize new environmental impacts.

## 20.1.Environmental Studies and Permits

The EIS was completed in 1999 by Clifton Associates Ltd. S.C.. PAS initiated a voluntary environmental audit February 18, 2003 completed by Ing. Eduardo Escárcega Rangel, Director General of the company 'Soluciones de Ingeniería y Calidad Ambiental S.A. de C. V.,' certified auditor for Procuraduría Federal de Protección al Ambiente (PROFEPA). From this audit an action plan was developed and monitored for compliance with reporting to PROFEPA. One of the recommendations was updating the EIS, which was completed by Clifton Associates Ltd. in 2006.

Mining generates tailings, which are materials considered to be potentially hazardous wastes. PAS filed an application to become a hazardous waste generator in January 1999 and the required permit was received on March 26, 2001.

A modification to the mine's Manifestacion de Impacto Ambiental and technical study for its land use change permit were prepared by Clifton Associates and approved by the Secretaria de Medio Ambiente Recursos Naturales y Pesca (SEMARNAT) in 2013. This modification permits the mine and plant expansion to 2000 tpd capacity.

La Colorada voluntarily participates in PROFEPA's "Clean Industry" Program which involves independent verification of compliance with all environmental permits and the implementation of good environmental management procedures and practices. The mine obtained its first certification in 2008 and has been re-certified every two years since, with the most recent certificate awarded on 10 August 2012.

To the author's knowledge, La Colorada is in compliance with all environmental regulations and holds all necessary permits to operate and expand the mine to 2,000 tpd capacity.

#### Permits:

Environmental Impact Statement "Manifestacio de Impacto Ambiental" for construction was submitted and granted approval under D.O.O.DGOEIA.- 007244 by the Secretaria de Medio Ambiente Recursos Naturales y Pesca (SEMARNAT) on November 11, 1999, renewed for five years on October 7, 2005 and again for another five years on November 8, 2010. To the author's knowledge La Colorada is in compliance with reporting requirements of this permit.

Permit number 251/99/MA, October 6, 2000, from Delegacion Federal en Zacatecas Subdelegacion de Recursos Naturales Departamento de Suelos for a change in land use to construct tailings dam 6

Permit 32/DM-0040/12/10, December 2, 2010 from SEMARNAT for the construction of tailings dam 7

PAS holds a permit (Concesión 03ZAC1037661/11EQGE02) dated September 19, 2002 which permits the discharge of waters into the surface of the La Colorada property.

#### 20.2. Waste and Tailings Disposal

All broken waste rock and a portion of tailings are currently disposed of as fill during the cut and fill mining cycle. There are no known environmental issues with this form of disposal.

Tailings disposable is covered in section 18 "Project Infrastructure – Tailings Storage".

### 20.3. Social and Community

There are currently no social issues with the communities in proximity of La Colorada, although there is potential for this to change which could impact the operation. This is mitigated through programs in building sustainable community relations through cultural respect and socio economic support and in environmental stewardship (PAS, Sustainability Report, 2012).

### 20.4. Closure Plan

The closure plan was last updated July 2, 2010 by Clifton and Associates Ltd.

Mexican law does not require the submission of a closure plan and therefore does not require a bond or other form of advance payment for reclamation. They do however apply the principle of “el que contamina paga” (those who contaminate pay). PAS voluntarily adheres to international standards for mining operations and chose to prepare the initial closure plan and update it as necessary. The closure plan is to both World Bank and International Finance Corporation (IFC) standards.



The closure requirements are:

- Demolish building and physical infrastructure
- Close and fill surface accesses to the mine such as access ramps. Plug openings such as shafts and raises
- Stabilize and eliminate access to mine areas, stopes, and raises
- Restore roadways and building sites
- Monitor stability and drainage of tailings and waste dumps

A closure cost estimate for La Colorada was prepared according to State of Nevada approved SRCE methodology in 2011 and is updated every year. Pan American has estimated the present value of the final site reclamation costs for the La Colorada property to be approximately \$4.0 million.

## 21.0 CAPITAL AND OPERATING COST

La Colorada is a mature operation with a documented history of capital and operating costs. This history forms the basis of projecting future costs for budgeting and financial modeling. Actual costs realized in the past and costs projected for the future are presented in this section.

### 21.1. Capital Costs

Each year, PAS approves capital projects for operational upgrades to sustain, improve, or expand production at Company operations, provide for equipment additions or replacements, and to make infrastructure improvements for local communities. Capital costs include exploration, mine development, equipment purchases, engineering studies of long term projects, design costs, site infrastructure, construction of new or expansion of TSFs, etc.

During the five year period from 2008 to 2013, capital spending at the La Colorada Mine totaled \$69.5 million. Of this total, 62% went to mine operations, 29% went to ore processing operations, and 9% went to general and administration projects. During this period, annual spending on capital programs at La Colorada averaged \$11.6 million, and ranged from \$2.3 million in 2009 to \$20.0 million in 2012.

Table 39 summarizes capital spending for the period 2008 to 2012.

Table 39: La Colorada Capital Spending Actual 2008-2013 (000\$)

Year	2008	2009	2010	2011	2012	2013
Operation Summary						
Mine	\$9,005	\$1,346	\$5,445	\$6,105	\$11,610	\$9,469
Ore Process	\$2,239	\$956	\$1,117	\$4,617	\$7,921	\$3,493
Surface Facilities	\$862	\$24	\$732	\$1,856	\$2,169	\$523
Total Capital Program	\$12,106	\$2,326	\$7,295	\$12,578	\$21,700	\$13,485
Mine						
Exploration	\$1,847	\$0	\$1,666	\$1,721	\$3,984	\$4,983
Development	\$3,736	\$0	\$0	\$0	\$0	\$460
Mine Equipment	\$1,907	\$768	\$2,222	\$3,202	\$2,826	\$2,959
Mine Ventilation	\$686	\$0	\$0	\$513	\$1,548	\$745
Mine Dewatering	\$51	\$452	\$500	\$264	\$2,574	\$0
Mine Backfill System	\$431	\$0	\$763	\$0	\$0	\$0
Mine Infrastructure Other	\$345	\$126	\$295	\$405	\$678	\$321
Total Mine	\$9,005	\$1,346	\$5,445	\$6,105	\$11,610	\$9,469
Ore Process						
Ore Crushing	\$0	\$0	\$0	\$0	\$0	\$0
Oxide Processing	\$137	\$0	\$0	\$74	\$0	\$250
Sulphide Processing	\$250	\$69	\$329	\$573	\$0	\$463
Tailings Storage	\$1,812	\$887	\$699	\$3,882	\$5,198	\$1,575
Plant Infrastructure	\$40	\$0	\$89	\$88	\$2,722	\$1,205
Total Ore Process	\$2,239	\$956	\$1,117	\$4,617	\$7,921	\$3,493
Operations Support						
Community Works	\$0	\$0	\$209	\$268	\$524	\$0
Mobile Equipment	\$449	\$0	\$327	\$923	\$592	\$523
Voice & Data Systems	\$161	\$24	\$42	\$17	\$41	\$0
Fire & Security Systems	\$134	\$0	\$155	\$74	\$116	\$0
Total Operations Support	\$118	\$0	\$0	\$573	\$895	\$0

PAS will continue to invest capital in La Colorada in the future in order to sustain operations and provide support for the local communities. Future capital requirements are forecast in the LOM and are based on a combination of sustaining and expansion capital requirements.

The current LOM, which spans the years 2014 through 2027, projects total capital requirements at La Colorada at \$248.8 million. Of this total, 32% is for mine expansion, 44% is for sustaining mine operations; 21% is for ore processing operations; and 3% is for general and administration projects. Neither the additional exploration expenditures that will be incurred nor any positive outcomes of that exploration that may or may not occur have been included in the LOM plan presented in the PEA.

Table 40 summarizes the sustaining and expansion capital spending program projected for the period from 2014 to 2027.

Table 40: La Colorada Capital Spending During Expansion Project 2014-2017 (000\$)

Area (\$ Million)	2014	2015	2016	2017	2014-2017 LOM + Expansion Capital	2014-2017 Expansion Capital Only
Major Projects						
Shaft & Hoist Installation	\$8.8	\$23.0	\$8.5	-	\$ 40.3	-
Plant Expansion	\$3.6	\$33.6	\$8.7	-	\$ 46.0	\$ 46.0
Infrastructure Upgrades	\$6.5	\$9.4	\$0.1	-	\$ 16.1	\$ 11.9
Underground Development	\$2.0	\$2.6	\$2.1	\$1.7	\$ 8.4	\$ 4.8
Additional Mine Equipment	-	\$4.1	-	\$4.1	\$ 8.3	\$ 8.3
Initial Sulphide Tailings Expansion	\$5.0	-	-	-	\$ 5.0	-
Project Indirects	\$2.3	\$5.8	\$4.9	-	\$ 12.9	\$ 5.2
Sub Total Projects	\$28.2	\$78.6	\$24.4	\$5.8	\$ 137.0	\$ 76.1
Other Capital						
Normal Mine and Plant Sustaining Capital	\$5.8	\$3.8	\$5.2	\$5.5	\$ 20.3	\$ (0.3 )
Ongoing Tailings Dam Expansions	-	-	-	\$6.6	\$ 6.6	\$ 4.2
Sub-total Other Capital	\$5.8	\$3.8	\$5.2	\$12.1	\$ 26.9	\$ 3.9
Total Capital	\$34.0	\$82.3	\$29.6	\$17.9	\$ 163.8	\$ 80.0

The estimate for Shaft and Hoist Installation is based on a “Borehole Hoisting Scoping Stud” dated 25 January, 2013 for PAS by Cementation. This report estimates a total cost of \$26,849,000 and project duration of 18 months. To this amount, PAS has added \$400k for additional underground development, \$530k as the result of an updated estimate for detailed engineering, \$4,482k for items not included in the Cementation scope (Connection to power line, bad ground allowance, geotechnical diamond drill hole, additional concrete costs, delays and others), \$400k for additional underground development and \$8,065k in contingencies for a total of \$40,324k.

The estimate for the expansion of the sulphide flotation plant is based on the report “Evaluación Económica Preliminar Ampliación Planta de Beneficio de Sulfuros a 1500 TMPD Unidad Minera La Colorada Chalchihuies, Zac. By PROMIMET, December, 2013” where a capital cost of \$33,478k was estimated for the expansion (option 2). This amount distributed as \$2,812k for crushing, \$4,344k for stockpile, \$8,433k for grinding, \$6,964k for flotation, \$2,478k for thickening, \$519k for compressors, \$2,348k for substation and offices, and \$5,580k for contingencies of 20%. PAS added further engineering, construction management and contingencies of \$12,494k to arrive at a total capital estimate for the sulphide plant expansion of \$45,972k.

The estimate for the expansion of the surface infrastructure is based on the report “Resumen Infraestructura (de superficie) by PROMIMET, December 3, 2013 where a capital cost of \$10,368k was estimated. This amount was

distributed as \$350k to supply an additional 6,385 cfm of compressed air, \$350k for water supply, \$144k for voltage regulation, \$4,894k for a 17 km 115KV power line and substation, \$2,902k for roads and new auxiliary buildings and \$1,728k for contingencies. To this amount, PAS has added \$5,710k primarily in additional costs for a longer power line and contingencies.

Additional underground mine development of 7,262 meters at an average cost of \$1,300 for a total of \$8405k will be required over the project expansion period in order to access and develop the shaft and to develop additional production areas to increase the mine production rate.

The mine engineering staff has estimated that an additional 11 pieces of underground mobile equipment will be required in 2015 and a further 11 in 2017 at a capital cost of \$8,254k. The additional equipment requirements are 6 - 1.5 cubic meter capacity scooptrams, 6 - 3.0 cubic meter capacity scooptrams, 2 - 15 tonne capacity haul trucks, 2 - service trucks, 2 - personnel vehicles and 2 - tractors.

The cost estimate of \$5,000k for the construction of the third stage of dam 7 is based on memos from PROMIMET to Ing. Raymundo Cerna re Construcción Etapa Tres Presa de Jales Siete dated from November to December, 2013. Additional capital costs for the TSF expansion are included in the sustaining capital in later years.

PAS has included a capital cost estimate of a further \$12,933k for project indirects. Included in this total is the cost of the owner's project management team, third party consultants, PAS technical support, freight, insurance, office supplies and other miscellaneous items required to manage the expansion project over the course of the next 4 years.

Capital expenditures for the rest of the LOM period 2018 to 2027 are as presented in Table 41.

Table 41: La Colorada Sustaining Capital Expenditure 2018-2027

Year	2018	2019	2020	2021	2022
Mine	\$5,085	\$3,705	\$6,961	\$5,564	\$3,970
Ore Process	\$400	\$400	\$400	\$400	\$400
Surface Facilities	\$730	\$730	\$730	\$730	\$730
Tailings	\$0	\$0	\$4,200	\$3,300	\$4,350
Exploration	\$2,000	\$2,000	\$2,000	\$2,000	\$2,000
Total Capital Program	\$8,215	\$6,835	\$14,291	\$11,994	\$11,450
Year	2023	2024	2025	2026	2027
Mine	\$6,085	\$4,626	\$4,305	\$3,795	\$0
Ore Process	\$400	\$400	\$400	\$400	\$0
Surface Facilities	\$730	\$500	\$500	\$250	\$0
Tailings	\$0	\$0	\$0	\$0	\$0
Exploration	\$0	\$0	\$0	\$0	\$0
Total Capital Program	\$7,215	\$5,526	\$5,205	\$4,445	\$0

Mine sustaining capital is primarily rebuild and replacement of mine equipment, mine development, mine dewatering (with provision for a new pumping station on the 660 level in 2020), and extensions to the ventilation circuits.

Tailings storage costs are estimated on the basis of \$4 per tonne for oxide tailings and \$3 per tonne for sulphide tailings.

Exploration costs are those amounts estimated as necessary to convert the existing mineral resources that are included in the LOM plan to mineral reserves.



In the opinion of Martin Wafforn, P. Eng., Vice President of Technical Services for PAS who is an author of this report and a QP as that term is defined in NI 43-101, the capital cost estimates have been completed to a level of accuracy consistent with a PEA.

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA, including the expanded mine plan, capital and operating cost estimates and economic evaluation, will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

## 21.2. Operating Costs

Operating costs are tabulated by La Colorada on a monthly basis using industry standard accounting software and in accordance with accounting principles generally accepted in Canada. Operating costs include labor and benefits for operating, maintenance and administration employees, contractor costs, materials and supplies, power, water, fuel and lubes, etc. The total annual cost to operate La Colorada averaged \$37.3 million per year during the five year period 2008 through 2012, or \$103.43 per ore tonne processed (PAS AIF, 1999 to 2011) . The preliminary total annual operating cost for 2013 was \$50.9 million or \$113.52 per tonne processed.

Actual operating costs realized at La Colorada during years 2008 through 2013 are summarized in Table 42.

Table 42: La Colorada Summary Operating Costs Actual 2008-2013

Year	2008		2009		2010	
Tonnes Processed	377,844		324,916		345,697	
Operating Cost Summary	\$000	\$/Tonne	\$000	\$/Tonne	\$000	\$/Tonne
Mining	\$19,046	\$ 50.41	\$18,126	\$ 55.79	\$20,994	\$60.73
Processing	\$7,966	\$ 21.08	\$7,067	\$ 21.75	\$8,263	\$23.90
G&A	\$7,488	\$ 19.82	\$5,525	\$ 17.00	\$7,487	\$21.66
Total	\$34,500	\$ 91.31	\$30,718	\$ 94.54	\$36,838	\$106.56

Year	2011	2012	2013
Tonnes Processed	404,533	419,591	448,659

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Operating Cost Summary	\$000	\$/Tonne	\$000	\$/Tonne	\$000	\$/Tonne
Mining	\$24,213	\$59.85	\$25,911	\$61.75	\$29,835	\$66.50
Processing	\$9,724	\$24.04	\$11,126	\$26.52	\$10,985	\$24.48
G&A	\$10,737	\$26.54	\$11,112	\$26.48	\$10,112	\$22.54
Total	\$44,674	\$110.43	\$48,149	\$114.75	\$50,933	\$113.52

Costs used for the long term plan are based on expected staffing levels and organization chart, current pricing for power, materials and supplies, etc. Projected costs are adjusted for known and assumed price increases, and operating experience. Labor costs include salaries, benefits and overtime. Smelting, refining and transportation costs are based on current contracts, adjusted for expected changes in contract terms. Consumption rates for reagents, fuel, oils, power, etc. are based on actual experience at the operation and metallurgical testing.

Operating costs are broken into fixed and variable categories and applied to planned mine and process tonnes, ore types and labor schedule for estimating.

During the Years 2014 through 2027, the period covered by the current long term plan, total operating costs at La Colorada are projected to be \$121.82 per tonne in 2014 and then decline to a low of \$100.26 per tonne when the expansion has been completed in 2018. The reduction in unit operating costs is primarily due to the fixed costs of the operation being distributed over a greater number of tonnes processed.

Operating costs projected by the long term plan are summarized in Table 43.

Table 43: La Colorada Operating Costs Long Term Plan 2013-2024

Year	2014		2015		2016		2017		2018		2019
Tonnes Mined	456,250		456,250		549,100		547,325		657,000		657,006
	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$
Mining	\$31,950	\$70.03	\$31,580	\$69.22	\$35,753	\$65.11	\$36,156	\$66.06	\$40,416	\$61.52	\$40,537
Processing	\$12,365	\$27.10	\$12,358	\$27.09	\$13,689	\$24.93	\$13,722	\$25.07	\$14,183	\$21.59	\$14,132
G&A	\$11,266	\$24.69	\$11,269	\$24.70	\$11,286	\$20.55	\$11,269	\$20.59	\$11,269	\$17.15	\$11,269
Total	\$55,581	\$121.82	\$55,207	\$121.00	\$60,728	\$110.60	\$61,147	\$111.72	\$65,868	\$100.26	\$65,938

Year	2020		2021		2022		2023		2024		2025
Tonnes Mined	658,800		657,000		657,000		657,000		658,800		657,000
	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$	\$/Tonne	Total \$
Mining	\$41,429	\$62.89	\$41,144	\$62.62	\$41,291	\$62.85	\$41,124	\$62.59	\$41,351	\$62.77	\$42,471
Processing	\$14,248	\$21.63	\$14,203	\$21.62	\$14,073	\$21.42	\$14,244	\$21.68	\$14,114	\$21.42	\$13,921
G&A	\$11,286	\$17.13	\$11,269	\$17.15	\$11,269	\$17.15	\$11,156	\$16.98	\$11,172	\$16.96	\$11,269
Total	\$66,963	\$101.64	\$66,616	\$101.39	\$66,633	\$101.42	\$66,524	\$101.25	\$66,637	\$101.15	\$67,661

Year	2026		2027	
Tonnes Mined	657,000		657,178	
	Total \$	\$/Tonne	Total \$	\$/Tonne
Mining	\$41,740	\$63.36	\$39,339	\$59.88
Processing	\$13,924	\$21.14	\$13,722	\$20.89
G&A	\$11,269	\$17.11	\$11,269	\$17.15
Total	\$66,933	\$101.60	\$64,330	\$97.91



## 22.0

## ECONOMIC ANALYSIS

PAS updates long range mine plans and financial models for each of its operations to demonstrate economic viability. Inputs to the long term plans and financial models include current mineral resource and mineral reserve tabulations, long term production schedules, current forecasts for metal prices and operating costs, current forecasts for future smelting and refining contract terms, capital spending, mine reclamation and closure, and royalty and tax assumptions

The current La Colorada Long Term Plan spans the fourteen year period from the year 2014 through 2027. La Colorada is a mature operation with a documented history of production, operating and capital costs, and financial reporting. This history forms the basis of long term planning for La Colorada. Annual cash flow projections for La Colorada are estimated over the remaining life of the mine based on estimates of capital expenditures, production costs and sales revenue developed specifically for this project.

In order to evaluate the economic benefits of the expansion plan, a complete LOM plan was created using the non – expanded production rate (in this case the 2014 budgeted rate of 1,250 tpd). The same production base of mineral reserves and mineral resources were used in both cases. Certain aspects of the mine plan were also required in both cases, such as the total amount of mine development including the new shaft in order to access the mineral reserves and mineral resources.

Table 47 presents highlights from the current La Colorada long term plan and financial model. Discussion of specific elements and analysis of the current financial model prepared for La Colorada are provided in the following sections.

### 22.1. Production Base

The Plan assumes processing of: (i) 5.4 million tonnes (63% of the total material processed) that are classified as proven and probable mineral reserves; (ii) 1.3 million tonnes (15% of the total material processed) that are classified as measured and indicated mineral resources; and (iii) 1.9 million tonnes (22% of the total) that are classified as inferred mineral resources. The LOM plan was prepared using end of year 2012 mineral reserves and mineral resources and adjusted for production information available as of mid-2013. The Plan is summarized in Table 44. The mineral reserves and mineral resources presented in this report contain additional diamond drilling information to the life of mine plan presented however in the opinion of the authors this does not negatively impact the outcome. In fact the increased mineral reserves presented in this report could be viewed as serving to reduce the amount of inferred mineral resource presented in the LOM.

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

Table 44: Production Base for the LOM 2014-2027

Production Base	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)*	Zn (%)*
Oxides					
Proven and Probable Mineral Reserves					
Candelaria	357,534	333	0.50	N/A	N/A
Estrella	1,071,421	391	0.40	N/A	N/A
Total	1,428,955	377	0.42	N/A	N/A
Measured and Indicated Mineral Resources					
Candelaria	-			N/A	N/A
Estrella	397,368	281	0.37	N/A	N/A
Total	397,368	281	0.37	N/A	N/A
Inferred Mineral Resources					
Candelaria	73,341	245	0.10	N/A	N/A
Estrella	96,668	303	0.37	N/A	N/A
Total	170,009	278	0.25	N/A	N/A
Sulphides					
Proven and Probable Mineral Reserves					
Candelaria	3,219,970	402	0.31	2.08 %	3.75 %
Estrella	766,764	357	0.28	1.45 %	2.76 %
Total	3,986,734	393	0.30	1.96 %	3.56 %
Measured and Indicated Mineral Resources					
Candelaria	741,217	414	0.44	0.93 %	1.36 %
Estrella	173,607	329	0.57	1.27 %	2.25 %
Total	914,824	398	0.47	1.00 %	1.53 %
Inferred Mineral Resources					
Candelaria	1,289,448	286	0.27	1.95 %	3.47 %
Estrella	395,371	171	0.15	1.53 %	1.90 %
Total	1,684,819	259	0.24	1.85 %	3.10 %
Mineral Reserve Total	5,415,689	389	0.34	1.96 %	3.56 %
M&I Mineral Resource Total	1,312,192	363	0.42	1.00 %	1.53 %
Inf. Mineral Resource Total	1,854,828	261	0.24	1.85 %	3.10 %

\*Base metal grades for sulphide mineralization only

## 22.2.

## Planned Production

The Plan projects production of 88.0 million ounces of silver, 62.6 thousand ounces of gold, 171.1 thousand tonnes of zinc and 101.1 thousand tonnes of lead over the remaining life of mine.

Payable production totals 83.9 million ounces of silver, 60.2 thousand ounces of gold, 145.5 thousand tonnes of zinc and 96.1 thousand tonnes of lead over the LOM. Rates used to calculate payable quantities of metal production are based on current concentrate smelting and doré refining contracts.

22.3.

Revenue

La Colorada revenue is reported on the basis of net smelter return. Smelting and refining terms used to calculate net smelter return in the financial model are based on current contracts. An allowance for deleterious elements penalties is included in the financial model based on past experience with La Colorada concentrates.



Using the metal prices used for the mineral reserves in this report, the La Colorada LOM plan generates revenues from metal sales of \$2.38 billion with 78% of this amount estimated to come from the sale of silver, 3% from the sale of gold, 11% from the sale of zinc and 8% for the sale of lead. Net revenues over the LOM total \$2.17 billion after smelting and refining charges and the new 0.5% production royalty that PAS considers is likely to be imposed on the mining industry by the Mexican government.

#### 22.4.

#### Costs

The La Colorada financial model includes the mining, processing, general and administration operating costs presented and discussed in this technical report. In addition to operating costs, the model includes allowances for corporate overhead, reclamation, and exploration costs. All costs and expenses used for the financial model have been estimated based on real and current experience at La Colorada.

- The long term capital program discussed in this report is included in the financial model.

Mexico corporate taxes are included in the financial model at current tax rates and include the new proposed taxes that PAS considers are likely to be imposed on the mining industry by the Mexican government.

The taxes included in the financial model are Mexican corporate incomes tax at 30% of taxable income plus a 0.5% royalty on revenues from gold and silver plus a 7.5% tax calculated on income before interest, taxes, and depreciation.

- Potential salvage value of equipment at the end of the mine life is not considered in the financial model.

- Operating and capital costs are not escalated in the financial model.

The average cash operating cost over the remaining life of mine is projected to be \$7.55 per payable ounce of silver produced. In the La Colorada financial model, cash operating costs are the sum of mine, process and general administrative operating costs plus smelting, refining, and product transportation charges less revenues generated by gold, lead and zinc sales.

The average total production cost over the remaining life of mine is projected to be \$8.86 per payable ounce of silver produced. Total production cost is calculated as the sum of total cash operating cost plus royalties, reclamation and

closure costs, depreciation and salvage value.

## 22.5.

## Cash Flow

The PEA for the La Colorada expansion demonstrates that the project has the potential to be robust at the metal prices assumed for the mineral reserves (silver - \$22 per ounce) presented in this Technical Report as well as at a silver price of \$19 per ounce which is below the price as of the date of this report. Assuming a long term silver price of \$19 per ounce, and prices of \$1,850 per tonne of zinc and \$2,100 per tonne of lead, the expanded mine has the potential to generate estimated net revenues of \$1.4 billion and after tax, undiscounted net cash flow of \$372 million over the next 10 years 2014 through 2023, including the new Mexican mining taxes. The PEA estimates an after tax NVP of \$38.6 million at a 10% discount rate, an estimated IRR of 22% and an estimated payback period of 2.5 years. Using a long term silver price assumption of \$25 per ounce, the expansion project's economic potential becomes even more attractive with an estimated NPV of \$71.7 million at a 10% discount rate, an estimated IRR of 32% and an estimated payback period of 2 years. Using the metal prices assumed for estimating the mineral reserves presented in this technical report of \$22 per ounce of silver (base case), the LOM plan generated \$666.5 million in undiscounted cash flow with an estimated NPV of the expansion project over the course of the next 10 years of \$54.1 million at a 10% discount rate, an estimated IRR of 27% and a payback period of 2.2 years as shown in Table 45:

Table 45: NPV Cash Flow and Capital Payback

<b>Metal Price Assumptions</b>		<b>Base Case</b>	
Ag Price - \$ Toz	\$ 19.00	\$ 22.00	\$ 25.00
Zn Price - \$ DMT	\$ 1,850	\$ 1,850	\$ 1,850
Pb Price - \$ DMT	\$ 2,100	\$ 1,950	\$ 2,100
Au Price - Toz	\$ 1,200	\$ 1,300	\$ 1,200
Ten-Year Comparison (2014 - 2023)			
Net Revenue (US\$M)	\$ 1,443	\$ 1,624	\$ 1,817
Undiscounted Net Cash Flow (US\$M)	\$ 372	\$ 489	\$ 614
Total Mine 10% NPV (US\$M)	\$ 196	\$ 272	\$ 354
Expansion 10% NPV (US\$M)*	\$ 38.6	\$ 54.1	\$ 71.7
IRR	23 %	27 %	32 %
Payback Period (years)	2.5	2.2	2.0
Life of Mine (2014 - 2027)			
Net Revenue (US\$M)	\$ 1,925	\$ 2,167	\$ 2,426
Undiscounted Net Cash Flow (US\$M)	\$ 510	\$ 666	\$ 834
Total Mine 10% NPV (US\$M)	\$ 243	\$ 333	\$ 429
Expansion 10% NPV (US\$M)*	\$ 25.8	\$ 36.1	\$ 47.6
IRR	22 %	27 %	32 %
Payback Period (years)	2.5	2.2	2.0

\* Expansion 10% NPV is calculated based on the differential cash flow from expanding the mine versus status quo operation assuming the same tonnes and grade are mined

Sensitivity analysis was completed to determine the sensitivity of cash flow to changes in metal prices, mineral grades, metallurgical recovery, operating costs and capital cost. A summary of the analysis is provided below and in Table 46.

Silver price, grade and recovery variables are the largest drivers to the La Colorada cash flow model, followed by operating costs.

Cash flow is most sensitive to changes in silver price, followed by changes in silver grade or silver recovery. Modeled cash flow changes 1.8% for every 1% change in silver price; while a 1% change in silver grade or silver recovery results to a 1.7% change in cash flow.

- Cash flow changes 0.9% for every 1% change in operating costs.
- Cash flow changes 0.2% for every 1% change in sustaining capital costs.

Changes in base metal and gold variables have limited impact on cash flow, due to the minor contribution to revenue coming from these sources. For example, a 1% change in individual base metal variables result in a 0.3% change in cash flow; while a 1% change in individual gold variables result in a 0.1% change in cash flow.

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.

Table 47 shows the PEA expansion financial model summary and Table 48 the non-expansion case summary.

Table 46: La Colorada Long Term Plan Cash Flow Sensitivity

Sensitivity Variable	Variable % Change	Cash Flow Total LTP	Cash Flow % Change	
Silver Price				
Increase Metal Price	1.10	\$ 785,377	118	%
Base Case (LTP)	1.00	\$ 666,468	100	%
Decrease Metal Price	0.90	\$ 547,559	82	%
Silver Grade				
Increase Silver Head Grade	1.10	\$ 779,373	117	%
Base Case (LTP)	1.00	\$ 666,468	100	%
Decrease Silver Head Grade	0.90	\$ 553,563	83	%
Silver Recovery				
Increase Silver Recovery	1.10	\$ 779,373	117	%
Base Case (LTP)	1.00	\$ 666,468	100	%
Decrease Silver Recovery	0.90	\$ 553,563	83	%
Operating Cost				
Decrease Operating Cost	1.10	\$ 608,402	91	%
base case	1.00	\$ 666,468	100	%
Increase Operating Cost	0.90	\$ 724,534	109	%
Sustaining Capital Cost				
Decrease Sustaining Capital Cost	1.10	\$ 649,907	98	%
base case	1.00	\$ 666,468	100	%
Increase Sustaining Capital Cost	0.90	\$ 683,029	102	%

Table 47: Summary Data from La Colorada Financial Model

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>Ore Processing</b>									
Tonnes Milled	456,250	456,250	549,100	547,325	657,000	657,006	658,800	657,000	657,000
Ag g/t	368	371	362	366	408	409	410	411	403
Au g/t	0.29	0.29	0.30	0.31	0.34	0.33	0.35	0.38	0.4
Pb% (Sulfide Ore Only)	1.51	1.37	1.53	1.60	2.26	2.06	2.45	2.28	1.7
Zn% (Sulfide Ore Only)	2.73	2.63	2.81	2.86	3.98	3.53	4.37	4.46	2.8
Ag Recovery, %	89.1	88.7	89.5	88.9	89.8	89.8	89.3	89.3	89.5
Au Recovery, %	67.9	67.9	67.7	67.7	67.7	67.7	67.7	67.6	67.7
Pb Recovery, % (Sulfide Only)	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.5
Zn Recovery, % (Sulfide Only)	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3
<b>Metal Price</b>									
Ag, \$/Toz	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00
Au, \$/Toz	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300
Pb, \$/DMT	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950
Zn, \$/DMT	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850
<b>Production - Total Metal</b>									
Silver Ounces Produced	4,816,431	4,825,467	5,721,019	5,722,984	7,739,435	7,757,616	7,750,848	7,757,009	7,600,000
Gold Ounces Produced	2,907	2,924	3,641	3,743	4,894	4,698	4,974	5,402	6,000
Lead Tonnes Produced	4,011	3,638	5,265	5,477	9,876	8,990	10,705	9,948	7,500
Zinc Tonnes Produced	6,972	6,709	9,298	9,443	16,707	14,835	18,411	18,760	11,000
<b>Production - Payable Metal</b>									
Silver Ounces Produced	4,604,477	4,617,822	5,459,387	5,474,621	7,380,127	7,389,331	7,384,190	7,392,474	7,200,000
Gold Ounces Produced	2,813	2,829	3,509	3,612	4,715	4,533	4,794	5,197	5,800
Lead Tonnes Produced	3,811	3,456	5,002	5,203	9,383	8,540	10,170	9,451	7,100

Zinc Tonnes Produced	5,926	5,703	7,903	8,027	14,201	12,609	15,649	15,946	10,
-------------------------	-------	-------	-------	-------	--------	--------	--------	--------	-----

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Net Smelter Return - Metal Basis										
Silver	\$101,298	\$101,592	\$120,107	\$120,442	\$162,363	\$162,565	\$162,452	\$162,634	\$159,651	\$124,7
Gold	\$3,657	\$3,677	\$4,562	\$4,696	\$6,129	\$5,893	\$6,232	\$6,757	\$7,567	\$6,63
Lead	\$7,431	\$6,739	\$9,753	\$10,145	\$18,296	\$16,653	\$19,832	\$18,429	\$14,009	\$19,36
Zinc	\$10,964	\$10,550	\$14,621	\$14,850	\$26,272	\$23,327	\$28,951	\$29,501	\$18,679	\$32,12
Trans, Smelt, Ref	\$(10,042 )	\$(9,194 )	\$(11,913 )	\$(11,948 )	\$(18,819 )	\$(17,837 )	\$(19,927 )	\$(19,369 )	\$(15,907 )	\$(18,3
Total	\$113,308	\$113,364	\$137,130	\$138,184	\$194,241	\$190,602	\$197,539	\$197,952	\$183,998	\$164,5
Net Smelter Return - Product Sold Basis										
Precious Metal Dore	\$26,088	\$28,003	\$26,721	\$32,253	\$33,925	\$30,888	\$31,364	\$32,250	\$32,510	\$35,20
Lead Concentrate	\$75,071	\$73,212	\$93,769	\$89,335	\$131,841	\$133,638	\$135,236	\$134,323	\$129,678	\$97,59
Zinc Concentrate	\$12,150	\$12,150	\$16,640	\$16,596	\$28,474	\$26,076	\$30,939	\$31,378	\$21,809	\$31,70
Total	\$113,308	\$113,364	\$137,130	\$138,184	\$194,241	\$190,602	\$197,539	\$197,952	\$183,998	\$164,5
Income Statement										
NSR	\$113,308	\$113,364	\$137,130	\$138,184	\$194,241	\$190,602	\$197,539	\$197,952	\$183,998	\$164,5
Royalties	\$(521 )	\$(523 )	\$(620 )	\$(622 )	\$(838 )	\$(838 )	\$(839 )	\$(843 )	\$(832 )	\$(653
Op Costs	\$(55,581 )	\$(55,207 )	\$(60,728 )	\$(61,148 )	\$(65,868 )	\$(65,938 )	\$(66,964 )	\$(66,616 )	\$(66,633 )	\$(66,5
Depreciation & Amortization	\$(6,844 )	\$(5,808 )	\$(6,990 )	\$(6,967 )	\$(8,364 )	\$(8,364 )	\$(8,387 )	\$(8,364 )	\$(8,364 )	\$(8,36
Reclamation Provision	\$(300 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332
Equipment Salvage Value	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Exploration Taxes	\$(906 )	\$(1,300 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$0
Net Income	\$31,822	\$32,490	\$43,535	\$43,959	\$76,143	\$73,742	\$77,554	\$78,059	\$64,832	\$47,82
Cash Flow Statement										
Net Income	\$31,822	\$32,490	\$43,535	\$43,959	\$76,143	\$73,742	\$77,554	\$78,059	\$64,832	\$47,82
Operating Activities	\$11,016	\$10,810	\$13,365	\$14,104	\$15,513	\$15,718	\$15,820	\$16,149	\$20,529	\$19,44
Investing Activites	\$(37,826 )	\$(84,350 )	\$(31,601 )	\$(19,895 )	\$(8,215 )	\$(6,835 )	\$(14,291 )	\$(11,994 )	\$(11,450 )	\$(7,21
Cash Flow	\$5,013	\$(41,050 )	\$25,299	\$38,168	\$83,442	\$82,625	\$79,083	\$82,214	\$73,910	\$60,00

The PEA is preliminary in nature and includes inferred mineral resources that are considered too speculative geologically to have the economic considerations applied to them that would enable them to be categorized as mineral reserves. There is no certainty that the results of the PEA will be realized. Mineral resources that are not mineral reserves have no demonstrated economic viability.





Table 48: Summary Data from La Colorada Financial Model - Non Expansion Case

Year	2014	2015	2016	2017	2018	2019	2020	2021	2022
Ore Processing									
Tonnes Milled	456,250	456,250	457,500	456,250	456,250	456,250	457,500	456,250	456,250
Ag g/t	368	371	369	373	374	403	408	405	403
Au g/t	0.29	0.29	0.32	0.31	0.33	0.36	0.39	0.35	0.35
Pb% (Sulfide Ore Only)	1.51	1.37	1.58	1.48	1.64	2.23	2.40	2.14	2.14
Zn% (Sulfide Ore Only)	2.73	2.63	2.96	2.77	2.87	3.89	4.28	3.83	4.28
Ag Recovery %	89.1	88.7	88.9	88.2	88.0	88.4	87.8	87.7	87.7
Au Recovery %	67.9	67.9	67.8	67.9	67.9	67.9	67.9	67.9	67.9
Pb Recovery % (Sulfide only)	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4
Zn Recovery % (Sulfide only)	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3
Metal Price									
Ag, \$/Oz	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00
Au, \$/Oz	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300
Pb, \$/DMT	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950
Zn, \$DMT	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850
Production - Total Metal									
Silver Ounces Produced	4,816,431	4,825,467	4,828,623	4,828,696	4,828,024	5,225,222	5,261,854	5,215,284	5,215,284
Gold Ounces Produced	2,907	2,924	3,159	3,101	3,332	3,594	3,870	3,535	3,535
Lead Tonnes Produced	4,011	3,638	4,208	3,933	4,348	5,909	6,372	5,681	5,681
Zinc Tonnes Produced	6,972	6,709	7,574	7,062	7,323	9,924	10,958	9,764	10,958
Production - Payable Metal									
Silver Ounces Payable	4,604,477	4,617,822	4,617,678	4,631,129	4,634,083	5,000,776	5,036,570	4,995,118	5,036,570

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Gold Ounces Payable	2,813	2,829	3,051	3,002	3,230	3,483	3,745	3,423	3,511
Lead Tonnes Payable	3,811	3,456	3,997	3,736	4,131	5,613	6,053	5,397	5,511
Zinc Tonnes Payable	5,926	5,703	6,438	6,003	6,224	8,435	9,314	8,299	9,011
Net Smelter Return - Metal Basis									
Silver	\$ 101,298	\$ 101,592	\$ 101,589	\$ 101,885	\$ 101,950	\$ 110,017	\$ 110,805	\$ 109,893	\$ 110,017
Gold	\$ 3,657	\$ 3,677	\$ 3,967	\$ 3,903	\$ 4,199	\$ 4,528	\$ 4,869	\$ 4,450	\$ 4,528
Lead	\$ 7,431	\$ 6,739	\$ 7,795	\$ 7,286	\$ 8,055	\$ 10,946	\$ 11,804	\$ 10,524	\$ 10,946
Zinc	\$ 10,964	\$ 10,550	\$ 11,910	\$ 11,105	\$ 11,515	\$ 15,605	\$ 17,231	\$ 15,354	\$ 15,605
Trans, Smelt, Ref	\$(10,042 )	\$(9,194 )	\$(9,873 )	\$(9,379 )	\$(9,721 )	\$(11,979 )	\$(12,584 )	\$(11,708 )	\$(11,979 )
Total	\$ 113,308	\$ 113,364	\$ 115,388	\$ 114,800	\$ 115,998	\$ 129,117	\$ 132,124	\$ 128,513	\$ 129,117
Net Smelter Return - Prod Sold Basis									
Precious Metal Dore	\$ 26,088	\$ 28,003	\$ 26,721	\$ 32,253	\$ 33,925	\$ 30,888	\$ 31,364	\$ 32,250	\$ 33,925
Lead Concentrate	\$ 75,071	\$ 73,797	\$ 75,274	\$ 70,098	\$ 69,334	\$ 81,392	\$ 82,495	\$ 79,722	\$ 81,392
Zinc Concentrate	\$ 12,150	\$ 12,150	\$ 13,393	\$ 12,448	\$ 12,738	\$ 16,838	\$ 18,266	\$ 16,541	\$ 16,838
Total	\$ 113,308	\$ 113,949	\$ 115,388	\$ 114,800	\$ 115,998	\$ 129,117	\$ 132,124	\$ 128,513	\$ 129,117
Income Statement									
NSR	\$ 113,308	\$ 113,364	\$ 115,388	\$ 114,800	\$ 115,998	\$ 129,117	\$ 132,124	\$ 128,513	\$ 129,117
Royalties	\$(521 )	\$(523 )	\$(524 )	\$(525 )	\$(527 )	\$(569 )	\$(574 )	\$(568 )	\$(569 )
Op Costs	\$(55,581 )	\$(55,080 )	\$(55,073 )	\$(55,173 )	\$(53,785 )	\$(54,011 )	\$(54,088 )	\$(54,295 )	\$(53,785 )
Depreciation & Amortization	\$(6,844 )	\$(5,808 )	\$(5,824 )	\$(5,808 )	\$(5,808 )	\$(5,808 )	\$(5,824 )	\$(5,808 )	\$(5,808 )
Reclamation Provision	\$(300 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )
Equipment Salvage Value	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0	\$ 0
Exploration	\$(1,109 )	\$(1,300 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )	\$(1,200 )
Taxes	\$(17,262 )	\$(17,750 )	\$(18,495 )	\$(18,257 )	\$(19,168 )	\$(23,701 )	\$(24,726 )	\$(23,388 )	\$(23,701 )
Net Income	\$ 31,691	\$ 32,572	\$ 33,940	\$ 33,504	\$ 35,177	\$ 43,497	\$ 45,380	\$ 42,922	\$ 43,497
Cash Flow Statement									
Net Income	\$ 31,691	\$ 32,572	\$ 33,940	\$ 33,504	\$ 35,177	\$ 43,497	\$ 45,380	\$ 42,922	\$ 43,497
Operating Activities	\$ 11,016	\$ 10,578	\$ 11,479	\$ 12,013	\$ 12,259	\$ 12,609	\$ 12,750	\$ 12,842	\$ 12,259
Investing Activities	\$(28,001 )	\$(33,482 )	\$(20,814 )	\$(11,217 )	\$(13,076 )	\$(8,274 )	\$(5,186 )	\$(12,144 )	\$(8,274 )
Cash Flow	\$ 14,707	\$ 9,667	\$ 24,605	\$ 34,301	\$ 34,360	\$ 47,832	\$ 52,944	\$ 43,619	\$ 47,832



Year	2025	2026	2027	2028	2029	2030	2031	2032	LO
Ore									
Processing									
Tonnes									
Milled	454,850	458,250	456,250	457,500	456,250	456,250	456,250	364,609	8,
Ag g/t	312	310	293	293	299	305	325	357	3,
Au g/t	0.33	0.36	0.30	0.32	0.31	0.29	0.33	0.37	0,
Pb% (Sulfide Ore Only)	2.30	2.04	1.62	1.77	1.45	1.56	1.45	1.19	1,
Zn% (Sulfide Ore Only)	4.22	3.68	2.88	2.96	2.37	2.64	2.22	1.48	3,
Ag Recovery %	88.0	88.4	90.9	92.9	92.9	92.9	92.9	92.9	8,
Au Recovery %	67.9	67.7	67.3	67.1	67.1	67.1	67.1	67.1	6,
Pb Recovery % (Sulfide only)	85.4	85.4	85.4	85.4	85.4	85.4	85.4	85.4	8,
Zn Recovery % (Sulfide only)	82.3	82.3	82.3	82.3	82.3	82.3	82.3	82.3	8,
Metal Price									
Ag, \$/Oz	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22.00	\$22,
Au, \$/Oz	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,300	\$1,
Pb, \$/DMT	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,950	\$1,
Zn, \$DMT	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,850	\$1,
Production -									
Total Metal									
Silver Ounces Produced	4,011,192	4,036,635	3,909,684	4,007,630	4,068,977	4,147,791	4,424,699	3,884,353	8,
Gold Ounces Produced	3,254	3,608	2,955	3,108	3,087	2,891	3,215	2,937	6,
Lead Tonnes Produced	6,082	5,427	4,944	6,905	5,631	6,073	5,656	3,716	10,
Zinc Tonnes Produced	10,768	9,459	8,472	11,126	8,883	9,919	8,321	4,435	1,
Production -									
Payable									
Metal									
Silver Ounces Payable	3,834,082	3,853,986	3,723,710	3,779,998	3,837,861	3,912,199	4,173,378	3,663,724	8,
Gold Ounces Payable	3,149	3,478	2,823	2,952	2,933	2,746	3,054	2,790	6,
Lead Tonnes Payable	5,778	5,156	4,697	6,560	5,349	5,769	5,373	3,531	90,

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Zinc Tonnes Payable	9,152	8,040	7,201	9,457	7,551	8,431	7,073	3,770	14
Net Smelter Return - Metal Basis									
Silver	\$84,350	\$84,788	\$81,922	\$83,160	\$84,433	\$86,068	\$91,814	\$80,602	\$1,100
Gold	\$4,094	\$4,521	\$3,671	\$3,838	\$3,813	\$3,570	\$3,971	\$3,627	\$7,000
Lead	\$11,267	\$10,054	\$9,159	\$12,792	\$10,431	\$11,250	\$10,477	\$6,885	\$1,000
Zinc	\$16,932	\$14,874	\$13,322	\$17,496	\$13,969	\$15,598	\$13,084	\$6,974	\$2,000
Trans, Smelt, Ref	\$(11,424 )	\$(10,709 )	\$(10,132 )	\$(11,842 )	\$(10,609 )	\$(11,159 )	\$(10,896 )	\$(8,368 )	\$(2,000 )
Total	\$105,218	\$103,527	\$97,942	\$105,444	\$102,037	\$105,327	\$108,451	\$89,720	\$2,000
Net Smelter Return - Prod Sold Basis									
Precious Metal Dore	\$21,904	\$20,051	\$14,883	\$0	\$0	\$0	\$0	\$0	\$3,000
Lead Concentrate	\$66,135	\$67,987	\$68,852	\$85,894	\$85,687	\$87,392	\$92,565	\$80,020	\$1,000
Zinc Concentrate	\$17,180	\$15,490	\$14,206	\$19,550	\$16,350	\$17,935	\$15,886	\$9,700	\$2,000
Total	\$105,218	\$103,527	\$97,942	\$105,444	\$102,037	\$105,327	\$108,451	\$89,720	\$2,000
Income Statement									
NSR	\$105,218	\$103,527	\$97,942	\$105,444	\$102,037	\$105,327	\$108,451	\$89,720	\$2,000
Royalties	\$(439 )	\$(443 )	\$(425 )	\$(433 )	\$(439 )	\$(446 )	\$(477 )	\$(419 )	\$(9,000 )
Op Costs	\$(54,123 )	\$(53,744 )	\$(54,219 )	\$(53,393 )	\$(53,661 )	\$(54,026 )	\$(54,027 )	\$(48,067 )	\$(1,000 )
Depreciation & Amortization	\$(5,790 )	\$(5,834 )	\$(5,808 )	\$(5,824 )	\$(5,808 )	\$(5,808 )	\$(5,808 )	\$(4,641 )	\$(1,000 )
Reclamation Provision	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(332 )	\$(6,000 )
Equipment Salvage Value	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Exploration	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$(1,000)
Taxes	\$(22,238 )	\$(22,167 )	\$(21,850 )	\$(19,893 )	\$(19,893 )	\$(19,893 )	\$(19,893 )	\$(19,893 )	\$(3,000 )
Net Income	\$22,297	\$21,008	\$15,308	\$25,569	\$21,904	\$24,823	\$27,915	\$16,368	\$6,000
Cash Flow Statement									
Net Income	\$22,297	\$21,008	\$15,308	\$25,569	\$21,904	\$24,823	\$27,915	\$16,368	\$6,000
Operating Activities	\$12,521	\$12,114	\$13,936	\$11,552	\$12,335	\$11,515	\$10,519	\$12,899	\$2,000
Investing Activities	\$(4,422 )	\$(9,370 )	\$(3,774 )	\$(2,431 )	\$(9,624 )	\$(2,450 )	\$(2,725 )	\$(1,300 )	\$(1,000 )
Cash Flow	\$30,396	\$23,752	\$25,470	\$34,691	\$24,615	\$33,887	\$35,709	\$27,967	\$6,000

23.0

ADJACENT PROPERTIES

There is no relevant information on adjacent properties to report.

24.0

OTHER RELEVANT DATA AND INFORMATION

No other data or information is relevant for the review of the La Colorada project.

25.0

INTERPRETATION AND CONCLUSIONS

La Colorada was evaluated by PAS while under option from Minas between September 1997 and March 1998. The decision was taken to purchase the property and develop a feasibility study to increase production from what Minas was achieving. With a feasibility study construction was initiated.

La Colorada mine has been operated under PAS' management safely and economically since early 2001. Production has greatly increased due to capital investment which has been used to increase processing capacity and underground infrastructure including pumping and ventilation. Investment in exploration, particularly diamond drilling, has added significant mineral reserves and made mining and planning more reliable.

This Technical Report demonstrates that the proven and probable mineral reserves presented in this report will be economic with the forecast metal prices and other assumptions presented herein and further demonstrates that the La Colorada expansion project has the potential to be economically robust. Based on the current mineral reserve and mineral resources, the mine is projected to operate until the end of 2027. This projected mine life may increase if additional mineral resources are defined and can be converted to mineral reserves.

In the authors' opinion, the diamond drilling and channel sampling information that has been collected is of sufficient spacing and quality for mineral resource and reserve estimation. The reliability of the mineral resource and reserve estimates have been confirmed by reconciliations between production to the mineral reserve and plant to production data.

This report details the methodology employed and demonstrates why the authors conclude that the continued operation of the La Colorada mine is technically feasible and economically viable and that the expansion plans contemplated by the PEA have the potential to be robust at current prices. It is the opinion of the authors of this Technical Report that the data contained herein is of sufficient quality and reliability to make these conclusions.

25.1.

Risks

The management of the mine continuously analyses and studies the potential for risk. They plan, budget and execute projects needed to ensure continuous production levels.

The most significant risks are those affecting the entire industry such as costs escalation and skilled labour shortages. Another risk of operating in Mexico is the drug cartel wars and related violence which could affect transport of goods and personnel, property security, property loss and personnel safety.



26.0

RECOMMENDATIONS

It is the authors' recommendation to continue the exploration efforts and improvements to infrastructure which could lead to increases in mineral reserves and mine production. As the mine is currently in operation, the work programs necessary to maintain annual updates to the mineral reserve estimates are in place and conducted on a daily basis by a full complement of technical and operating staff at the mine. The costs for these work programs are included in the annual operating budgets, mine plan and life of mine plan.

It is recommended that PAS continue to follow the life of mine plan and make the capital investments that are detailed in that plan. It is further recommended to continue to follow the current sampling and quality control programs as may be revised from time to time by the authors of this Technical Report. It is also recommended to continue with the diamond drilling program and the related sampling and quality control programs in order to assure sufficient data density and reliability for future new mineral resource additions in deeper or lateral parts of the mine as well as for satellite deposits. The mine has a budget in 2014 of US\$3.8M in order to conduct exploration and definition drilling programs in an attempt to convert inferred mineral resources to mineral reserves, add new inferred mineral resources and to locate new orebodies. These exploration programs are closely supervised and revised by Michael Steinmann P.Geo., EVP Business Development & Geology.

The authors of this Technical Report recommend that the mine should continue to operate and that PAS proceed with the expansion project in the following general manner:

- Establish an owners project team to manage consultants and contractors
- Continue to develop to the bottom of the planned new shaft location.

Proceed with detailed engineering of the shaft and construction. The authors note that the upper part of the existing shaft was developed on vein and that stoping operations were conducted to the shaft. This precludes personnel transport in the existing shaft, precludes further deepening or capacity expansion and increases the risk of extended downtime to the operation. For these reasons the authors recommend that a new shaft be developed regardless of mine expansion.

Proceed with engineering of the sulphide plant and surface infrastructure expansion, finalize the flow sheet and then proceed with basic and detailed engineering, with construction to start in 2015.

Proceed with additional engineering to further define the optimal tailings storage locations and construction designs from an environmental and cost of storage perspective. It is further recommended that an expansion to the sulphide tailings storage facility in 2014 proceed as planned.

That planned expansions to the ventilation circuits are completed in 2014 and that ventilation recommendations are closely followed. It is recommended that further engineering and definition of the dewatering, ventilation, development and mine equipment requirements are also conducted during 2014.

In the opinion of Martin Wafforn, P. Eng., Vice President of Technical Services for PAS who is an author of this report and a QP as that term is defined in NI 43-101, the capital cost estimates have been completed to a level of accuracy consistent with a PEA.

As the engineering progresses, a system should be developed to update the capital cost estimates and check the economic viability prior to the start of the plant and infrastructure expansion in 2015.

## 27.0

## REFERENCES

Process Research Associates Ltd., Flotation and Cyanidation Study on Samples from La Colorada, May 2000

Lewis Geoscience, Structural Analysis, La Colorada Mine October 1998

Annual Information Forms, Pan American Silver Corp., 1999 to 2011 inclusive

Pan American Silver Corp., La Colorada Mine Project, Zacatecas, Technical Report, A. Sharp et. al., September 30, 2007

Informe de Visita de Asesoría de Ventilación, November 18-20, 2010 Ing. Ariel H. Orellana Wiarco

Informe de Visita de Asesoría de Ventilación, Ing. Ariel H. Orellana Wiarco, December 6-8, 2011

Estudio de calor de mina Candelaria, Ing. Ariel H. Orellana Wiarco, , December, 2012

Edgar Filing: PAN AMERICAN SILVER CORP - Form 6-K

Plan de Restauración y Cierre (PRC), Mina La Colorada, Mpio. De Chalchihuites, Zac. Clifton Associates Ltd., July 2, 2010

Sustainability Report, Pan American Silver Corp, Vancouver, BC. 2011

Project 100796, Rev 2 for Pan American Silver Corp. La Colorada Mine Borehole Hoisting Scoping Study, January 25, 2013 by Cementation Canada Inc.

Memo re project 100796 re hoisting capacity by Cementation dated October 16, 2013

Memos from PROMIMET to Ing. Raymundo Cerna re Construcción Etapa Tres Presa de Jales Siete dated from November to December. 2013

PAS internal memo “LC – Tailings Dam Stage 3 Support Document” for Capital Appropriation Request, December, 2013.

Evaluación Económica Preliminar Ampliación Planta de Beneficio de Sulfuros a 1500 TMPD Unidad Minera La Colorada Chalchihuites, Zac. By PROMIMET, December, 2013

Resumen Infraestructura (de superficie) by PROMIMET, December 3, 2013

28.0

CERTIFICATES of QUALIFIED PERSONS

**CERTIFICATE of QUALIFIED PERSON**

I, Dr. Michael Steinmann, Executive Vice President, Corporate Development and Geology of Pan American Silver Corp. ("Pan American"), 1500-625 Howe St, Vancouver, BC, V6C 2T6, Canada do hereby certify that:

I am the co-author of the technical report titled "Technical Report – Preliminary Economic Analysis for the (a) Expansion of the La Colorada Mine, Zacatecas, Mexico", with an effective date of December 31, 2013 (the "Technical Report").

I graduated with a Master of Science in Geology degree from the University of Zurich, Switzerland, in 1993. I also earned a Doctor of Natural Science in Geology degree from the Swiss Federal Institute of Technology, Zurich, Switzerland, in 1997. I am a Professional Geologist in good standing with The Association of Professional (b) Engineers and Geoscientists of the Province of British Columbia. My experience is primarily in the areas of mining geology and exploration and I have worked as a geologist for a total of 20 years since my graduation from the University of Zurich.

I have read the definition of 'qualified person' set out in National Instrument 43-101 ("the "Instrument") and certify that (c) by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a 'qualified person' for the purposes of the Instrument.

I am responsible for the preparation of the sections of the Technical Report as detailed in Table 5 – List of Qualified (d) Persons.

I am currently employed as the Executive Vice President, Corporate Development and Geology for Pan American, (e) the owner of the La Colorada Property, and by reason of my employment, I am not considered independent of Pan American as described in section 1.5 of the Instrument.

I have had prior involvement with the La Colorada Property that is the subject of the Technical Report; I am an executive with Pan American and was the co-author of the technical report titled "Technical Report for the La (f) Colorada Property, Zacatecas, Mexico", with an effective date of December 31, 2012. I have conducted numerous site visits to the La Colorada Property, most recently from September 17<sup>th</sup> to 19<sup>th</sup>, 2013.

(g) I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with the Instrument and that form.

(h) As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, British Columbia, this 30<sup>th</sup> day of January, 2014.

***“Signed and Sealed”***

Michael Steinmann, P.Geo, Ph.D

## **CERTIFICATE of QUALIFIED PERSON**

I, Martin Wafforn, Vice President, Technical Services of Pan American Silver Corp. (“Pan American”), 1500-625 Howe St, Vancouver, BC, V6C 2T6, Canada do hereby certify that:

I am the co-author of the technical report titled “Technical Report – Preliminary Economic Analysis for the (a) Expansion of the La Colorada Mine, Zacatecas, Mexico”, with an effective date of December 31, 2013 (the “Technical Report”).

I graduated with a Bachelor of Science in Mining degree from the Camborne School of Mines in Cornwall, England in 1980. I am a Professional Engineer in good standing with The Association of Professional Engineers (b) and Geoscientists of the Province of British Columbia. I am also a Chartered Engineer in good standing in the United Kingdom. My experience is primarily in the areas of mining engineering and I have worked as a engineer in the mining industry for a total of 31 years since my graduation from the Camborne School of Mines.

I have read the definition of ‘qualified person’ set out in National Instrument 43-101 (“the “Instrument”) and certify that (c) by reason of my education, affiliation with a professional association and past relevant work experience, I fulfil the requirements of a ‘qualified person’ for the purposes of the Instrument.

I am responsible for the preparation of the sections of the Technical Report as detailed in Table 5 – List of Qualified (d) Persons.

I am currently employed as the Vice President, Technical Services for Pan American, the owner of the La Colorada (e) Property, and by reason of my employment, I am not considered independent of Pan American as described in section 1.5 of the Instrument.

I have had prior involvement with the La Colorada Property that is the subject of the Technical Report; I am an (f) executive with Pan American Silver Corp. and was the co-author of the technical report titled “Technical Report for the La Colorada Property, Zacatecas, Mexico”, with an effective date of December 31, 2012. I have conducted numerous site visits to the La Colorada Property, most recently on October 25, 2013.

I have read the Instrument and Form 43-101F1, and the Technical Report has been prepared in compliance with the (g) Instrument and that form.



As of the effective date of the Technical Report, to the best of my knowledge, information and belief, the Technical (h) Report contains all the scientific and technical information that is required to be disclosed to make the Technical Report not misleading.

Dated at Vancouver, British Columbia, this 30<sup>th</sup> day of January, 2014.

*“Signed and Sealed”*

Martin Wafforn, P. Eng.

## **SIGNATURES**

Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

**PAN AMERICAN SILVER CORP**  
(Registrant)

Date: February 3, 2014 By: /s/ Delaney Fisher

Name: Delaney Fisher

Title: Vice President Legal Affairs and Corporate Secretary